Guided Pathways to Success in Kentucky

Greg Heileman
Associate Provost

University of Kentucky
What is the Purpose of Analytics?

The Big Why:

To support data-informed decision-making
To assess effectiveness of interventions/programs
Reporting/compliance

Takeaway #1: Analytics is Storytelling
What is the Purpose of Analytics?

The Big Why:

- To support data-informed decision-making
What is the Purpose of Analytics?

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The Big Why:

- To support data-informed decision-making
- To assess effectiveness of interventions/programs
- Reporting/compliance

Takeaway #1: Analytics is Storytelling
Earnings and unemployment rates by educational attainment, 2015

<table>
<thead>
<tr>
<th>Educational Attainment</th>
<th>Median Usual Weekly Earnings ($)</th>
<th>Unemployment Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctoral degree</td>
<td>1,623</td>
<td>1.7</td>
</tr>
<tr>
<td>Professional degree</td>
<td>1,730</td>
<td>1.5</td>
</tr>
<tr>
<td>Master's degree</td>
<td>1,341</td>
<td>2.4</td>
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<tr>
<td>Bachelor's degree</td>
<td>1,137</td>
<td>2.8</td>
</tr>
<tr>
<td>Associate's degree</td>
<td>798</td>
<td>3.8</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>738</td>
<td>5.0</td>
</tr>
<tr>
<td>High school diploma</td>
<td>678</td>
<td>5.4</td>
</tr>
<tr>
<td>Less than a high school diploma</td>
<td>493</td>
<td>8.0</td>
</tr>
</tbody>
</table>

All workers: $860

All workers: 4.3%

Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.
Projected percentage change in employment by typical entry-level educational requirement, 2014–24

All occupations: 6.5%

- No formal educational credential
- High school diploma or equivalent
- Some college, no degree
- Postsecondary nondegree award
- Associate's degree
- Bachelor's degree
- Master's degree
- Doctoral or professional degree
Cost of Higher Education

PUBLIC FTE ENROLLMENT AND EDUCATIONAL APPROPRIATIONS PER FTE, U.S., FY 1992-2017

- Educational Appropriations Per FTE (Constant $)
- Net Tuition Per FTE (Constant $)
- Net FTE Enrollment (Millions)

U.S. Personal Debt

Source: Federal Reserve Bank of New York
Attainment Gap

Baccalaureate Degree Attainment by Age 24 by Family Income Quartile

Who We Serve

How access at University of Kentucky has changed

Peer schools are shown in yellow

Students from...
Bottom 60%

Top 20%

Top 10%

Top 1%

Source: The Equality of Opportunity Project
Who We Serve

How access at University of Louisville has changed

Peer schools are shown in yellow

Students from...
Bottom 60%

Top 20%

Top 10%

Top 1%

Source: The Equality of Opportunity Project
How access at Northern Kentucky has changed

Students from...
Bottom 60%

Top 20%

Top 10%

Top 1%

Source: The Equality of Opportunity Project
Who We Serve

How access at Kentucky Community and Technical College System has changed

Peer schools are shown in yellow

Students from...
Bottom 60%

Top 20%

Top 10%

Top 1%

Source: The Equality of Opportunity Project
How access at Harvard has changed

Peer schools are shown in yellow

Source: The Equality of Opportunity Project
Storytelling

Student Analytics Dashboard

Student Flows

Drilldown

<table>
<thead>
<tr>
<th>Year</th>
<th>Term</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Student Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Fall</td>
<td>Female</td>
<td>Hispanic</td>
<td>Full-Time Teller</td>
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</table>

Options

- High School GPA
- ACT Composite
- SAT Total

3,157 Students

Graduated

1,452 of cohort

46.0%
Storytelling
Higher Education’s Task:

- Increase access/equity
Our Story

Higher Education’s Task:

- Increase access/equity
- Improve outcomes/success
Our Story

Higher Education’s Task:
- Increase access/equity
- Improve outcomes/success
- Contain costs
Our Story

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Places a premium on: Data-informed decision making
Our Story

Higher Education’s Task:
- Increase access/equity
- Improve outcomes/success
- Contain costs

Places a premium on: **Data-informed decision making**

Pressures to: **Replicate the success of others**
How many of you have been here?
Big State University Improves Graduation Rates by Training Advisors as Mimes!
Big State University Improves Graduation Rates by Training Advisors as Mimes!
Email from an administrator later that day:

*Dear <Insert your name here>,*

*Please see the attached article from the Chronicle.*
Email from an administrator later that day:

Dear <Insert your name here>,

Please see the attached article from the Chronicle. What are we doing about advisor mime training?
Dear <Insert your name here>,

Please see the attached article from the Chronicle. What are we doing about advisor mime training? How soon can we get this up and running?
Dear <Insert your name here>,
Please see the attached article from the Chronicle. What are we doing about advisor mime training? How soon can we get this up and running? Why didn’t we think of this!
Know Thyself
Know Thyself

- Student success depends on local conditions ... what works at one place may not work at another.
Strategy = Take the River

Tactics = Use a boat
Know Thyself

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

- Think about your college/university as a system ... and evaluate improvement opportunities accordingly.
Know Thyself

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

- Think about your college/university as a system ... and evaluate improvement opportunities accordingly.

Takeaway #2: Analytics should inform strategies and tactics, not initiate them
The university as an interconnected **system**.
The university as an interconnected system.

Input: Students. Measurable characteristics: preparation, background, demographics, etc.
The university as an interconnected **system**.

**Input**: **Students**. Measurable characteristics: preparation, background, demographics, etc.

**Output**: **Graduates**. Measurable characteristics: assessed outcomes, career achievements, etc.
The university as an interconnected **system**.

- **Input:** **Students.** Measurable characteristics: preparation, background, demographics, etc.
- **Output:** **Graduates.** Measurable characteristics: assessed outcomes, career achievements, etc.
- **Feedback** can improve system performance
The university as an interconnected system.

Input: **Students**. Measurable characteristics: preparation, background, demographics, etc.

Output: **Graduates**. Measurable characteristics: assessed outcomes, career achievements, etc.

Feedback can improve system performance, and inform admissions.
The university as an interconnected **system**.

- **Input:** Students. Measurable characteristics: preparation, background, demographics, etc.
- **Output:** Graduates. Measurable characteristics: assessed outcomes, career achievements, etc.
- **Feedback** can improve system performance, and inform admissions.
- In this talk we’ll focus on the **curriculum** piece of the system.
Analytics Maturity

As a part of continuous improvement, we’re all working to improve our analytics capabilities.
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- You start someplace ... and gradually improve capabilities over time.
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- Patience is required
As a part of continuous improvement, we’re all working to improve our analytics capabilities.

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- Patience is required ... the time scale for substantive change is years.

“Good judgement comes from experience, and experience comes from bad judgement.” –Rita Mae Brown

Takeaway #3: Analytics is a process, not a product.
Analytics Maturity

As a part of continuous improvement, we’re all working to improve our analytics capabilities.

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“Good judgement comes from experience, and experience comes from bad judgement.”
—Rita Mae Brown

**Takeaway #3: Analytics is a process, not a product**
Analytics Workflow
Analytics Workflow

Data Ingestion

text:

enterprise data

ETL

data mart
Analytics Workflow

Data Ingestion

upload services

data mart

Analytics

enterprise data

ETL
Analytics Workflow
Curricula and Degree Plans

Curriculum
(Courses & Prerequisites.)
Curricula and Degree Plans
Curricula and Degree Plans

Plan Optimizer

Degree Requirements (Program)

Curriculum (Courses & Prerequisites.)

Degree Plans (Program)
Curricula and Degree Plans

- Plan Optimizer
- Degree Plans (Program)
- Degree Exploration
- Curriculum (Courses & Prerequisites)
- Degree Requirements (Program)
Curricula and Degree Plans

Curriculum
(Courses & Prerequisites.)

Degree Requirements
(Program)

Degree Exploration

Plan Optimizer

Degree Plans
(Program)

Public Facing

Curriculum (Courses & Prerequisites.)

Degree Requirements (Program)
COMPUTER AND INFORMATION SCIENCES AND SUPPORT SERVICES.

Instructional programs that focus on the computer and information sciences and prepare individuals for various occupations in information technology and computer operations fields.
Degree Plans – Explore Careers

**Career Opportunities:**

With a degree in Mechanical Engineering from UNM, students are ready to:
- Work in robotics, manufacturing, aerospace, biotech, and more
- Develop alternative energy resources
- Design aircraft and automotive vehicles
- Conduct atmospheric research

<table>
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<tr>
<th>Career</th>
<th>Median Salary</th>
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<tr>
<td>Mechanical Engineers</td>
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<td>Mechanical Engineering Technologists</td>
<td>$61,580</td>
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<td>Mechanical Drafters</td>
<td>$52,200</td>
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<tr>
<td>Mechanical Engineering Technicians</td>
<td>$53,530</td>
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* Data obtained from the Occupational Information Network (O*NET) under sponsorship of the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA).

**Contact Information:**

Anna Mae Apodaca: Coordinator, Program Advisement
(505) 277-2762
apodaca@unm.edu
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<th>Program</th>
<th>Degree</th>
<th>Online</th>
<th>Plan</th>
<th>Credits</th>
<th>Information</th>
<th>Degree Plan</th>
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## Degree Plans – Pathways

### DIET
Agriculture and Related Sciences

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Minimum Grade</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ENGL 101 - English Composition I</td>
<td>Minimum Grade</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 101 - General Biology I</td>
<td>Minimum Grade</td>
<td>4</td>
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<tr>
<td>HMEC 191 - University Seminar I - Human Ecology</td>
<td>Minimum Grade</td>
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</tr>
<tr>
<td>HMEC 215 - Introduction to Nutrition</td>
<td>Minimum Grade</td>
<td>3</td>
</tr>
<tr>
<td>MTSC 121 - College Algebra</td>
<td>Minimum Grade</td>
<td>3</td>
</tr>
<tr>
<td>MVSC 101 - Lifetime Fitness and Wellness</td>
<td>Minimum Grade</td>
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<table>
<thead>
<tr>
<th>Term 2</th>
<th>Minimum Grade</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ENGL 102 - English Composition II</td>
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</tr>
<tr>
<td>BIOL 102 - General Biology II</td>
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</tr>
<tr>
<td>HMEC 192 - University Seminar II - Human Ecology</td>
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<tr>
<td>HMEC 105 - Principles and Analysis of Food Preparation</td>
<td>Minimum Grade</td>
<td>3</td>
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<tr>
<td>Art/Humanities</td>
<td>Minimum Grade</td>
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</tr>
<tr>
<td>PSYC 201 - Introduction to General Psychology</td>
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<table>
<thead>
<tr>
<th>Term 3</th>
<th>Minimum Grade</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CHEM 101 - General Chemistry I</td>
<td>Minimum Grade</td>
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</tr>
<tr>
<td>NTRS 321 - Biometrics</td>
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</tr>
<tr>
<td>BIOL 208 - Anatomy and Physiology II</td>
<td>Minimum Grade</td>
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</table>
## DIET

**Agriculture and Related Sciences**

### Degree Plan

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Term 2</th>
<th>Term 3</th>
<th>Term 4</th>
<th>Term 5</th>
<th>Term 6</th>
<th>Term 7</th>
<th>Term 8</th>
<th>Term 9</th>
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</thead>
<tbody>
<tr>
<td>ENGL 101 English Composition I</td>
<td>3 Credits</td>
<td>ENGL 102 English Composition II</td>
<td>3 Credits</td>
<td>CHEM 101 General Chemistry I</td>
<td>4 Credits</td>
<td>CHEM 102 General Chemistry II</td>
<td>4 Credits</td>
<td>CHEM 210 Organic Chemistry I</td>
</tr>
<tr>
<td>BIOL 101 General Biology I</td>
<td>4 Credits</td>
<td>BIOL 102 General Biology II</td>
<td>3 Credits</td>
<td>NTRS 321 Biometrics</td>
<td>3 Credits</td>
<td>HMEC 250 Introduction to Food Science</td>
<td>3 Credits</td>
<td>HMEC 395 Global Societies (Non-Ed Mejias)</td>
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<td>HMEC 191 University Seminar I - Human Ecology</td>
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<td>HMEC 192 University Seminar II - Human Ecology</td>
<td>1 Credit</td>
<td>BIOL 208 Anatomy and Physiology II</td>
<td>3 Credits</td>
<td>HMEC 201 History</td>
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<td>HMEC 425 Medical Nutrition Therapy I</td>
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<tr>
<td>HMEC 215 Introduction to Nutrition</td>
<td>3 Credits</td>
<td>HMEC 225 Principles and Analysis of Food Preparation</td>
<td>3 Credits</td>
<td>HMEC 335 Nutrition Through Life-Cycle</td>
<td>3 Credits</td>
<td>HMEC 310 Introduction to Dietetic Practices</td>
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<td>HMEC 426 Medical Nutrition Therapy II</td>
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<td>MTSC 121 College Algebra</td>
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<td>Art/Humanities</td>
<td>14 Credits</td>
<td>ENGL 200 Speech</td>
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<td>HMEC 427 Nutrition Education and Counseling</td>
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<td>HMEC 493 Food Service Management Practicum</td>
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<td>HMEC 494 Enrichment Practicum</td>
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</table>

**Total: 125 Credit Hours**

- **Strict Corequisite:**
- **Corequisite:**
- **Prerequisite:**
- **Pre Corequisite Field:**
- **Unblocked:**
- **Unblocked Field:**
Degree Plans - Pathways

DIET
Agriculture and Related Sciences

125 Credit Hours
Analytics Journey

Curricular Analytics

Plan Optimizer

Degree Plans (Program)

Degree Exploration

Public Facing

Curriculum (Courses & Prerequisites.)

Degree Requirements (Program)
We created a curricular analytics framework that provides predictive analytics around teaching and curricular reforms.

Curricular complexity and student success are inversely related. Curricular complexity can be decomposed into two independent parts:

- Instructional complexity – concerned with the manner in which courses are taught and supported.
- Structural complexity – concerned with the manner in which curricula are organized.

Is it possible to improve outcomes without changing how you teach?
We created a **curricular analytics** framework that provides predictive analytics around teaching and curricular reforms.

Curricular complexity and student success are inversely related.
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Curricular Analytics

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Is it possible to improve outcomes without changing how you teach?
### Curricular Complexity: 118.0

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Term 2</th>
<th>Term 3</th>
<th>Term 4</th>
<th>Term 5</th>
<th>Term 6</th>
<th>Term 7</th>
<th>Term 8</th>
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</thead>
<tbody>
<tr>
<td>1 CHEM 2090</td>
<td>10 PHYS 1112</td>
<td>9 PHYS 2213</td>
<td>4 PHYS 2214</td>
<td>1 ECE FOUND</td>
<td>1 ECE FOUND</td>
<td>1 CDE</td>
<td>1 ECE ELECT</td>
</tr>
<tr>
<td>15 MATH 1910</td>
<td>12 MATH 1920</td>
<td>8 MATH 2930</td>
<td>5 MATH 2940</td>
<td>5 ECE 3400</td>
<td>1 ECE FOUND</td>
<td>1 ECE ELECT</td>
<td>1 ECE ELECT</td>
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<tr>
<td>1 ENGRI</td>
<td>6 CS 111X</td>
<td>6 ECE 2100</td>
<td>4 ENGRD 2XXX OUTSIDE ECE TECH</td>
<td>4 ECE 2100</td>
<td>4 ADVISOR APPROVED</td>
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<td>1 ADVISOR APPROVED</td>
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<td>1 PE</td>
<td>1 WRITING SEMINAR</td>
<td>4 ECE 2300</td>
<td>5 ECE 2200</td>
<td>1 ADVISOR APPROVED</td>
<td>1 ADVISOR APPROVED</td>
<td>1 Liberal Studies</td>
<td>1 Liberal Studies</td>
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<tr>
<td>1 WRITING SEMINAR</td>
<td>1 PE</td>
<td>1 Liberal Studies</td>
<td>1 Liberal Studies</td>
<td>1 Liberal Studies</td>
<td>1 Liberal Studies</td>
<td>1 Liberal Studies</td>
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</tr>
</tbody>
</table>

**Complexity:**
- **Term 1:** 19.0
- **Term 2:** 30.0
- **Term 3:** 28.0
- **Term 4:** 19.0
- **Term 5:** 9.0
- **Term 6:** 5.0
Curricular Complexity: 118.0

Credits: 4

- Centrality: 0
- Complexity: 15
- Blocking factor: 10
- Delay factor: 5

Term 1:
- CHEM 2090
- MATH 1810

Term 2:
- PHYS 1112
- MATH 1820

Term 3:
- PHYS 2213
- MATH 2930

Term 4:
- PHYS 2214
- MATH 2940

Term 5:
- ECE FOUND
- ECE 3400

Term 6:
- ECE FOUND

Term 7:
- CDE

Term 8:
- ECE ELECT

Complexity:
- Term 1: 19.0
- Term 2: 30.0
- Term 3: 28.0
- Term 4: 19.0
- Term 5: 9.0
- Term 6: 5.0

Complexity: 4.0

Complexity: 4.0
Curricular Complexity: 118.0

- Term 1: CHEM 2090
- Term 2: PHYS 1112, MATH 1910, CS 111X
- Term 3: PHYS 2213, MATH 1920, MATH 2930
- Term 4: PHYS 2214, MATH 3240, ECE 1000
- Term 5: ECE FOUND, ECE 3400
- Term 6: ECE FOUND, ECE ELECT
- Term 7: CDE, ECE ELECT
- Term 8: ECE ELECT

Credits: 4
- Centrality: 15
- Complexity: 6
- Blocking Factor: 1
- Delay Factor: 5

Complexity:
- Term 1: 19.0
- Term 2: 30.0
- Term 3: 28.0
- Term 4: 19.0
- Term 5: 9.0
- Term 6: 5.0
- Term 7: 4.0
- Term 8: 4.0
Structural Complexity – Institution 2

Curricular Complexity: 485.0

Term 1
- 1 ANCH 150
- 1 CHEM 211
- 1 DISC 100
- 37 MATH 210

Term 2
- 34 MATH 220
- 26 PHYS 240
- 1 ANCH 200
- 24 PHYS 250

Term 3
- 3 ECE 216
- 16 ECE 226
- 14 ECE 227
- 15 ECE 241

Term 4
- 5 ECE 228
- 4 ECE 229
- 3 ECE 250
- 11 ECE 276

Term 5
- 5 ECE 334
- 17 ECE 376
- 7 ECE 377
- 11 ECE 380

Term 6
- 11 ECE 302
- 8 ECE 303
- 10 ECE 330
- 12 ECE 381

Term 7
- 7 ECE 402
- 11 ECE 403
- 7 ECE 466
- 8 ECE 467

Term 8
- 1 FOCUS A
- 1 FOCUS B
- 10 ECE 430
- 8 ECE 472
- 1 ANCH 308
- 1 DISC 300

Complexity:
- ANCH 150: 41.0
- CHEM 211: 62.0
- DISC 100: 28.0
- MATH 210: 84.0
- PHYS 240: 88.0
- PHYS 250: 88.0
- ECE 216: 41.0
- ECE 226: 41.0
- ECE 227: 41.0
- ECE 241: 41.0
- ECE 228: 41.0
- ECE 229: 41.0
- ECE 250: 41.0
- ECE 276: 41.0
- ECE 334: 41.0
- ECE 376: 41.0
- ECE 377: 41.0
- ECE 380: 41.0
- ECE 302: 41.0
- ECE 303: 41.0
- ECE 330: 41.0
- ECE 381: 41.0
- ECE 402: 41.0
- ECE 403: 41.0
- ECE 430: 41.0
- ECE 466: 41.0
- ECE 467: 41.0
- FOCUS A: 28.0
- FOCUS B: 28.0

Total Complexity: 485.0
Structural Complexity – Institution 2
Curricular Analytics in Action

University of New Mexico —

Percent of programs reduced since AY 2013-14: 0.0% (0/100)

Percent of programs at 120 credit hours: 0.0% (0/100)

Total credit hours saved: 0
Curricular Analytics in Action

University of New Mexico —

Percent of programs reduced since AY 2013-14: 49.0% (48/98)

Percent of programs at 120 credit hours: 44.9% (44/98)

Total credit hours saved: 372
Curricular Analytics in Action

University of New Mexico —

Percent of programs reduced since AY 2013-14: 71.7% (71/99)
Percent of programs at 120 credit hours: 58.6% (58/99)
Total credit hours saved: 527
Curricular Analytics in Action

University of New Mexico —

Percent of programs reduced since AY 2013-14: 86.9% (86/99)

Percent of programs at 120 credit hours: 71.7% (71/99)

Total credit hours saved: 664
University of New Mexico —
  • Over a 8-year time period (2010–18) 4-year graduation rate increase:
    12.6% → 35%
University of New Mexico —

- Over a 8-year time period (2010–18) 4-year graduation rate increase:
  12.6% $\rightarrow$ 35%

$\sim$ 300% increase!
Over a 8-year time period (2010–18) 4-year graduation rate increase: 12.6% → 35%  

≈ 300% increase!

Saves students at least $35M/year.
Curricular Analytics in Action

University of New Mexico —

- Over a 8-year time period (2010–18) 4-year graduation rate increase:
  12.6% → 35%

  ~ 300% increase!

- Saves students at least $35M/year.

- Very little change in the six-year graduation rate ... the pathways were made more efficient.
Statewide Infrastructure

Institution A Cloud
- Courses/Prequisites
- Degree Requirements
- Degree Plans
- Degree Investigation App

Institution Z Cloud
- Degree Plans
- Degree Requirements
- Courses/Prequisites
- Degree Investigation App

...Cross-institutional Degree Plans App...

CPE Cloud
- Workforce Data
- Curricular Analytics
- State Workforce Dashboard
- Curricular Analytics Dashboard
- Statewide Course Articulation
Analytics Journey

Student Information System (SIS)

Curriculum
(Courses & Prerequisites.)

Degree Requirements (Program)

Curricular Analytics

Curricular Efficiency

Faculty Facing

Plan Optimizer

Degree Plans (Program)

Degree Exploration

Public Facing

Curriculum (Courses & Prerequisites.)

Degree Requirements (Program)
Analytics Journey

- Student Information System (SIS)
- Transfer Articulation
- Requirments Exceptions
- Curriculum (Courses & Prerequisites.)
- Degree Plans (Program)
- Degree Exploration
- Curricular Analytics
- Curricular Efficiency
- Faculty Facing
- Plan Optimizer
- Degree Requirements (Program)
- Public Facing
Analytics Journey

- Student Information System (SIS)
- Transfer Articulation
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- Curricular Efficiency
- Degree Plans (Program)
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- Degree Exploration
- Plan Optimizer
- Degree Plans (Program)
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Analytics Journey

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- Transfer Articulation
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- Student Demographics/Resilency
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- Degree Plans (Program)
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- Curriculum (Courses & Prerequisites.)
- Student Demographics/Resilency
- Requirements Exceptions
- Transfer Articulation
- Student Information System (SIS)
Analytics Journey

Student Information System (SIS)

Transfer Articulation

Requirements Exceptions

Student Demographics/Resiliency

Curriculum (Courses & Prerequisites.)

Plan Optimizer

Student Dimension

Curricular Analytics

Degree Plans (Program)

Curricular Efficiency

Degree Exploration

Public Facing Faculty Facing

Curricular Efficiency

Public Facing Faculty Facing

Curricular Analytics

Degree Plans (Program)

Degree Exploration

Faculty Facing

Curricular Analytics

Degree Plans (Program)

Degree Exploration

Public Facing

Curricular Analytics

Degree Plans (Program)

Degree Exploration

Public Facing
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- Public Facing
- Faculty Facing
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- Plan Optimizer
- Degree Requirements (Program)
- Student Dimension
- Student Information System (SIS)
Many different degree plans can be created that satisfy a single curriculum.
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Are some of them better than others with respect to particular student populations?
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Are some of them better than others with respect to particular student populations? E.g.,

- Lighter load in the fall term for athletes competing in the fall.
- Not too many "killer courses" in one term.
- Separate toxic and combine synergistic courses in the same term.
- First-year courses selected to improve chances of success (ease a student into college).
- Spread curricular complexity evenly across all terms.

Many different **degree plans** can be created that satisfy a single curriculum.

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- Spread curricular complexity evenly across all terms.

If we can quantify these things, we can construct optimization algorithms that take a curriculum as input, and produce an optimized (personalized) degree plan as output.
Napoleon’s Grande Armée – March to Moscow

Carte Figurative des pertes successives en hommes de l’Armée Française dans la Campagne de Russie 1812-1813.

[Diagram showing the march of Napoleon's Grande Armée to Moscow, with annotations indicating the number of men lost at various points on the journey.]
Sankey Flows

3,157 Students

College of Arts and Sciences
781 students (24.7%)
Sankey Flows

391 Students

Graduated: 96 students (24.67% of cohort)
Analytics Journey

- Student Information System (SIS)
- Transfer Articulation
- Requirements Exceptions
- Student Demographics/Resilency
- Curriculum (Courses & Prerequisites.)

Student Dimension

Plan Optimizer

Curricular Analytics

Curricular Efficiency

Individual Plan

Degree Exploration

Degree Plans (Program)

Faculty Facing

Student/Advisor Facing

Public Facing

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Curricular Analytics

Plan Optimizer

Student Dimension

Student Information System (SIS)

Transfer Articulation

Requirements Exceptions

Student Demographics/Resilency

Curriculum (Courses & Prerequisites.)
Analytics Journey

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- Curricular Efficiency
- Individual Plan
- Degree Exploration
- Progress Reasoner
- Faculty Facing
- Student/Advisor Facing
- Public Facing
Analytics Journey

**STUDENT ID:** 1C0000008

**MINOR:** N/A

**MAJOR:** Computer Engineering

**CONCENTRATION:** N/A

<table>
<thead>
<tr>
<th>ADMISSION TO PROGRAM</th>
<th>GPA</th>
<th>ATTEMPTED CREDIT HOURS</th>
<th>COMPLETION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2010</td>
<td>2.77</td>
<td>213</td>
<td>93%</td>
</tr>
</tbody>
</table>

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**

**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 161
- PHYC 160
- MATH 163
- ECE 420
- ECE 344L
- ECE 340
- ECE 330
- ECE 206L
- ECE 203
- Fine Arts
- Physical and Natural Sciences
- Humanities
- ENGL 219 or ENGL 220 or CJ 130 or PHIL 156 or UNIV 201
- Tech Elective
- PHYC 161
- ENGL 219
- ECE 440
- ECE 419
- ECE 331
- ECE 331
- ECE 314
- ECE 213
- ECE 238L
- ECE 231
### REQUIREMENTS NOT COMPLETED

- **MATH 162**
- **ECE 300**

### COURSES NOT COUNTED

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Grade</th>
<th>Notes</th>
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<tbody>
<tr>
<td>CS 105L: A</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>THEA 130: A</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>PENP 114: B</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>CS 155L: A</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>PENP 115: A+</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>COP 105: CR</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>MATH 264: D+</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>ECE 213: IF</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>PHVC 168: CR</td>
<td>Grade Not Sufficient</td>
<td></td>
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<tr>
<td>MATH 101: A</td>
<td>Transfer Course</td>
<td></td>
</tr>
<tr>
<td>CHEM 111: WF</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>ECE 417: W</td>
<td>McMaster</td>
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</tr>
<tr>
<td>MATH 264: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>CS 152L: W</td>
<td>McMaster</td>
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<tr>
<td>ENGE 102: WP</td>
<td>McMaster</td>
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<tr>
<td>MATH 327: W</td>
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<td></td>
</tr>
<tr>
<td>MATH 123: WP</td>
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<td></td>
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<td>MATH 235: WP</td>
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<td></td>
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<tr>
<td>ECE 341: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>MATH 123: C+</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>PENP 108: A-</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>MATH 120: B-</td>
<td>Not applicable towards degree</td>
<td></td>
</tr>
<tr>
<td>MATH 150: D</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>SPAN 212: F</td>
<td>Grade Not Sufficient</td>
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</tr>
<tr>
<td>MATH 129: D</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>PSY 105: C-</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>CHEM 111: NC</td>
<td>Grade Not Sufficient</td>
<td></td>
</tr>
<tr>
<td>MATH 150: WP</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>ECE 340: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>MATH 264: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>MATH 327: W</td>
<td>McMaster</td>
<td></td>
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<tr>
<td>ECE 203: W</td>
<td>McMaster</td>
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<tr>
<td>ARTH 101: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>MATH 129: WP</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>ANTH 101: W</td>
<td>McMaster</td>
<td></td>
</tr>
<tr>
<td>ECE 345: W</td>
<td>McMaster</td>
<td></td>
</tr>
</tbody>
</table>
Analytics Journey

Student Information System (SIS)
Transfer Articulation
Requirements Exceptions
Student Demographics/Resilency
Curriculum (Courses & Prerequisites.)

Student Dimension
Plan Optimizer
Degree Plans (Program)
Curricular Analytics
Cohort Analytics
Progress Reasoner

Curricular Efficiency
Individual Plan
Degree Exploration
Student/Advisor Facing
Student/Advisor Facing
Student/Advisor Facing
Student Progress
Public Facing
Faculty Facing
Analytics Journey

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Student Progress

Student/Advisor Facing

Cohort Analytics

Progress Resasoner

Student Demographics/Resilency
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

- 90%-95%: 13 Students
- 90%-95%: 20 Students
- 90%-95%: 19 Students

Requirements Completed

Number of Students

0%  5%  10%  15%  20%  25%  30%  35%  40%  45%  50%  55%  60%  65%  70%  75%  80%  85%  90%  95%  100%
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.

<table>
<thead>
<tr>
<th>Students</th>
<th>Average GPA</th>
<th>Average Credit Hours</th>
<th>Average Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1006</td>
<td>3.46</td>
<td>124</td>
<td>61%</td>
</tr>
</tbody>
</table>

Efficiency Rating

Avg Credits Counted Towards Degree: 75
Avg Credits Not Counted Towards Degree: 49

Student Progress Histogram

- Off Track Students
- On Track Students
- Students Ahead

85% - 90%: 9 Students
85% - 90%: 2 Students
85% - 90%: 62 Students
### Grade Not Sufficient

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MUS 101</td>
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<td>ISM 100</td>
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<td>MUS 214</td>
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<td>HIST 101</td>
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<td>MUSE 215</td>
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<td>CS 101</td>
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</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Count</th>
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<tbody>
<tr>
<td>PHYC 167</td>
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<td>PHYC 168</td>
<td>149</td>
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<td>ECOP 105</td>
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<td>MATH 163</td>
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<td>MATH 162</td>
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<tr>
<td>PHYC 161</td>
<td>77</td>
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<tr>
<td>PHYC 160</td>
<td>71</td>
</tr>
</tbody>
</table>

---

**Fine Arts**

**Engineering**
Action Analytics versus Reporting Analytics:
Action Analytics versus Reporting Analytics:

- Reporting analytics need to ... be correct, or you might get in trouble.
Statutory Requirements for Reporting IPEDS Data

General Mandate

NCES is authorized by law under the Section 153 of the Education Sciences Reform Act of 2002 (P.L. 107-279). Accordingly, NCES "shall collect, report, analyze, and disseminate statistical data related to education in the United States and in other nations, including -

- collecting, acquiring, compiling (where appropriate, on a state by state basis), and disseminating full and complete statistics on the condition and progress of education, at the pre-school, elementary, secondary, and postsecondary levels in the United States, ...;
- conducting and publishing reports and analyses of the meaning and significance of such statistics;
- collecting, analyzing, cross-tabulating, and reporting, to the extent feasible, so as to provide information by gender, race, ...; and
- assisting public and private educational agencies, organizations, and institutions in improving and automating statistical and data collection activities..."

Mandatory Reporting for Institutions with Program Participation Agreements

The completion of all IPEDS surveys, in a timely and accurate manner, is mandatory for all institutions that participate in or are applicants for participation in any Federal financial assistance program authorized by Title IV of the Higher Education Act (HEA) of 1965, as amended. The completion of the surveys is mandated by 20 USC 1094, Section 487(a)(17) and 34 CFR 668.14(b)(19).

The Department of Education relies on postsecondary institutions to accurately report data to IPEDS, and nearly all institutions do. Institutions themselves sometimes identify misreporting issues and work with ED to correct those problems without the need for further action by the Department. The Department is concerned about any instances of intentional or significant misreporting. Under these circumstances, the Office of Federal Student Aid may take administrative action to appropriately address the issue.
Action Analytics versus Reporting Analytics:

- Reporting analytics need to ... be correct, or you might get in trouble.

- Action analytics need to ... direct you to the right decision.
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“When you get the answer your looking for, ya hang up.”
—Billy Beane (in Moneyball)
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“When you get the answer your looking for, ya hang up.”
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Takeaway #4: Student success is about action analytics
Takeaways

- Analytics is storytelling
· Analytics is storytelling

· Analytics should inform strategies and tactics, not initiate them
Takeaways

- Analytics is storytelling
- Analytics should inform strategies and tactics, not initiate them
- Analytics is a process, not a product
Takeaways

• Analytics is storytelling

• Analytics should inform strategies and tactics, not initiate them

• Analytics is a process, not a product

• Action analytics – point you in the right direction
Questions?