Analytics for Academics: Producing Actionable Information about Students and Learning to Improve Effectiveness

October 27, 2017
Mills College, Oakland, CA

Resource Binder
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## Workshop Schedule

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<th>Activity</th>
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<td>8:00 – 8:30</td>
<td>Arrival, check-in, registration</td>
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<td>8:30 – 8:45</td>
<td>Welcome / Introductions Facilitated by David Chase</td>
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<tr>
<td>8:45 – 9:15</td>
<td>Framework for Purposeful Integration of IR and Assessment Activities Facilitated by Monica Stitt-Bergh and John Stanley</td>
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<tr>
<td>9:15 – 11:00</td>
<td>Use Data Analytics to Engage Stakeholders in Decision Making (with 10 min. break) Facilitated by John Stanley</td>
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<tr>
<td></td>
<td><em>Participants work with examples of data analytics that have been used in multiple ways by stakeholders to understand and respond to student learning patterns and needs.</em></td>
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<tr>
<td>11:00 – 12:30</td>
<td>Connect Learning Theory, Analytics, and Use of Assessment Results Facilitated by Monica Stitt-Bergh</td>
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<tr>
<td></td>
<td><em>Participants become familiar with the intersection of learning theory and data analytics; apply that knowledge to a case study involving student achievement in written communication; and explore how analytics and good visualization can help faculty interpret and use assessment results for learning improvement.</em></td>
</tr>
<tr>
<td>12:30 – 1:45</td>
<td>Networking Lunch</td>
</tr>
<tr>
<td>1:45 – 3:45</td>
<td>Build a Culture of Inquiry (with 15 min. break) Facilitated by Monica Stitt-Bergh and John Stanley</td>
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<td></td>
<td><em>Participants learn about the challenges of building a culture of inquiry based on analytics, including ethical implications, affordability, data availability, and expertise. Participants review strategies for overcoming such challenges as they consider different campus contexts.</em></td>
</tr>
<tr>
<td>3:45 – 4:30</td>
<td>Take Lessons from Analytics, Learning Theory, and Visualization to Make Progress Back Home Facilitated by Monica Stitt-Bergh and John Stanley</td>
</tr>
<tr>
<td></td>
<td><em>Participants consider integrative practices in action on their campus; chart ideas for integrating analytics, learning theory, and visualization; receive feedback from facilitators and peers on their planned next steps; and reflect on workshop take-aways.</em></td>
</tr>
<tr>
<td>4:30</td>
<td>Workshop Conclusion</td>
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Facilitator

Monica Stitt-Bergh

Monica Stitt-Bergh is an associate specialist in the Assessment Office at the University of Hawai‘i at Mānoa and the current President of the Association for the Assessment of Learning in Higher Education. Her specialization is in assessing written communication. In her current position, Monica serves as an internal consultant for and offers workshops on learning outcomes assessment, and she plans and conducts institutional assessment projects. She has spent the last eight years working to create a positive view of assessment and increase use of assessment findings. Previously, Monica assisted with the University of Hawai‘i at Mānoa’s writing-across-the-curriculum program and implementation of a new general education program. Her classroom experience includes teaching courses on writing as well as social science research methods. Monica received her BA in English from the University of Michigan and her MA in Composition and Rhetoric and PhD in Educational Psychology from the University of Hawai‘i. She has published and given conference presentations on program learning outcomes assessment in higher education, writing program evaluation, self-assessment, and writing-across-the-curriculum.

Email: bergh@hawaii.edu

John C. Stanley

John Stanley is the Director of Institutional Research at the University of Hawai‘i - West Oahu, where he is responsible for assessment and institutional research functions. Mr. Stanley has served in institutional research positions at four-year institutions and community colleges. He has published institutional research articles and has instructed workshops on using analytics to improve student outcomes at regional and national conferences. He was awarded best presenter at the 2012 California-AIR Conference. He received his BA in mathematics from the University of Texas at Austin and MEd in higher education from the University of Hawai‘i at Manoa. He is currently in the fourth year of his PhD in Educational Psychology at UH Manoa.

Email: jstanley@hawaii.edu

Stitt-Bergh, M. & Stanley, J. (2017, October) This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License
WSCUC Representative

David Chase

David Chase is the Associate Vice President of Educational Programs at WASC Senior College and University Commission. Prior to joining WSCUC in 2017, David was responsible for leading Academic Affairs at the American Film Institute Conservatory in Los Angeles, California, which included the planning, development, and evaluation the Conservatory’s academic programs and serving as the Accreditation Liaison Officer. David also held the position of Senior Associate Director of Institutional Effectiveness at the University of the Pacific, where he also served as the Assistant Dean of the Conservatory of Music and taught courses in the Music Management program and in the core seminars of Pacific’s General Education program. He earned Bachelor of Music and Master of Arts in Music degrees from Pacific’s Conservatory. David is a co-author of the book Assessment in Creative Disciplines: Quantifying and Qualifying the Aesthetic, and has published and presented workshops on assessing student learning and on teaching, learning, and assessment in higher education arts disciplines. He is a graduate of the third class of WSCUC’s Assessment Leadership Academy.

Email: dchase@wscuc.org
Overview of and Preparation for Workshop

David Chase
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

October 26, 2017
David Chase – WSCUC Educational Programs

WHY WE’RE HERE ...???
• Examine the benefits and challenges of **strategically aligning and integrating** teaching and learning, assessment, analytics/IR, and a culture of inquiry at your institution.

• Develop an understanding of the role **analytics** can play in higher education decision-making and integrated planning.

• Expand your institution’s ability to **integrate** analytics and assessment and **connect and use** them to improve learning.

---

• Explore **strategies for engaging** faculty and other stakeholders in organizational learning resulting from analytics and assessment.

• Assess institutional status and readiness for creating a sustainable culture of evidence-based improvement, and **identify next steps** for fully embedding these integrated processes within your institutional culture.

• Develop a **community of colleagues** with whom to share ideas, resources, and good practices.
The ideas and strategies build on good practices in IR/analytics and assessment, - AND ...
Some ideas are emergent to respond to changes in higher ed.
The approaches are not prescribed byWSCUC - BUT ...
They are intended to help institutions use data better to support student achievement and institutional vitality.

**AN INVITATION TO PLAY ...**

**OUR EXPERT FACILITATORS**

John Stanley  
Director of Institutional Research  
University of Hawai‘i - West Oahu
OUR EXPERT FACILITATORS

Monica Stitt-Bergh
Associate Specialist, Office of Assessment,
University of Hawai‘i at Manoa

ONE IDEA TO BEGIN WITH...

Define
Measure
Analyze
Act
Framework for Purposeful Integration of IR and Assessment Activities

Monica Stitt-Bergh
John Stanley
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

Monica Stitt-Bergh, University of Hawai‘i – Mānoa
John Stanley, University of Hawai‘i – West O‘ahu

Analytics – using data, statistics, and models to increase understanding

Not Dr. John

Not Dr. Monica
Analytics—Today’s Workshop

Not a stats class. Not a math class.

Framework for purposeful integration of institutional research and assessment activities
Driving Forces

1. Volume of data
2. Demand for data (accountability)
3. Data use no longer limited to reporting

Purposeful Integration of IR and Assessment Functions

Definitions:

**Institutional Research**
1. collection of institutional data useful for analysis, planning, & accreditation review; 2. the office that collects, organizes, & reports such data.

**Assessment (of student learning)**
an ongoing, iterative process consisting of four basic steps: 1. defining learning outcomes; 2. choosing a method or approach & then using it to gather evidence of learning; 3. analyzing & interpreting the evidence; and 4. using this information to improve student learning.
Diversity of Organizational Structures & Overlapping Needs


Reflection Activity

Take 3 minutes to ✓ the column you believe best represents your campus (or program).
Think – Pair – Share Activity

1 minute + 5 minutes per person

1. Area(s) of notable strength?
2. Area(s) for improvement?
3. If IR and assessment were integrated to a large extent, what campus/program issue could be better addressed or potentially solved?

Workshop Methodology

• Mini workshops
  • Analytics
  • Learning theory
  • Ethical implications & feasibility
• Concepts & case studies
• Activities and Q & A
• Take home lessons learned & excitement about your vision
Framework for Purposeful Integration of IR and Assessment Activities

Reflection Activity

To what extent does your campus already have institutional research (IR) and assessment capacity?  
To what extent is your campus or program using their combined energies?

Please make a “✓” in the column you believe best represents your campus (or program).

<table>
<thead>
<tr>
<th>Data management and reporting</th>
<th>Large Extent</th>
<th>Moderate Extent</th>
<th>Small Extent</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized institutional data (i.e., one source to ensure data accuracy).</td>
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<td></td>
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<tr>
<td>Interactive online reporting.</td>
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<tr>
<td>Data security measures.</td>
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Comments/notes:

<table>
<thead>
<tr>
<th>IR analytical reporting</th>
<th>Large Extent</th>
<th>Moderate Extent</th>
<th>Small Extent</th>
<th>Unsure</th>
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<td>Utilize research from the literature or other campus’s IR &amp; assessment offices.</td>
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<tr>
<td>Use statistics to predict or explain gradation &amp; retention data (or other IR data).</td>
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<td>Develop visualization tools to convey data and findings.</td>
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<tr>
<td>Present research studies and key findings to campus stakeholders.</td>
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Comments/notes:

continued on next page
Use an electronic system for assessment reporting.

Monitor assessment reporting.

Analyze survey responses (e.g., motivation, behaviors, self-assessments).

Evaluate learning evidence (e.g., projects, assignments, performances, exams).

Provide technical assessment expertise to faculty, staff, & administrators.

Distribute key findings from assessment in a useable format (e.g., good visualizations).

Use assessment findings to improve learning quality.

Comments/notes:

### Integration of IR and assessment activities

<table>
<thead>
<tr>
<th>Integration of IR and assessment activities</th>
<th>Large Extent</th>
<th>Moderate Extent</th>
<th>Small Extent</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use student information (e.g., prior performance, motivation, socio-economic class) to aid the interpretation of assessment findings and student outcomes.</td>
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</tr>
<tr>
<td>Use student information (e.g., prior knowledge, prior performance, motivation, socio-economic class) to predict student (learning) outcomes.</td>
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</tr>
<tr>
<td><strong>Use multiple data sources</strong> to develop action plans to improve learning quality and student success (Data sources such as student information system, learning management system, evaluation of learning evidence, survey responses).</td>
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<tr>
<td><strong>Use statistics to examine equity</strong> in student (learning) outcomes across groups of students.</td>
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</tbody>
</table>

Comments/notes:

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1 Assessment refers to student learning assessment, which is an “ongoing, iterative process consisting of four basic steps: 1. defining learning outcomes; 2. choosing a method or approach and then using it to gather evidence of learning; 3. analyzing and interpreting the evidence; and 4. using this information to improve student learning” (WASC Handbook Glossary)
Framework for Purposeful Integration of IR and Assessment Activities

Think – Pair – Share

1. On your campus (or program), what’s an area(s) of notable strength? (i.e., checked “large extent” above)

2. What’s an area(s) that may need improvement? (i.e., checked “small extent” above)

3. If IR and assessment were integrated to a large extent, what campus/program issue(s) could be better addressed or potentially solved?

When you’ve finished, discuss with and get feedback from someone nearby.
Use Data Analytics to Engage Stakeholders in Decision Making

John Stanley
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

Monica Stitt-Bergh, University of Hawai‘i – Mānoa
John Stanley, University of Hawai‘i – West O‘ahu

USE DATA ANALYTICS TO ENGAGE STAKEHOLDERS IN DECISION MAKING

John Stanley
Director, Institutional Research
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Session objectives

1. Define “analytics” and discuss driving forces.

2. Examine several case studies that have used analytics to improve institutional effectiveness.

3. Examine the use of analytics in the following key areas:
   a) Student surveys
   b) Enrollment management

Challenges for Institutional Research

- Compliance vs. Self-Improvement
- From reporting to analysis
- Converting data into ‘actionable’ information
- Follow highest standards, best practices
- Know your customers, mission
- Leverage technology, stay abreast of tech
- Empower staff, continuous honing of skills
- Effective senior-management support working with IR
"I've seen too many IR offices that operate like a reporting agency and focus IR analysis only on what has happened in the past. Decisions, however, are made about the future – specifically, about the expected outcomes of future events... For the future of IR, professionals should become active in helping to minimize the risks of a decision by providing insightful analysis about possible outcomes."

– Bob Daly, eAIR Newsletter, March 2016

“Analytics is the use of data, statistical analysis, and explanatory and predictive models to gain insights and act on complex issues.”

-EDUCAUSE Center for Applied Research

EDUCAUSE Center for Applied Research Video: “What is Analytics?”
Downloaded from:
http://www.educause.edu/ero/article/video-what-analytics
From hindsight to foresight

Gartner Analytic Ascendancy Model

Most of IR is stuck here

What happened?

Descriptive Analytics

Diagnostic Analytics

Predictive Analytics

Prescriptive Analytics

How can we make it happen?

Why did it happen?

Optimization

Foresight

Insight

Difficultly

IR tasks applied to Gartner Model

**DESCRIPTIVE**

1. Disaggregating retention rates by gender, ethnicity, Pell, first gen. status, etc.
2. Descriptive data in tables, charts, and graphs.

**DIAGNOSTIC**

1. Using statistics to estimate differences between groups and identify important drivers of behavior.
2. Interactive dashboards with slice and dice capability, drill downs.

**PREDICTIVE**

1. Building a prediction model to identify students that are ‘at-risk’ of dropping out.
2. Interactive dashboards with ‘what-if’ capability.
3. Using learning community as a variable in a prediction model.

**PRESCRIPTIVE**

1. Delivering student dropout predictions to academic advising in order to provide actionable information.
2. Visualization systems that push risk data to academic advisors.
3. A more precise gauge of the impact of learning communities provided to LC coordinators.
Analytics typology

Descriptive
Optimization
Explanatory
Action
Diagnostic
Predictive
Business Intelligence
A.I.
Academic
Prescriptive
Visualization
Big Data
Exploratory
Action
Business
Learning

Source: https://library.educause.edu/~/media/files/library/2012/1/el/0206.pdf.pdf

Visualization & Predictive Analytics
Visualization

- Data visualization is used to communicate data or information by representing it as visual objects (e.g., heatmaps, chords, sankeys).

- The goal is to communicate information clearly and efficiently to help users make:
  - faster insights
  - clearer choices
  - faster decision making

Visualization with Microsoft Power BI (free)

Sources:
Visualization with Microsoft Power BI

Interactive charts and graphs with explanatory text. This example provides student success information as required by the regional accreditor.
Other report examples

Standard admissions report for public consumption

Heatmap for classroom capacity planning

Bowtie graph for major migration reporting

Power BI solution for survey data

- Challenge – each row contained individual data elements
- Columns by individual numbered question or numbered answer
- Report needs to be updated as students continue to take survey
- Report needs to be disaggregated by school and program
- Comments need to be organized
## Typical survey issues

- Dataset is duplicated for each question
- Extra columns (other answers) deleted
- New columns for filters are added
- Columns renamed for clarity
- Each step is recorded, can be “played back” and edited at any time

## Power BI for survey data

- Each copied table is then merged
- Power BI has options that will automate this each time source table is updated
- Resultant merged table now ready to be used for developing visualization
Activity: Survey Analytics

Alphabet University NSSE Survey Results - 2016

Class Level: Freshman, Sophomore, Junior, Senior

1. Ranking per week. Participating in co-curricular activities (organizations, camps, etc.):
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

2. Using learning services (tutoring, writing center, etc.):
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

3. Providing support for your overall well-being (mental health, counseling, etc.):
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

4. Providing opportunities to be involved socially:
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

5. Attending events that address important social, economic, or political issues:
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

6. Encouraging contact among students from different backgrounds (social, academic, political, etc.):
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

7. Understanding people from other backgrounds (social, academic, political, etc.):
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Excellent

8. How would you evaluate your overall educational experience at this institution?:
   - Class Level: Freshman, Sophomore, Junior, Senior
   - Possible responses: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent

Table: Ethnicity

- African American, Filipino, Hispanic, Mixed Asian, Other Pacific Island, Chinese, Japanese, Native Hawaiian, Other

Table: Gender

- M, F, Other

Table: Degree

- BA, BS, BSN, BBA, MD, Other

Table: College

- Business, Humanities, College, Social Sciences

Activity: Survey Analytics

Alphabet University NSSE Survey Comments

Students Served: 19

Search
- Social Sciences
  - SOC
  - PSY
- Natural Sciences
  - BIO
  - CHEM
- Engineering
  - VTE, Mech
- Humanities

Comments of students:

- Give more opportunities for students to participate in campus and off-campus activities.
- More professors should be available to answer questions and provide feedback.
- More engaging courses and presentations.
- Need to take more classes to fulfill all the requirements.
- More professors should support students and be more approachable.

Constants of success:

- Grades, GPA, SAT scores, standardized tests, etc.

Internalized learning goals:

- Critical thinking, problem-solving, effective communication, etc.

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Brainstorm, Pair & Share Activity

Read *Data Analytics Worksheet 3A*, see dashboard, and then

A. Think about the various questions that can be answered using the dashboard.
B. Write down at least one useful question that a department might ask. Do parameters need to be added to the dashboard to answer new questions?
C. What might the department do with answers to the question(s) if the answers were disappointing?

Noteworthy case studies

1. Loma Linda University  
   (extensive use of visualization in IR and assessment reports)

2. Purdue University  
   (‘Data Digest’ provides all public-facing data)

...See syllabus for more references
Brainstorm, Pair & Share Activity
Enhancing survey data sharing and utilization with analytics

Scenario:
You are the Director of Institutional Effectiveness at Alphabet University and charged with using NSSE results to identify strengths and weaknesses in the undergraduate experience and promote the use of disaggregated data. Specifically, a campus-wide initiative encourages departments to use NSSE data to enhance co-curricular offerings. Departments were asked to review their NSSE results and organize retreats to discuss how their departmental missions and student outcomes might be informed by the data. For example, if increasing participation in co-curricular activities is an outcome goal for a department, faculty/staff would examine their students’ scores on several NSSE items related to this area.

1. Think about the various questions that can be answered using the parameters in the dashboard. (Remember: each parameter can be checked/unchecked to allow for more detailed questions & answers). Write down at least one useful question that a department might ask regarding student engagement at Alphabet University.

2. Share your questions in pairs or as a group. Discuss what parameters might need to be checked/unchecked **or new parameters added** to the dashboard in order to visualize the answers.

3. What might the department do with answers to the question(s) if the answers were disappointing?
For the most part, the faculty were very good in clearly explaining course goals and requirements, teaching in an organized way, using videos and presentation software to explain difficult points, and providing prompt and detailed feedback on tests and completed assignments.

Give more opportunities for students to participate off-campus and/or in study abroad programs. I think if I had taken an internship or even just one semester abroad, it would have made my college experience even cooler. Bridging the gap between the college world and the career world could have been a better outcome from my college experience. I feel that there needs to be more staff support in my academic program. I enjoyed classes but would have liked more real, practical assignments and social interaction. Many of the courses were heavy in lecture, reading, and homework. The bookstore was very good about getting books or ordering quickly if they ran out. The small campus allowed fast access to financial aids and student services too.

Had to take more classes to fulfill all of the various requirements. The degree plans were well-organized but it was still difficult to time the availability of certain courses.
Predictive Analytics

- Uses historical data to predict or forecast future behaviors, trends, or outcomes
- Powerful and accurate predictive models can be constructed using matriculation data from your Student Information System (SIS).

Benefits of predictive analytics

- Can generate “actionable” data about students. (i.e., data used by academic support services to effectively assist students).
  (i.e. enrollment likelihood, retention, course pass/fail, degree completion, gainful employment, etc.)
How institutions are using predictive analytics

• Admissions recruitment
  (Goenner & Pauls, 2006)

• Identifying at-risk students
  (Herzog, 2006; Sujitparapitaya, 2006)

• Students’ price response to tuition increases or financial aid
  (Des Jardins, 2001; Herzog & Stanley, 2017)

• Other uses?
  – Student Learning
  – Strategic Planning
  – Finance

A few examples of colleges using predictive analytics...
Noteworthy case studies

1. University of Texas at Austin (improved retention rates & credit load; NY Times article)
2. Georgia State University (reduced achievement gaps, featured nationally)
3. University of Nevada, Reno (raised retention 4% pts, featured nationally)

...See additional resources for more references

Enrollment Management

- **Prospect Scoring**: Outcome: Likelihood of Accepting Admissions Offer
- **Retention Scoring**: Outcome: Likelihood of fall-to-spring retention, fall-to-fall retention
- **Graduation Scoring**: Outcome: Likelihood of graduation, time-to-degree
- **Persistence Scoring**: Outcome: Re-enrollment
Predictive Analytics at UH West Oahu

Two active initiatives at UHWO:

1. In-house development of custom prediction models by UHWO Institutional Research Office.

2. Starfish© early alert software administered by UHWO Student Affairs.

How does predictive modeling work?

1. Data collected from student information system.
2. Train and validate prediction model using standard statistical methods.
3. Prediction estimates calculated per student.

New student at the beginning of their first semester:
- First Generation
- High School GPA (2.89)
- Registered for 12 credits
- Lower socio-economic
- Undeclared major
- No freshmen exp. course
- No educational goals survey completed

Probability of Drop-Out: 75%
A taxonomy of SIS data available

Sample data for academic advisors

<table>
<thead>
<tr>
<th>ID</th>
<th>LAST NAME</th>
<th>FIRST NAME</th>
<th>EMAIL</th>
<th>CURRENT CREDITS</th>
<th>RESIDENT</th>
<th>AP/CLEP</th>
<th>HS GPA</th>
<th>WORK ON CAMP</th>
<th>1st YR EXP</th>
<th>% FIN NEED MET</th>
<th>STAR LOGINS</th>
<th>ADVISOR PREVIOUS CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>HI</td>
<td>6</td>
<td>3.80</td>
<td>Y</td>
<td>Y</td>
<td>77%</td>
<td>5</td>
<td>Y</td>
</tr>
<tr>
<td>002</td>
<td></td>
<td></td>
<td></td>
<td>14</td>
<td>HI</td>
<td>0</td>
<td>3.33</td>
<td>N</td>
<td>Y</td>
<td>63%</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>003</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>CA</td>
<td>6</td>
<td>3.00</td>
<td>N</td>
<td>N</td>
<td>45%</td>
<td>0</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>AGE</th>
<th>GENDER</th>
<th>ETHNICITY</th>
<th>COLLEGE</th>
<th>MAJOR</th>
<th>DEGREE</th>
<th>Ed Goal Specified</th>
<th>Relative Risk Value</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>18</td>
<td>F</td>
<td>CH</td>
<td>CA&amp;H</td>
<td>ART</td>
<td>BA</td>
<td>Yes</td>
<td>14.92</td>
<td>LOW</td>
</tr>
<tr>
<td>002</td>
<td>18</td>
<td>F</td>
<td>HW</td>
<td>CSS</td>
<td>SOC</td>
<td>BA</td>
<td>Yes</td>
<td>36.88</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>003</td>
<td>18</td>
<td>M</td>
<td>UNDEC</td>
<td>UNDEC</td>
<td>UNDEC</td>
<td>UNDEC</td>
<td>No</td>
<td>89.18</td>
<td>HIGH</td>
</tr>
</tbody>
</table>
### Academic advising intervention example

<table>
<thead>
<tr>
<th>John</th>
<th>Monica</th>
</tr>
</thead>
<tbody>
<tr>
<td>- First Generation</td>
<td>- SAT Combined = 1100</td>
</tr>
<tr>
<td>- SAT Combined = 900</td>
<td>- H.S. GPA = 3.50</td>
</tr>
<tr>
<td>- H.S. GPA = 2.99</td>
<td>- Accounting Major</td>
</tr>
<tr>
<td>- 75% Unmet Financial Need</td>
<td>- 15 credits registration</td>
</tr>
<tr>
<td>- Undeclared</td>
<td>- Educational Goals = “Earn B.A.”</td>
</tr>
<tr>
<td>- Dropout risk probability: <strong>70%</strong></td>
<td>- Dropout risk probability: <strong>10%</strong></td>
</tr>
<tr>
<td>- Risk group: <strong>7 of 10 (moderate risk)</strong></td>
<td>- Risk group: <strong>1 of 10 (low risk)</strong></td>
</tr>
<tr>
<td><strong>Intervention strategy:</strong></td>
<td><strong>Intervention strategy:</strong></td>
</tr>
<tr>
<td>- Proactive advising</td>
<td>- Monitor Starfish reporting</td>
</tr>
<tr>
<td>- Meta major pathway mapping</td>
<td>- Mid-semester check-in</td>
</tr>
<tr>
<td>- Revisit financial aid support</td>
<td>- Re-assess dropout risk at end-of-semester</td>
</tr>
<tr>
<td>- Check for ill-advised registration choices</td>
<td></td>
</tr>
</tbody>
</table>

### Starfish Results – Spring 2017, 3rd week

- 51 faculty/lecturers participated (32% of all faculty and lecturers).
- 87% of student referrals submitted were “kudos” (1,133 of 1,306).
- 100 students referred to academic advising (3.6% of Spring 2017 enrollment).
- 51 students referred for academic support.

*Source: UHWO Student Affairs*
Admissions recruitment example

John
- No interest expressed
- Multiple branch campus applications submitted
- Lives within 9 miles
- High high school preparation index
  - Probability of accepting admissions offer: **33%**

Admissions offer:
- $5 admission packet
- Merit Scholarship

Monica
- Attended recruitment fair
- Expressed interest in BUSA major
- Lives within 9 miles
- Submitted application 12 months in advance
  - Strong High School Fit index
  - Probability of accepting admissions offer: **85%**

Admissions offer:
- $2 admission packet

SIS data avail. for enrollment prediction

Banner SIS tables listed in red

Demographic
- Gender
- Age
- Ethnicity

Contact
- Days since inquiry
- Visit
- Referral
- Phone

Application
- Application Date
- Auto admit

Academic
- Program of Study
- Multiple applications

Pre-College
- H.S. GPA & Rank
- SAT
- AP CLEP
- Early College
- Transfer GPA
- Transfer Credits

Enrollment Choice

Program of Study
- Expression of academic interest

Financial
- FAFSA date
- EFC
- Parent gross income

Interaction
- Ethnicity by Geographic Origin
  (geodemographic)
  - H.S. preparation Index
  - Aviation by Distance
  - # of Inquiries by Distance

Enrollment Choice

Admissions recruitment example

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- Lives within 9 miles
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- AP CLEP
- Early College
- Transfer GPA
- Transfer Credits

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- Expression of academic interest

Financial
- FAFSA date
- EFC
- Parent gross income

Interaction
- Ethnicity by Geographic Origin
  (geodemographic)
  - H.S. preparation Index
  - Aviation by Distance
  - # of Inquiries by Distance

Enrollment Choice
Tile system for enrollment mgmt.

Dashboard tiles organized to ascend underlying reports from descriptive to prescriptive modes of delivery.

Descriptive analytics

Analyzing student characteristics across prediction deciles provides key information to enrollment managers.
Predictive analytics

Prediction model results are readily available to provide conceptual information about variables and model accuracy.

Final activity

Brainstorm, Pair & Share Activity

Read Data Analytics Worksheet 3B, see dashboard and data, and then

A. Based on the data provided, what is the strongest indicator of degree completion likelihood? What is the relative strength of this predictor?

B. How might these data inform changes in policies or practices and help struggling students get the help they need?
Brainstorm, Pair & Share Activity
Explanatory analytics for student success

Scenario:
Senior leaders at Alphabet University (AU) conducted a study of factors contributing to academic progress and degree completion. The study used a set of ‘leading indicators’ - measureable educational achievements and academic and enrollment patterns - to understand which groups of students made progress and which did not.

You are the Provost at AU and your job is to interpret the ‘leading indicators’ reports and determine which factors are correlated with a student’s likelihood of completing a degree.

Instructions: Take 12 minutes to interpret and discuss the dashboard, table, and path diagram. As a group, answer the following questions:

1. Based on the data provided, what is the strongest indicator of degree completion likelihood? What is the relative strength of this predictor?

2. How might these data inform changes in policies or practices and help struggling students get the help they need?
Alphabet University
Leading Indicators Milestone Achievement Data

Milestone Achievement Degree Seeking Freshmen (2010)

<table>
<thead>
<tr>
<th>Retained 2nd Term</th>
<th>Retained 2nd Year</th>
<th>24+ Credit First Year</th>
<th>Math YR 1</th>
<th>English YR 1</th>
<th>Retained 3rd Year</th>
<th>Degree Completion</th>
<th>Completion 4 Yrs</th>
<th>Completion 5 Yrs</th>
<th>Completion 6 Yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
<td>70</td>
<td>67</td>
<td>48</td>
<td>76</td>
<td>64</td>
<td>61</td>
<td>35</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

Probability of Completion Based on Credit Completion Ratio

<table>
<thead>
<tr>
<th>Year 1 CCR 80%+</th>
<th>Year 1 CCR Less Than 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>23</td>
</tr>
</tbody>
</table>

Probability of Completion by First-Year Credits Earned

Probability of Completion Based on Achievement of English & Math Milestones

- Achieved Milestone
- Did Not Achieve Milestone

<table>
<thead>
<tr>
<th>Math Enrollment Yr. 1</th>
<th>Math Completion Yr. 1</th>
<th>English Enrollment Yr. 1</th>
<th>English Completion Yr. 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>42</td>
<td>66</td>
<td>59</td>
</tr>
<tr>
<td>66</td>
<td>44</td>
<td>65</td>
<td>49</td>
</tr>
</tbody>
</table>

Ethnicity
- African Am
- Chinese
- Hispanic
- Mixed Asian
- Native Hlth
- Samoan
- Caucasian
- Filipino
- Japanese
- Mixed Rac
- Other Pacif
- Vietnamese

Gender
- F
- M
- No...

College
- Business
- General
- Natural Sciences
- Engineering
- Humanities
- Social Sciences
### Fall 2010 First-Time Full-Time Bachelor’s Degree-Seeking Cohort

<table>
<thead>
<tr>
<th>Cohort Headcount</th>
<th>Number of Completers</th>
<th>6-Year Graduation Rate (%)</th>
<th>Credit Completion Ratio in YR 1</th>
<th>Completed at least 24 credits in YR 1</th>
<th>Completed MATH course in YR 1</th>
<th>Completed ENGLISH course in YR 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>1047</td>
<td>552</td>
<td>53%</td>
<td>68% Yes 37% No Diff 31%</td>
<td>72% Yes 33% No Diff 39%</td>
<td>64% Yes 39% No Diff 25%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>URM 2/</td>
<td>680</td>
<td>292</td>
<td>43%</td>
<td>61% Yes 20% No Diff 41%</td>
<td>65% Yes 24% No Diff 40%</td>
<td>57% Yes 37% No Diff 20%</td>
</tr>
<tr>
<td>Non-URM 3/</td>
<td>367</td>
<td>260</td>
<td>70%</td>
<td>70% Yes 50% No Diff 20%</td>
<td>74% Yes 35% No Diff 40%</td>
<td>66% Yes 43% No Diff 24%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>690</td>
<td>373</td>
<td>54%</td>
<td>63% Yes 30% No Diff 33%</td>
<td>67% Yes 30% No Diff 36%</td>
<td>59% Yes 35% No Diff 23%</td>
</tr>
<tr>
<td>Male</td>
<td>357</td>
<td>179</td>
<td>50%</td>
<td>61% Yes 25% No Diff 36%</td>
<td>65% Yes 26% No Diff 39%</td>
<td>57% Yes 39% No Diff 18%</td>
</tr>
<tr>
<td>S.E.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pell</td>
<td>440</td>
<td>198</td>
<td>45%</td>
<td>63% Yes 29% No Diff 34%</td>
<td>67% Yes 27% No Diff 40%</td>
<td>59% Yes 44% No Diff 15%</td>
</tr>
<tr>
<td>Non-Pell</td>
<td>607</td>
<td>354</td>
<td>58%</td>
<td>67% Yes 45% No Diff 22%</td>
<td>71% Yes 29% No Diff 42%</td>
<td>63% Yes 36% No Diff 27%</td>
</tr>
<tr>
<td>Residency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident</td>
<td>867</td>
<td>502</td>
<td>58%</td>
<td>74% Yes 54% No Diff 20%</td>
<td>78% Yes 48% No Diff 30%</td>
<td>70% Yes 48% No Diff 22%</td>
</tr>
<tr>
<td>Non-Resident</td>
<td>180</td>
<td>50</td>
<td>28%</td>
<td>40% Yes 20% No Diff 20%</td>
<td>39% Yes 14% No Diff 25%</td>
<td>40% Yes 20% No Diff 20%</td>
</tr>
</tbody>
</table>

1/ This cohort is limited to bachelor’s degree-seeking students who were full-time during their first term.
2/ URM includes African American, Alaskan Native, Guamanian or Chamorro, Hispanic, Micronesian, Mixed Race (2 or more), Native Hawaiian/Pacific Islander, Portuguese, Samoan.
3/ Non-URM includes Caucasian, Asian.

### Strongest Predictors of Degree Completion (Fall 2010 Freshmen)

<table>
<thead>
<tr>
<th>Strongest</th>
<th>Credits Earned Yr. 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Term GPA</td>
<td>OR = 5.9 WS 145.6***</td>
</tr>
<tr>
<td>Math First Year</td>
<td>OR = 1.5 WS 23.9***</td>
</tr>
<tr>
<td>Unmet Finan. Need (-)</td>
<td>OR = 1.9 WS 23.8***</td>
</tr>
<tr>
<td>Ethnicity (Non URM)</td>
<td>OR = 2.1 WS 21.1***</td>
</tr>
<tr>
<td>Resident</td>
<td>OR = 1.5 WS 12.0***</td>
</tr>
<tr>
<td>Completed Ed. Goals Surveys</td>
<td>OR = 1.5 WS 6.2*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weakest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree Completion</td>
<td>These variables account for approximately 42% of the variance in a student’s likelihood of completing a degree (Pseudo R Square = .421).</td>
</tr>
</tbody>
</table>

**OR = “Odds Ratio”**
The OR is a measure of association between an exposure and an outcome. In a logistic model, the OR is typically used to indicate relative strength of a predictor. It represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.

**WS = “Wald statistic”**
The WS is a measure of statistical significance and an indication of generalizability.

(*** indicates statistical significance at the .000 level, (***) at the .01 level, and (*) at the .05 level)

Stitt-Bergh, M. & Stanley, J. (2017, October) This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License
**After lunch**

*Discuss challenges of establishing analytics...*

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Predictive data</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Infrastructure</td>
<td>- Culture change</td>
</tr>
<tr>
<td>- Technology</td>
<td>- Wary of misuse of data</td>
</tr>
<tr>
<td>- People/Expertise</td>
<td>- Questions about data used to generate scores</td>
</tr>
<tr>
<td>- Opportunity Costs</td>
<td>- Students’ access to risk scores</td>
</tr>
<tr>
<td><strong>Data availability</strong></td>
<td>- Self-fulfilling prophecy</td>
</tr>
<tr>
<td>- Student Information System</td>
<td></td>
</tr>
<tr>
<td>- Learning Management System</td>
<td></td>
</tr>
<tr>
<td>- Budget/ Human Resource Silos</td>
<td></td>
</tr>
</tbody>
</table>
Connect Learning Theory, Analytics, and Use of Assessment Results

Monica Stitt-Bergh
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

Monica Stitt-Bergh, University of Hawai‘i – Mānoa
John Stanley, University of Hawai‘i – West O‘ahu

Test score = first-year math grade + peer group + study time + interest

Connect Learning Theory, Analytics, and Use of Assessment Results
Outcomes

Before lunch, you will be able to

1. Explain how a “theory of learning” and a “theory of change” can help design an analytics project
2. Name several factors/variables to include in an analytics project

“Assessment”

Learning Outcomes Assessment

It provides tools & processes to develop (or evolve) a curriculum that is

• Coherent & cohesive
• Effective
• Equity-minded

We can use analytics to investigate whether the curriculum is coherent & cohesive, effective, and equity-minded.
Use of Analytics

Analytics for individual alerts, feedback, etc.

Analytics for program and institutional decision making.

Typical Questions

• To what extent do seniors meet our performance expectations?
• Does learning achievement vary across groups of students?
• What factors impact learning achievement?
• Does [X] impact learning achievement? To what extent? For which students?
• If we do [X], what is likely to happen to learning achievement?
Start with a Conceptual Model

Prevent garbage in / garbage out and avoid misleading or damaging inferences:

use a theory of learning
and a theory of change.

Interconnected

Theory of Learning

Analytics & Data Visualization

Theory of Change

Learning Assessment
Learning is . . .

A durable change that is not solely due to biological maturation or aging

Activity: Theory of Learning

Brainstorm, Pair & Share Activity

What is involved in the process of learning?

Three-minute brainstorm

Four-minute pair & share
Brainstorm, Pair & Share

1. What is involved in the **process** of learning? (three-minute brainstorm)
   *How does something get “stuck” in our brains so it’s a permanent change?*

2. Pair & Share (four minutes)
Domain of Learning

Learning involves two linked processes:
(a) interaction between learner and environment
(b) integration of content (knowledge, skills, etc.) & incentive (emotion, motivation, volition)

Learning is an addition to or a reconstruction of existing structures/schemes

Regardless of age

Processes (learner—environment—content—intention)
Learning as addition to or reconstruction of existing structures
Theory of Learning: Implications for Analytics

Include in your model:

1. Student prior knowledge
2. Environmental & experiential factors
3. Incentive/motivation

“The most important single factor influencing learning is what the learner already knows.”

David Ausubel
1. **Student prior knowledge examples**
   - High school GPA
   - Entrance exam score
   - Placement exam score
   - Pre-requisite course grade
   - Number of courses taken/credits earned
   - Pre-test score
   - Etc.

2. **Environmental & experiential examples**
   - Characteristics of assignments
   - Characteristics of classes (size, teaching method)
   - Co-curricular/student organization participation
   - Time spent on school, work, etc.
   - Visits to advising, tutoring, office hours, etc.
   - Student’s peer group
   - Participation in study abroad, honors, remedial, etc.
   - Etc.
3. Incentive/motivation examples

- Interest in learning or desire to learn
- Incentive to learn (compulsory, license, reward or punishment)
- Beliefs about the value of the knowledge or skill
- Barriers to learning (defense, fear, low self-efficacy)
- Etc.
### Theory of Change: Implications for Analytics

- Learning to write takes practice, individual attention, constructive feedback; is best taught in context
- Require 1 foundational course plus 5 writing-emphasis courses
- Faculty need help to be effective
- Course & assignment design workshops
- Online support materials for faculty
- Writing Tutors for native and non-native speakers (optional)
- Limit to 20 students
- Partner with librarians for information literacy
- Formative feedback to students

### Written Communication

**Examine the theory of change:**

What may be appropriate to add to a model?

**Written Communication Example**

- Formative feedback received

**What else?**
Meaningful questions:

1. Do students in different groups perform equally well in quantitative reasoning?
   • Gender
   • Hawaiian/non-Hawaiian
   • Pell eligibility

2. What factors/variables impact student achievement?
### Quantitative Reasoning Pilot Project

**Applying a theory of learning**

<table>
<thead>
<tr>
<th>Student prior knowledge</th>
<th>grade in prior math course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>time spent studying</td>
</tr>
<tr>
<td>Incentive/motivation</td>
<td>assignment counts toward course grade</td>
</tr>
</tbody>
</table>

**Self-report: importance of grade**

---

### Quantitative Reasoning Pilot Project

**Applying a theory of change**

<table>
<thead>
<tr>
<th>Require 1 foundational course</th>
</tr>
</thead>
</table>

| Tutors, supplemental instruction groups, and a Math Learning Center are available (optional) |

---

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Quantitative Reasoning Pilot Project

Conceptual Model

Score on rubric = prior math grade + study time + importance of good grade

But what data are available?

http://tinyurl.com/hdg78cu

Quantitative Reasoning

[Graph showing quantitative reasoning metrics such as average assumption score, average communication score, average interpretation score, average calculation score, average representation score, and student count with a score of 100.]
Connect Learning Theory, Analytics, and Use of Assessment Results

Internal Dashboard Example—Interactive

Quantitative Reasoning

Average Outcome Score by Meta Major

Race/Ethnicity Distribution

Gender Distribution

Headcount by Credits Earned

Credit Completion Ratio >= 80%

Previous Grade of B or Higher in Math

Average Assumptions Score

Average Communication Score

Average Interpretation Score

Average Calculation Score

Average Representation Score

Student Count

Average Outcome Score

Average Cumulative GPA

Hawaiian / Non-Hawaiian

Pell Eligibility

Previously Received 'F' Grade

It’s interactive! Visit http://tinyurl.com/hdg78cu

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**Activity 4C**

**Table Activity**

*Answer the discussion questions for one scenario (CT or WC).*

20 minute table-talk

Table share-out & full group discussion

---

**Take Aways**

- Use a theory of learning & change
- Plan for use *before* data collection & analysis
  - Tip: discuss hypothetical results before collecting
- Balance cost and value
  - Number of items in the model = theory + resources
- Collaborative effort & transparency with stakeholders
Critical Thinking (CT)

This scenario does not give you all the information you need. Just roll with it. Do your best using what you know about higher education institutions. Make reasonable assumptions and share them with your table.

Context

To ensure undergraduates exit with competency in critical thinking, the campus requires undergraduates to take the following general education courses, offered at the 100- and 200-levels (i.e., first & second year):

- Math and Logical Thinking (one 3-credit course): Clarity of thought, critical thinking, and problem solving are developed by these courses that require students to understand the use of mathematics, logic, or other formal systems.
- Global Perspectives (two 3-credit courses): The global perspectives requirement introduces students to the political, social, economic, and cultural development of the world’s major civilizations while expanding their critical thinking skills.
- Arts and Humanities (two 3-credit courses): Through study of artistic, literary, and philosophical masterworks, students gain an appreciation of history and achievements and build their critical thinking skills.

In addition, each degree program is asked to include the development of critical thinking as part of their major’s core curriculum.

Meaningful Questions

A. To what extent are students meeting our performance expectations? Minimum expectation = “3” or higher on the Critical Thinking (CT) VALUE Rubric (0-4 point scale).
B. Which factors predict student achievement on the CT Rubric?

Planned Use of Results

As needed, make changes to or increase students’ learning opportunities inside the target courses.

Evaluation of Learning Evidence

Important: for the purpose of this activity, assume validity and reliability requirements have been satisfied and the student sample is representative of the undergraduate population.

Measurement tool: Critical Thinking VALUE Rubric
Evidence collected: 125 senior portfolios containing two written projects that exhibit critical thinking skills
Evaluation: Ten trained faculty scored. Two faculty independently scored each piece and their scores were averaged.
Results: Students’ average scores were aggregated.

<table>
<thead>
<tr>
<th>Mean score = 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard deviation = 0.9 (this statistic indicates how clustered around the mean the scores are)</td>
</tr>
<tr>
<td>Correlation: student’s GPA and CT score = 0.04 (very weak relationship between GPA and CT score)</td>
</tr>
</tbody>
</table>

Continued on next page
Discussion Questions for the Table

1. If the campus could collect 3-4 types of additional information to help answer meaningful question B, what information does your table think should be collected?

2. How might that additional information help the campus predict student achievement?

3. Who on the campus could help get the additional information?

4. What other insights or concerns does your table have?
Written Communication (WC)
This scenario does not give you all the information you need. Just roll with it. Do your best using what you know about higher education institutions. Make reasonable assumptions and share them with your table.

Context
The campus has an entry-level writing placement exam, two course requirements, and a writing center with tutors to help undergraduates meet the expected performance level in written communication. Requirements:
- Writing Placement Exam. Students who perform poorly must complete a remedial writing course before taking the first-year writing course.
- First-year Writing Course. A 3-credit course focused on written communication. Students complete at least 16 pages of polished writing, including a 5-page research paper.
- Upper-division Writing Course: A 3-credit course focused on writing in the major. Students complete at least 25 pages of polished writing, included a research-based paper (or equivalent) written in a common genre in their major field.

Meaningful Questions
A. To what extent are students meeting our performance expectations? Minimum expectation = “3” or higher on the Written Communication (WC) VALUE Rubric (0-4 point scale).
B. Which factors predict student achievement on the WC Rubric?

Planned Use of Results
If needed, change policy, change requirements, or change pedagogy in the required writing courses.

Evaluation of Learning Evidence
Important: for the purpose of this activity, assume validity and reliability requirements have been satisfied and the student sample is representative of the undergraduate population.
Measurement tool: Written Communication VALUE Rubric
Evidence collected: 125 writing assignments from students in the upper-division writing course.
Evaluation: Ten trained faculty scored. Two faculty independently scored each piece and the two scores were averaged.
Results: Students’ average scores were aggregated.

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</table>

Continued on next page
### Chart. Written Communication Mean Score: Overall and By Student Characteristics

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<th></th>
<th>All (N=125)</th>
<th>Underrepresented minorities (N=48)</th>
<th>Other students (N=77)</th>
<th>Female (N=69)</th>
<th>Male (N=56)</th>
<th>0-24 credits (N=34)</th>
<th>25+ credits (N=91)</th>
<th>Not eligible (N=80)</th>
<th>Eligible (N=45)</th>
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</table>

### Discussion Questions for the Table
1. If the campus could collect 3-4 types of additional information to help answer meaningful question B, what information does your table think should be collected?

2. How might that additional information help the campus predict student achievement?

3. Who on the campus could help get the additional information?

4. What other insights or concerns does your table have?
Use of Analytics

Analytics for program and institutional decision making.

Analytics for individual alerts, feedback, etc.

Learning Analytics for Individual Use

Automatically send individual students . . .

- Alerts
- Individualized feedback
- Summary of strengths and difficulties
- Customized problem sets or readings

Example of a Learning Mgt. System (LMS)

Potential Factors/Variables

See list in binder.

Potential Factors/Variables for Individual Use

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Connect Learning Theory, Analytics, and Use of Assessment Results

**Potential Factors/Variables: Analytics for Individual Use**

1. Matriculation Predictors (from Student Information System (SIS))
   a. Demographics (age, gender & ethnicity), GPA, pre-collegiate HS GPA, standardized test scores, first-generation, socio-economic class & financial need

2. Activity & Performance Indicators in Class (from Learning Management System (LMS))
   a. Number and frequency of LMS logins
   b. Amount of time spend on course website
   c. Number of discussion posts
   d. Responses to class polls

3. Grades and Formative Quiz Scores
   a. Percentage of points earned in course to date
   b. Change between past and current test/quiz scores

4. Student Artifacts (from LMS or hard-copy in-class assignments)
   a. Blogs, discussion forum posts
   b. Essays, written assignments

5. Student Learning Outcomes
   a. Measurement of student achievement in core competencies (from in-class assignments/tests)

**Other Noteworthy Examples**

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Other Noteworthy Examples

See list in binder.

*Other Noteworthy Examples*

On the bottom of the page “Potential Factors/ Variables . . .”


---

**Challenges**

We’ll discuss after lunch:

- Ethics
- Availability of data
- Affordability
- Expertise

**Analytics necessarily involves a theory, even if the creators are not aware of it.**
Self-assessment

Can you . . .

• explain how a “theory of learning” and a “theory of change” can help design an analytics project?
• name several factors/variables to include in an analytics project?

Lunch Time

Let’s talk more during lunch!
Build a Culture of Inquiry

Monica Stitt-Bergh
John Stanley
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

Monica Stitt-Bergh, University of Hawai‘i – Mānoa
John Stanley, University of Hawai‘i – West O‘ahu

Build a Culture of Inquiry
Ethical implications, affordability, data availability, and expertise
The dream . . .

Prediction
Customization
Optimization
Intervention

Online dating (eHarmony)
Books/movies (Amazon, Netflix)
Transportation (UPS)
Health (Fitbit; PREDICT)
Examples to Consider

- Policing
- College rankings
- College recruiting

Brainstorm, Pair & Share Activity

Analytics in higher ed: What might go wrong?

2-minute brainstorm. 4-minute pair & share
Build a culture of inquiry: Ethical implications, affordability, data availability, and expertise

Brainstorm, Pair & Share Activity

1. Analytics in higher education: What might go wrong?
   
   2-minute brainstorm to list as many ideas as you can.

2. Pair & Share.
   
   4-minutes to share an idea from above that’s important to you.
Ethical Implications

“Models are opinions embedded in mathematics”

“These models encoded human prejudice, misunderstanding, and bias into the software systems that increasingly managed our lives”

Cathy O’Neil, *Weapons of Math Destruction*

Models are never “theory free” – always subjective because the creators include and exclude variables.

E.g., college rankings that exclude financial data
Most models are based on correlation (not causation).

Spurious correlations are everywhere
http://www.tylervigen.com/spurious-correlations

E.g., go to Disneyland to increase Political Sci doctorates awarded?
Political Science doctorates awarded (US) has a very strong, positive relationship with visitors to Disneyland (0.999!)

Stereotyping-profiling can occur when (a) building the model and (b) interpreting the model’s results.

Some do not investigate the positive & negative and the intended & unintended consequences.
Useful Frameworks

See document: *Useful Frameworks for Ethical Practice*

1. Drachsler & Greller (2016)—DELICATE
2. Cormack (2016)—Purpose-oriented
   (#1 & #2 based in part on European data protection law)

Challenges to Establishing Analytics

Affordability
- Infrastructure
- Technology
- People/Expertise
- Opportunity Costs

Data availability
- Student Information System
- Learning Management System
- Budget/ Human Resource Silos
Build a culture of inquiry: Ethical implications, affordability, data availability, and expertise

Useful Frameworks for Ethical Practice

1. Drachsler & Greller (2016)—**DELICATE**
   Use the following to guide analytics project planning (based on Drachsler & Greller’s *Privacy and analytics—it’s a DELICATE issue* paper):
   1. **Determine the project’s value**—is it worthwhile? Explicitly state the rights of the students (or other data subjects).
   2. **Explain the intentions and objectives**—including the data to be collected, how long data will be kept, who has access, limits to the use of results.
   3. **Legitimate use** of data: why are you allowed the data? Explicitly state why existing data is insufficient and why you are allowed to collect new data.
   4. **Involve all stakeholders, including the students**. Be open about privacy concerns, the personal data collected, and staff training and safeguarding during discussions with stakeholders.
   5. **Consent** from the students before data collection and an opt-out option may be needed. Cormack (below) differentiates between data used for personal decisions and data used for program and institutional decisions. In the latter case, he suggests that student consent is not needed.
   6. **Anonymize** the data as far as possible and aggregate data.
   7. Technical procedures to **guarantee privacy** should be established.
   8. **External parties**, if involved, need to sign a contract stating they will follow data security rules. Everyone must use the data only for the stated intentions and nothing else.

2. Cormack (2016)—**Purpose oriented**
   Purpose determines practice (based on Cormack’s *A data protection framework for learning analytics* paper):
   1. **If purpose is to collect and analyze data to discover patterns:**
      a. No informed consent
      b. Ensure legitimate interest; clearly state expectations about intended use
      c. Reduce risk to individuals through standard data-security measures
   2. **If purpose is institutional/program-level use and initiatives:**
      a. Follow safeguards and data-security measures
      b. Examine for bias & unintended consequences, etc.
   3. **If purpose is student-level use and intervention:**
      a. Informed consent needed
      b. Offer interventions as a choice between standard practice and personalized support.
      c. Provide sufficient information for a student’s knowledgeable, freely given response

   The *Big Data* report offers important questions to consider during the process:
   1. **How representative is your data set? What information is missing that may bias the model?**
      This is not limited to the students (and student groups) that may be missing. Think about what information might be missing (e.g., student financial data, student access to transportation or childcare services).
2. **Does the data model account for biases?** Are biases built into the model – either during collection or analysis? What hidden biases might exist? What are the unintended consequences of using the model? What strategies help overcome them?

3. **How accurate are the predictions based on the model?** Is the model grounded in theory? Analytics is good at detecting correlations but is not good at explaining which correlations are meaningful so use a theory to select variables.

4. **Does the reliance on the model raise ethical or fairness concerns?** Balance the predictive value with fairness. Omit a variable if there are concerns about discrimination of a particular group. Consider how the data can be used to advance opportunities for underrepresented populations.

Citations (also in Additional Resources)


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Human expert judgment is crucial; machines cannot evaluate for fairness.
Challenges to Predictive Analytics

• Culture change (business model stigma)
• Wary of misuse of data
• Questions about data used in model to generate risk scores
• Students’ rights to access risk scores
• More accountability
• Profiling/ Self-fulfilling prophecy

Activity 5C, 5D

Pre-mortem Activity #1

Read Ethical use . . ., see spreadsheet, and then
A. Generate list of reasons from multiple perspectives.
B. Draft techniques/strategies to address reasons.
C. Share with a neighboring table.
Build a culture of inquiry: Ethical implications, affordability, data availability, and expertise

Pre-mortem Activity #1

The pre-mortem discussion is a technique to anticipate and address reasons why something may fail; it answers the question, “What could go wrong with this plan?” before the plan is implemented and then uses the answers to modify the plan to increase the likelihood of success.

Activity overview: Generate a list of reasons—from different perspectives—why an analytics project may fail because of ethical concerns, affordability, data availability, and/or lack of expertise. Then, draft possible techniques to increase the likelihood of project success.

Ethical use of student-level records and predicted behaviors

Context: A large (20,000+ students), public four-year university with approximately 2,000 incoming freshmen and a first-year advising office comprised of 5 FTE advisors (400 freshmen per advisor ratio). The campus averages a 75% fall-to-fall retention rate, and has a goal of increasing retention to 80%. Advisors are tasked with identifying at-risk freshmen students after their initial matriculation for a new early intervention program. The campus institutional research office reports the relative dropout risk of each freshman to advising staff via a secure online portal. The goal of the early intervention program is to identify at-risk students early and provide these students with timely academic or personal support services/interventions.

The spreadsheet (next page) lists new freshmen: selected student characteristics and a relative dropout risk score for each student. It is currently the second week of the spring semester and the advising office plans to contact the students who are identified as being at-risk.

A. Take four different perspectives and generate at least two reasons why the project may fail from each perspective. Perspectives: (1) advising staff, (2) institutional researchers, (3) provost, (4) student.

B. Select two (challenging) reasons from the list above and then draft possible techniques or strategies to address it and increase the likelihood of project success.

C. Share your table’s two reasons and techniques/strategies with a neighboring table.
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<th>Student Name</th>
<th>Email</th>
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<th>Retention Likelihood Decile</th>
<th>Geographic Origin</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Gender</th>
<th>Major</th>
<th>High School/Desc</th>
<th>SAT Math</th>
<th>SAT Reading</th>
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<th>First Generation Ind</th>
<th>First Semesters</th>
<th>Advancement Placements</th>
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### Pre-mortem Activity #2

**Read Oral Communication** and then

A. Generate list of reasons from multiple perspectives.
B. Draft techniques/strategies to address reasons.
C. Share with a neighboring table.

### A Key to Success: Transparency

**Bring many voices to the table**

<table>
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<tr>
<th>Possible players</th>
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<td>Student affairs</td>
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Recap

- Analytics is a tool, not a solution
- Analytics is subjective
- Expert and stakeholder perspectives are always needed
- Attend to intended and unintended consequences
Build a culture of inquiry: Ethical implications, affordability, data availability, and expertise

Pre-mortem Activity #2

Oral Communication (program/institutional level)

Context: a small (fewer than 4,000 students) campus that offers liberal arts combined with professional education; undergraduate and graduate degrees. The campus has two IR staff; nearly all faculty use Moodle (a learning management system/courseware). Undergraduates are required to take two courses designed to improve oral communication (OC) skills. Graduate students are required to give an oral presentation as part of their graduate degree program. The Institutional Effectiveness Committee works on quality assurance of student learning and is planning an analytics project related to oral communication. The Committee’s goals include the following:

- Collect and analyze data: (a) oral performance results of seniors in OC courses and graduate students; (b) student responses to an oral communication survey on experiences and confidence; (c) number of courses taken that included oral presentations; (d) incoming GPA (high school or undergraduate degree GPA); and (e) current GPA.
- Use the results for program-level changes: (a) increase faculty development opportunities related to teaching oral communication skills and (b) increase student opportunities to learn oral presentation skills (if results fall short of expectations).

A. Take different perspectives and generate at least two reasons why the project may fail from that perspective. Perspectives: faculty, student, administrator or institutional researcher.

B. Select two (challenging) reasons from the list above and then draft possible techniques or strategies to address them and increase the likelihood of project success.

C. Share your table’s two reasons and techniques/strategies with a neighboring table.
Take Lessons from Analytics, Learning Theory, and Visualization to Make Progress Back Home

Monica Stitt-Bergh

John Stanley
Analytics for Academics
Producing Actionable Information about Students and Learning to Improve Effectiveness

Monica Stitt-Bergh, University of Hawai‘i – Mānoa
John Stanley, University of Hawai‘i – West O‘ahu

Take home lessons from analytics, learning theory, & visualization
Recap

Integrate IR and assessment—intentionally & meaningfully—to

• collect useful data
• interpret “big data”
• improve learning quality and student outcomes for all student groups
• satisfy accountability requirements

Recap

Build models to predict future behaviors or outcomes.

“Story-at-a-glance” & interactive visualizations increase likelihood of use.
Recap

Use a *theory of learning* and a *theory of change* to create a **meaningful** model.

Meaningful models increase likelihood of use.

Recap

Build a culture of inquiry.

Attend to ethical concerns:
- use a framework
- many voices & transparency

Worth the cost:
- infrastructure & technology to collect and analyze useful data
- statistics and visualization expertise
- time for purposeful collaboration
Plan a Project Activity

1) Review morning’s reflection and think-pair-share.
2) Complete the questions.
3) Discuss with peer or with group members.

Sharing Final Thoughts

Ethically use analytics to optimize learning for the students’ benefit.

Analytics is one tool in a large toolbox.

Findings can be daunting, but not knowing is worse.

Are you excited about analytics? We are!

Mahalo! Thank you!
Take lessons from analytics, learning theory, and visualization to make progress back home

**Plan a Project Activity**

First, review your reflection and thoughts from this morning’s *Reflection Activity* and Think-Pair-Share (completed during the *Framework for Purposeful Integration* session).

Second, answer the questions below in a small group or by yourself. (Individuals: when you’ve finished, find another person to share with and get feedback from.) Use the *Questions to Aid Discussion* below to shape feedback to group/peers.

1. If your campus (or program) effectively used analytics, what specific positive benefits may occur?

2. Envision a specific project for your campus (program) that uses analytics and/or integrated assessment & IR.
   2. Briefly describe the **purpose** of the project and state a **meaningful question** to be answered.

3. Briefly describe how the results would be **used** and by whom.

4. Do the data already exist? (circle one)  
   Yes, all  
   Yes, some  
   No  
   Unsure

5. Who else would value this project? (For whom is it meaningful?)

6. What are **ethical concerns** regarding the project? (remember: consider from multiple perspectives)
7. Who (or what groups) would be involved because they have **expertise or an interest**? (Consider including experts in statistics, data management, data collection, visualization, teaching, learning theory, as well as students, opinion leaders on campus, etc.)

8. What are **barriers** you will likely encounter?

9. What will be **two keys to the project’s success**?

10. What do you still need to find out in order to plan and implement the project?

11. To start the project, what’s **the first thing you will do** when you get back to campus?

**Questions to Aid Discussion**
- Is it a meaningful project? Will people care enough to use the results?
- Does the intended use of results align with the purpose?
- Are the right people/groups involved? Anyone missing?
- Good awareness of ethical concerns?
- What other barriers may exist?
- What else may help ensure project success?
RESOURCES
ADDITIONAL RESOURCES

Analytics for Academics: Producing Actionable Information about Students and Learning to Improve Effectiveness

Case Studies

California State University (Visualization): http://www.calstatela.edu/associateprovost/csu-student-success-dashboard


Loma Linda University (Visualization): http://home.llu.edu/academics/academic-resources/educational-effectiveness/institutional-research/university-statistics

Purdue University (Learning Analytics):
   NBC news special: http://www.nbcnews.com/id/21134540/vp/32634348#32634348
   Campus link: https://www.itap.purdue.edu/studio/signals/

Purdue University (Visualization): https://www.purdue.edu/datadigest/

Rio Salado Community College (Learning Analytics):
   http://www.riosalado.edu/riolearn/Pages/RioPACE.aspx


University of Texas at Austin (Predictive Analytics):
   Campus link: http://studentsuccess.utexas.edu/approach
   New York Times article: http://www.nytimes.com/2014/05/18/magazine/who-gets-to-graduate.html?_r=0

Webpages & Videos


Annotated Bibliography – Learning Analytics in HE:

   http://er.educause.edu/articles/2012/7/beyond-retention-using-targeted-analytics-to-improve-student-success

Blending Human Intelligence and Analytics for Student Success (Educause):

Effective Learning Analytics: Using data and analytics to support students (Jisc) [website]: https://analytics.jiscinvolve.org/wp/


Journal of Learning Analytics [open access journal]: http://learning-analytics.info/journals/index.php/JLA/index

Learning Analytics Community Exchange [YouTube channel]: https://www.youtube.com/user/LaceprojectEu

Open Learning Analytics: Erik Duval at TEDxUHowest [TEDx Talk]: https://www.youtube.com/watch?v=LfXDzpTnvqY

Society for Learning Analytics Research (SoLAR) [website]: https://solaresearch.org/

Student Experience Traffic Lighting – Engagement Analytics [YouTube video]: https://www.youtube.com/watch?v=rH9roN8NFv0&list=PL440A0EBE129587E2&index=9&feature=pjpp_video

Articles, Books & Presentations


**Ethical Practice**

*Code of practice for learning analytics: Setting out the responsibilities of educational institutions to ensure that learning analytics is carried out responsibly, appropriately and effectively.* (2015, June). [https://www.jisc.ac.uk/guides/code-of-practice-for-learning-analytics](https://www.jisc.ac.uk/guides/code-of-practice-for-learning-analytics)

*Code of practice for learning analytics: A literature review of the ethical and legal issues.* (2014, November). [http://repository.jisc.ac.uk/5661/1/Learning_Analytics_A-_Literature_Review.pdf](http://repository.jisc.ac.uk/5661/1/Learning_Analytics_A-_Literature_Review.pdf)


Interesting Apps


National News—tales that encourage caution or inspire


Big data 101: Colleges are hoping predictive analytics can fix their dismal graduation rates. (2014). Vox. [http://www.vox.com/2014/7/14/5890403/colleges-are-hoping-predictive-analytics-can-fix-their-graduation-rates](http://www.vox.com/2014/7/14/5890403/colleges-are-hoping-predictive-analytics-can-fix-their-graduation-rates)

Case studies highlight use of student-level postsecondary data (2017). *eAIR Newsletter, 37*(4). [https://www.airweb.org/eAIR/specialfeatures/Pages/Case-Study-Data.aspx](https://www.airweb.org/eAIR/specialfeatures/Pages/Case-Study-Data.aspx)


THE VISUALS REFERENCE
FOR POWER BI - SEP 2017

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http://sql.bi/visual-reference

COMPARISON

Use these visuals when you want to display measures compared by its magnitude.

CHANGE OVER TIME

Use these visuals when you want to display the changing trend of measures.

PART-TO-WHOLE

Use these visuals when you want to display parts that compose measures.

FLOW

Use these visuals when you want to display a flow or dynamic relations.

RANKING

Use these visuals when you want to display measures by its rank order.

SPATIAL

Use these visuals when you want to display measures over spatial maps.

DISTRIBUTION

Use these visuals when you want to display the distribution of a measure.

CORRELATION

Use these visuals when you want to display relations between measures.

SINGLE

Use these visuals when you want to display a single value.
Dashboard Reference Sheet

Workshop Class Roster Dashboard
https://goo.gl/XzdwFU

UHWO Student Success Dashboard
https://goo.gl/dlVZ8B

Alphabet University NSSE Survey
https://goo.gl/zCBuoe
Dashboard Reference Sheet

Leading Indicators Reports

https://goo.gl/tlJ296

Quantitative Reasoning Pilot Project

http://tinyurl.com/hdg78cu

At-Risk Student Intervention Portal

https://goo.gl/IWHrJq