Enterprise Summit: Analytics
April 17-19, 2019 | Long Beach, CA
#EDUCAUSEEnterprise
Rethinking Enterprise Analytics in the Age of Big Data

Robert Carpenter, Associate Provost & Deputy CIO
Constance Pierson, Ph.D., Associate Vice Provost, IRADS
Jack Suess, Vice President of IT & CIO
About UMBC

- Founded: 1966
- Located 10 minutes from Baltimore, Maryland and 30 minutes from Washington, DC
- Student Enrollment, Fall 2018
  - Undergraduate: 11,260
  - Graduate: 2,507
  - Total: 13,767
  - Roughly 50% of students are transfers
  - Slightly less than 50% enter as STEM majors
- Carnegie Classification – Doctoral Universities (Higher Research Activity, approximately $100 million per year in funded research)
What We Will Discuss

• 2001-2006 - Our first failure in analytics
• 2007-2019 - How UMBC achieved success in analytics
• 2020 - 202x - Rebooting our analytics environment for the future
  • Why we are open to questioning our past success to rethink the skills, infrastructure, and tools we will need to be successful in the future
  • How we see this taking shape at UMBC
In 2001, UMBC purchased the full PeopleSoft suite, including Enterprise Performance Management (EPM).

In 2005, after struggling for 4 years to make EPM work we pulled the plug. Why did it fail:

- It was solely an IR effort and couldn’t scale.
- Institutionally, you can’t go from nothing to EPM.
- PeopleSoft oversold what it could do and licensing was too restrictive for including other data.

In 2006, IR director leaves to go to UCal Merced.
2007-2019 How DoIT and IR Learned From Failure

- IT planning to implement DW
- IR planning to build DW for official reporting
- Reconvene the DMC as a joint IR and DoIT effort
- 2008 DoIT and IR developed a shared vision for analytics & reporting
- 2009 DoIT and IR partner on a new data warehouse (REX) for UMBC
Data Reporting & Analytics

- Single DW serves entire campus and integrates systems throughout UMBC
- REX provides both transactional and official data for reporting and analysis - same tools and data tables - no “your numbers vs. my numbers”

Data Management

- Data is institutional resource
- Data is managed by the units

Data Governance

- More organic and owned by all
- Everyone’s responsibility
- No PS-specific reports written
- Guided parameter-driven reports serve back offices and administration
- Exploratory analysis using Pyramid available to authorized users
- Anonymized CSV files available for research & analysis
- IRADS mandated reporting directly out of REX
Data Management Committee
Meets twice a year to review progress made by various teams and solicit feedback on specific issues and prioritizations.

- VPs & Deans
  - Deans’ Representation

Campus Systems Executive Committee (CSEC)

IT Steering Committee

Data Warehouse Team
Assigns REX tickets, manages changes to data warehouse & reporting environment.
Director of DS

REX User Group
Informal meeting to discuss users needs and specific reports. Could be used to discuss training options.
Director of BI

Data Quality Team
Comprised of data managers from various functional offices to develop and monitor data integrity processes.
Director of DS

Data Access & Security Team
Manages access to and security levels in PS and REX, including confidentiality issues.
Director of SA

Setup Tables Team
Manages changes to plans and subjects as the rollups to orgs, colleges, etc.
Registrar’s Office

Training Team
Manages training material for both SA and REX
Director of BI
Integrating Academic Affairs, IR, & DoIT

• In 2017, Provost created Associate Provost for Analytics position in Academic Affairs and Bob Carpenter (Economics) to join his office
• In 2018, we looked at how academic analytics would evolve: integrating IRADS or focus on leveraging academic capabilities?
• Lots of discussion. In the end, Provost and I asked Bob to be a dual appointment in Academic Affairs and DoIT
  • Focus is on using analytics to address key issues in academic affairs and use technology to support academic priorities,
  • And to help our organizational capabilities catch up to our technological capabilities
Rebooting: Big bets on analytics

1. Rethinking our talent pool and connecting with the academic units.
   a. Bob’s connection with academic affairs grounds the unit with faculty and allows us to draw in talented students.

2. Betting on the cloud.
   a. We feel AWS, Google Cloud, and Microsoft Azure are the future.

3. Integrating analytics directly into our systems for students and faculty.
   a. How do we use data to personalize your experience (e.g. Advising)

4. Instrumenting the learning environment to focus on big questions.
   a. What pedagogical innovations are successful and for whom?
How we’re set up today; our priorities

● The component parts:
  ○ A Data Science Team (comprised mostly of students!)
  ○ A Business Intelligence and Student Success Technologies Group; and
  ○ Colleagues that constitute ”a coalition of the willing”
● We conduct analysis for prediction and assessment, design academic innovations, support planning, and construct advanced visualizations for improved decision support
What We Do

• Our overarching goals are to democratize information by
  • Making information easier to find
  • Making data easier to understand
  • Make information easier to act on
  • Designing and deploying academic innovations
  • Instrumenting the learning environment to assess impact of pedagogical innovations
Some examples to illustrate concepts:

- Progression barriers

- We know the 72 students in Calculus with C’s in Precalculus. They would not have been on anyone’s radar screen
Using Analytics for Early Interventions

• We’re piloting the use of predictive modeling as a complement to our faculty-driven early alert system.

• The pilot results (which follow) were combined with behavioral nudges. Students receiving the message passed the course at a higher rate.
Green and red shaded categories show "agreement" between FYI Alert and BbPredict on expected pass or expected failure in a course.

<table>
<thead>
<tr>
<th></th>
<th>BIOL 302L</th>
<th>PHYS 111</th>
<th>PSYC 100 (2060)</th>
<th>PSYC 100 (2061)</th>
<th>CHEM 352</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
</tr>
<tr>
<td>Received FYI Alert</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>91%</td>
<td>89%</td>
<td>97%</td>
<td>59%</td>
<td>99%</td>
</tr>
<tr>
<td></td>
<td>54</td>
<td>37</td>
<td>77</td>
<td>87</td>
<td>80</td>
</tr>
<tr>
<td>Yes</td>
<td>.</td>
<td>0%</td>
<td>100%</td>
<td>27%</td>
<td>68%</td>
</tr>
<tr>
<td></td>
<td>.</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
<td>Predicted DFW</td>
</tr>
<tr>
<td>Received FYI Alert</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>95%</td>
<td>72%</td>
<td>94%</td>
<td>67%</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>170</td>
<td>69</td>
<td>48</td>
<td>38</td>
</tr>
<tr>
<td>Yes</td>
<td>57%</td>
<td>23%</td>
<td>67%</td>
<td>14%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>69</td>
<td>3</td>
<td>14</td>
<td>1</td>
</tr>
</tbody>
</table>
Moving Forward: Expanding the Ecosystem

- Ultimately, the goal is all systems that support academic success, including PeopleSoft SA are combined in a single area. Allows for organizational efficiencies, smoother deployment
  - Student degree donut, our visual degree audit tool
  - Student registration guide, for guiding students through a productive advising session
  - Our “Personal Post” system for communicating with students
  - Implementation of new faculty advising system
  - Review of CRM technologies
Moving Forward: Rethinking REX in AWS

- UMBC moved BB Analytics (REX) from on-premise to running in AWS as part of IT roadmap.
- UMBC developed our own AWS pipeline for learning analytics.
- Leveraging the university’s data science capabilities.
- CIO/President connecting to high-capability students to support data science/ML efforts.
  - Leverages our resources
  - Provides students with a valuable applied learning experience
Caliper Event Stream

Amazon CloudFront

Amazon API Gateway

AWS Lambda

AWS Glue

Amazon Kinesis Firehose

Amazon S3

Contextual non-relational data (VitalSource books, users, etc)

Contextual Relational Data (SIS, Student portal, Analytics for Learn, etc)

Clients

Amazon Redshift
Next Generation Data

- Part of IT’s partnership with Vital Source

- Sharpens predictions, allows for more customized interventions
Lessons Learned Moving to AWS

• Systems:
  • Moving systems as-is is not that cost effective.
  • Leveraging AWS for what it does best is amazingly cost effective -- processing 140 million events -- $640.

• Tools are evolving:
  • It is well known that AWS, GCP, and AZURE are competing for customers and open source is the major player.
  • Big question - Could we utilize tools like R’s Shinyapps.io, Jupyter, or Dash to support institutional initiatives?

• People and skills :
  • UMBC is using our M.S. in Data Science to promote change.
Lessons Learned: Partnerships

- We’re not there yet...
- Our partnerships and pilots have been technically successful but haven’t been scaled and we’re not a fully data-informed institution:
  - EAB APS
  - Civitas
  - Blackboard Predict
- Learning analytics increasingly important.
Institutional Research
• Accountability and accreditation
• Official reporting & research support
• Decision support- putting data in context

Analysis:
• Supporting our student success initiative
• Collaborative partners with Academic Analytics and others across campus
• Analysis support for administrative units

Decision Support
• Primary responsibility for all REX reporting, with continued collaboration with IT
• Focus on data quality and integrity
• Providing data for institutional decision support

IRADS- Lessons Learned:
Revisiting Our Mission

As a unit:
• Making data more accessible, understandable & usable
• Campus data educators / collaborators
Lessons Learned: Organizational Capacity

• Technology can get ahead of organizational capability.
  • We deployed EAB APS but didn’t have the organizational commitment to use the data.
  • Likewise we deployed Civitas before we had the staff in place to intervene.
• Creating a data-informed culture is hard. It sheds light on some unpleasant facts we weren’t initially prepared to deal with (e.g. courses/sections with high DFW rates).
• UMBC strategic plan launched with goal of tracking performance but no real KPI’s initially identified.
• Importance of linking Academic Affairs, IR, and DoIT is to help support the cultural change needed to use data for change.
How This Might Fit Together

• Faculty and students can provide institutions with a strong pool of talent, especially in new tools.
• New tools and methods for visualization are being developed at a rapid pace.
• Teach them to fish! There are always more questions that faculty and leaders will have than resources to answer. Part of the goal of providing better visual tools is let them “experiment” with their data to understand it better.
• No one group on campus can fully provide a solution, partnership and collaboration is critical to success!
Questions or Comments

Contact information:
Jack Suess - Jack@umbc.edu
Dr. Connie Pierson - krach@umbc.edu
Dr. Robert Carpenter - bobc@umbc.edu
Session Evaluations
There are two ways to access the session and presenter evaluations:

1. In the online agenda, click on the “Evaluate Session” link.
2. From the mobile app, click on the session you want from the schedule > then click the associated resources > and the evaluation will pop up in the list.

#EDUCASEEnterprise