DESIGNING LEARNING ANALYTICS FOR HUMANS WITH HUMANS

Alyssa Friend Wise
Associate Professor
New York University
Director, NYU-LEARN

@NYU_LEARN
nyu.edu/learn-analytics
Meet Our Team

Alyssa Wise  Yoav Bergner  Xavier Ochoa  Qiujie Li  Susana Toro  
Yeonji Jung  JP Saramiento  Fabio Campos  Sameen Reza  Ofer Chen  Yu Wang  
Jing Zhang  Shiri Mund  Sophia Lu  Sophie Sommer  Trang Tran  Eunyoung Jeon
With thanks to our amazing partners at NYU-IT

Ben Maddox
*Chief Instructional Technology Officer*

Andrew Brackett
*Learning Analytics Specialist*

Jason Korenkiewicz
*Director of Instructional Technology Tools & Services*

Robert Egan
*eLearning Specialist*

Elizabeth McAlpin
*Project Director of Research & Outcomes Assessment*
And the many members of the larger LEARN community across NYU who participated in the projects described today

**Stern School of Business**
Kristen Sosulski
Ben Bowman
Sean Diaz
Marian Tes
Daniel de Valk

**Faculty of Arts & Sciences**
Selin Kalaycioglu
Lucy Appert
Tyrell Davis

**NYU Libraries**
Andrew Battista
Denis Rubin

**School for Professional Studies**
Victoria Axelrod
“Learning Analytics exist as part of a socio-technical system where human decision-making and consequent actions are as much a part of any successful analytics solution as the technical components.”

van Harmelen & Workman (2012)
"Learning Analytics exist as part of a socio-technical system where human decision-making and consequent actions are as much a part of any successful analytics solution as the technical components."

van Harmelen & Workman (2012)
AND YET . . .

Only 6% of student-facing learning analytics systems described in the literature 2004-2016 reported a clear, explicit needs analysis and only 11% reported any form of usability testing.

Bodily & Verbert (2017)
AND YET . . .

only 30% of dashboards described in the literature 2010-2015 included a report of authentic user evaluation

Schwendimann et al. (2016)
WHY DOES THIS MATTER?

MISALIGNMENT BETWEEN DESIGNERS’ INTENTIONS AND STUDENTS’ PERCEPTIONS CAN RESULT IN DISTRUST OF LA TOOLS

DE QUINCEY ET AL. (2019)
WHY DOES THIS MATTER?

TOOLS THAT ARE DESIGNED WITHOUT CONSIDERATION OF USER’S NEEDS AND THE SITUATIONS IN WHICH THEY WILL USE THEM ARE UNLIKELY TO IMPACT REAL WORLD PRACTICES IN ANY SIGNIFICANT WAY.

CUBAN (2001)
IN SUMMARY

The first decade of Learning Analytics has focused more on technical systems than human ones.

This represents a large gulf with what is known about best practices for Human-Computer Interaction Design.

Consequently there is now great interest in involving the intended users of learning analytics in their design.

Spotlight on these issues in recent JLA Special Section on Human-Centred Learning Analytics.
Special Section: Human-Centred Learning Analytics

Working Together in Learning Analytics: Towards the Co-Creation of Value

Co-Designing a Real-Time Classroom Orchestration Tool to Support Teacher-AI Complementarity

Teaching with Analytics: Towards a Situated Model of Instructional Decision-Making

Designing in Context: Reaching Beyond Usability in Learning Analytics Dashboard Design

Engaging Faculty in Learning Analytics: Agents of Institutional Culture Change
DESIGNING LEARNING ANALYTICS FOR HUMANS WITH HUMANS

BUT HOW?

GETTING INFORMATION ON

GATHERING INPUTS FROM

GENERATING IDEAS WITH
Learning Analytics @ NYU
a collaborative effort, focused on community change, that puts people, not data, first

We build **partnerships**
between researchers, information technology staff, faculty, administrators and students to **jointly advance**
data-informed teaching and learning

We **create** and **support** effective
teaching and learning **tools** that **augment**
**human capacity** to improve educational processes
Learning Analytics @ NYU

- Instructional Dashboard
- Collaboration Analytics
- Intro STEM Early Alerts
- Student Facing Analytics
- Instrumented Learning Spaces
- Reflection Analytics
- Presentation Feedback Tool
- Discussion Analytics
Learning Analytics @ NYU

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Establish the scope and goals for the project

- University-wide service to operate at scale
- Support data-informed decision-making
- Instructor of record at the heart of service

Some starting strategies

- Draw on existing knowledge and relationships
- Get an early version in the hands of humans
- Iterate quickly, scale slowly
Use cases drive design with instructor questions as the starting point.

**Professor Badino** teaches an large in-person undergraduate physics course in which students prepare for class discussion and problem solving with online readings and videos.

Prof. Badino wants to better understand relationships between student interaction with pre-class materials, in-class question scores, and their achievement on weekly quizzes.
# Learning Analytics Dashboard Design v1

## Resource Activity View

### Purpose
To identify **students** (engaging / not engaging with the resources)
& **resources** (frequently / infrequently accessed)

<table>
<thead>
<tr>
<th>Each Resource</th>
<th>Each Student</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>Week 1</td>
<td>W1 Reading</td>
</tr>
<tr>
<td></td>
<td>W1 Slides</td>
</tr>
<tr>
<td>Week 2</td>
<td>W2 Slides</td>
</tr>
<tr>
<td></td>
<td>W2 Video</td>
</tr>
<tr>
<td>Week 3</td>
<td>W3 Reading</td>
</tr>
<tr>
<td></td>
<td>W3 Slides</td>
</tr>
<tr>
<td></td>
<td>W3 Video</td>
</tr>
<tr>
<td>Week 4</td>
<td>W4 Quiz 1</td>
</tr>
<tr>
<td></td>
<td>W4 Video</td>
</tr>
<tr>
<td>Week 5</td>
<td>W5 Reading 1</td>
</tr>
<tr>
<td></td>
<td>W5 Reading 2</td>
</tr>
<tr>
<td></td>
<td>W5 Slides</td>
</tr>
</tbody>
</table>
To identify aspects of the materials which were difficult for students.

**Purpose**

Learning Analytics Dashboard Design v1

**Quiz Results View**

- **Score for Each Item (at the Class-level)**
  - Quiz: Week 5 Quiz 2
  - Item: Question 2
  - Which of the following is a true statement?
  - Avg. score: 55%
  - Number of students completed: 28

- **Detailed Results for Each Item**
  - Quiz Item: Quiz 1
    - Week 3 Quiz 1:
      - Q1: Matching
      - Q2: Multiple Choice
      - Q3: Multiple Choice
  - Week 5 Quiz 2:
    - Q1: True / False
    - Q2: Multiple Choice
    - Q3: Matching
    - Q4: Multiple Choice
  - Week 9 Quiz 3:
    - Q1: Matching
    - Q2: Short Answer
    - Q3: Multiple Choice
  - Week 12 Quiz 4:
    - Q1: True / False
    - Q2: Multiple Choice
    - Q3: Matching

- **Average Question Score**
NYU INSTRUCTIONAL DASHBOARD
FIRST FORAYS TO THE FIELD

[Diagram showing student performance data]

[Images of individuals]
(Not surprisingly) the process of actually using analytics to inform pedagogical decisions is complex.

**NYU INSTRUCTIONAL DASHBOARD**

**FIRST FORAYS TO THE FIELD**

Instructors’ excitement & high perceived value around analytics release/use

Struggles in connecting the data with their teaching and routines

Tool-provided data about student activity

Use of information to guide sense-making & pedagogical action

We need to examine the process of analytics use in situ.
Key Questions

In what ways do instructors make pedagogical decisions based on analytic data?

What implications for LA design and implementation can be drawn based on this?

Approach

Case studies with all 5 instructors who used the LA dashboard in their teaching during that first semester.

We need to examine the process of analytics use in situ
Template for Inquiry
starting from the literature

Q1. How Do Instructors Ask Questions of the Analytics?
Q2. How Do Instructors Interpret the Analytics?
Q3. How Do Instructors Respond to the Analytics?
Q4. How Do Instructors Check the Impact of Actions?

Q5. What are other important aspects of instructors’ analytics use?
Emergent Themes

Q1. How Do Instructors Ask Questions of the Analytics?
- Approaching the Analytics Based on Existing Areas of Curiosity
- Developing Questions through Interacting with the Analytics

Q2. How Do Instructors Interpret the Analytics?
- Getting Oriented through Focused Attention to the Analytics
- Examining Changes of Student Engagement over Time
- The Need for a Reference Point
- Triangulating the Analytics with Additional Information about Student
- Using the Course Context to Explain/Question the Analytics
- Inconsistent Attribution of Analytic Results

Q3. How Do Instructors Respond to the Analytics?
- Taking Action via Whole Class Scaffolding
- Taking Actions via Targeted Scaffolding
- Taking Actions via Revising Course Design
- Reflecting on Pedagogical Strategies and Knowledge
- Wait-and-See

Q4. How Do Instructors Check the Impact of Actions?
- Potential Value of Collaborative Interpretation
- Disconnection between Pedagogical Approaches and Data Presented
- Misalignment between Instructor and System Timing
- Analytics Seen as Useful but not Essential
- Experiencing a Learning Curve in Analytics Use

Q5. What are Other Important Aspects of Instructor Analytics Use?
- Data Interpretation Is Affective as Well as Cognitive
- Wrestling with Questions of Transparency around Analytics
A Model of Instructor Analytics Use

The model offers a **clear starting place** to *(re)*design LA to support instructors’ pedagogical decision-making by **guiding designers in thinking ahead** to instructor use during the design process.

### Implications for Dashboard Redesign

<table>
<thead>
<tr>
<th>I. Design to Support Processes Use</th>
<th>II. Align Information with Pedagogical Concerns</th>
<th>III. Support Sense-making Conversations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features for <strong>Question Generation</strong> &amp; Maintenance</td>
<td><strong>Organize Information</strong> from Teaching Perspective</td>
<td>Switch to De-identified Views for Sharing</td>
</tr>
<tr>
<td><strong>Visual Aids</strong> for Finding <strong>Entry Points</strong></td>
<td><strong>Align System Timing</strong> with Teaching <strong>Practices</strong></td>
<td></td>
</tr>
<tr>
<td>Support for Working with <strong>Reference Points</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flags</strong> for Later Decisions to <strong>Take Action</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Our partnership with IT has led to new models of dashboard (re)design and iterative improvement cycles.

Learning Analytics Dashboard Design v2

Assessment View
Along with design efforts, it is also important to consider **implementation supports** to facilitate **translating** information into actionable insights.

**Implications for Implementation Supports**

**I. Link Pedagogical Questions, Answers, & Actions Together**

- Interpretive dashboard shell plus weekly emails

**II. Support Collaborative Interpretation & Feedback**

- Workshops & One-on-one coaching sessions

**III. Cultivate Contextualized & On-Going Networks**

- Local instructor communities of practice around analytics use
Learning Analytics Dashboard Portal Design

Struggling Students Article

Article: How can I identify struggling students?

Instructors have many ways to identify struggling students. Your time spent in the classroom can sometimes be the best place to observe student knowledge and grasp on important concepts. Beyond the classroom, you may have artifacts such as written assignments that reveal student thoughts and understanding on relevant topics. Beyond these experiences and other direct student contact, your dashboards provide additional information that can help you gain insight into student behavior and knowledge. Two examples of this include: (1) Identifying students who aren’t accessing course material or are only doing so directly before the class, and (2) Studying the assessments that are linked to class assignments that are not completed.

Identifying Students who struggle

What next?

Things to consider
This article is a companion article for identifying students who struggle. We recommend checking out the companion article under the ‘Engagement’ section of questions in the learning analytics portal. The larger article discusses actions you can take at a student or class-level. We generally describe action in a general framework using three buckets. The video below discusses those ideas.
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- Presentation Feedback Tool
- Discussion Analytics
Co-Designing Student-Facing Learning Analytics

- NYU LEARN
- NYU IT + School EdTech
- Student Advisors
- Students
Key Questions for Participatory Design

- Who is in the room? (VON HIPPEL, 2005)
- What do they see? What are they told?
- What are they invited to do? (VERBERT, 2014)
- At what stages of the process do they participate?

*Note that students are frequently excluded* (MARJANOVIC, 2014)
Student-Facing Learning Analytics Project Phases

NEEDS ANALYSIS

CO-DESIGN

PROTO ITERATING

STEERING COMMITTEE

INTERVIEWS
Advisors -> faculty -> students

PERSONAS
Salient challenges

QUOTES
Represent personas
WE NEED YOUR IDEAS
FOR THE FUTURE OF STUDENT EXPERIENCE

Come participate in a workshop about how to unleash your creativity and help us design a new data tool to enhance how students learn at NYU.

Design Thinking Workshop
Three 5-hr Design Sessions

10 Student Participants

Human-Centered Design Methodology
THREE KEY DESIGN INGREDIENTS

**WIDE PROBLEM SCOPE**
The dashboard, data and academics are not the limit. Project objectives flexible from the beginning.

**SAFE DESIGN SPACE**

**GENERATIVE TENSIONS**
THREE KEY DESIGN INGREDIENTS

- **WIDE PROBLEM SCOPE**

- **SAFE DESIGN SPACE**
  Doc students led workshops for undergrads: a learning experience for everyone involved.

- **GENERATIVE TENSIONS**
THREE KEY DESIGN INGREDIENTS

WIDE PROBLEM SCOPE

SAFE DESIGN SPACE

GENERATIVE TENSIONS
Leveraging tensions as fuel for design; going beyond "tell me what you want".
Workshop Process
THREE FUNDAMENTAL TOOLS

**EMPATHY MAPPING**
The entire design process was centered on what the defined *personas* would feel or think about our ideas.

**DESIGN CARDS**

**LIVE PROTOTYPING**
## Student Persona Descriptions

<table>
<thead>
<tr>
<th>OS (Overwhelmed Student)</th>
<th>FG (First Gen Transitioner)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• College feels a lot more challenging than high school</td>
<td>• NYU perceived as great opportunity: stakes very high</td>
</tr>
<tr>
<td>• Is reassessing who they are (not the best in class any more)</td>
<td>• Generally very proficient and recognized in their environments but not recognized as much in new space</td>
</tr>
<tr>
<td>• May have some habits that could be improved around:</td>
<td>• May feel different to classmates</td>
</tr>
<tr>
<td>• Writing</td>
<td>• High pressure from family and fear of failure</td>
</tr>
<tr>
<td>• Time management</td>
<td>• May have trouble navigating additional opportunities</td>
</tr>
<tr>
<td>• Advocating for themselves</td>
<td></td>
</tr>
</tbody>
</table>
### Olivia (Overwhelmed Student)

**Says**
- I used to do well in school. Really well. I was the Valedictorian, and I always knew that I wanted to come to NYC. Now I am not so sure.
- I am confused about my grades. I am good at studying. I did well in school.

**Does**
- Tends to open the readings one or two days before class, sometimes the morning before the class itself.

### Frank (First Gen Transitioner)

**Says**
- I had a friend, one of these mentors, that told me how to navigate the statistics course…. there was all this stuff out there. I wish he would have told me earlier.
- I have learned to pace myself when studying, and do a little every day. I don’t know where I got that from, maybe another student.

**Does**
- Studies a bit every day. Without much structure; just allots a number of hours to study and reads or writes whatever is most urgent.
EMPATHY MAPPING
THREE FUNDAMENTAL TOOLS

EMPATHY MAPPING

DESIGN CARDS
A deck of cards allowed students to ask new questions about the data and see new angles and possibilities.

LIVE PROTOTYPING
DESIGN
CARDS

How much time a week you spent in this course
And how much others did

Connect you to

How much you were interacting in class
And how much others did
THREE FUNDAMENTAL TOOLS

EMPATHY MAPPING

DESIGN CARDS

LIVE PROTOTYPING
A UX designer materialized ideas into sketches with students in situ, during the workshops.
“HIVE” design – from Ideation to Prototype

First ideas drawn by students
“HIVE” design – from Ideation to Prototype

Design expanded and reflected back by facilitators and live designer
“HIVE” design – from Ideation to Prototype

First digital prototype brought back to the students for feedback
“HIVE” design – from Ideation to Prototype
**EMERGENT THEMES FROM STUDENTS**

<table>
<thead>
<tr>
<th>Data</th>
<th>Holistic</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using data was as only <em>part</em> of the story. Thus, students came up with tools that are more than dashboards.</td>
<td>Students underscored needs beyond academic help.</td>
<td>Sharing of information through the system seen as one of the powerful possibilities of data.</td>
</tr>
</tbody>
</table>
Student-Facing Learning Analytics Project Phases

- Needs Analysis
- Co-Design
- Prototyping
- Iterating
FINAL TAKEAWAYS FOR DESIGNING LA FOR HUMANS WITH HUMANS

Gathering (useful) input from humans to inform analytics is about much more than simply asking people what they would like.

Both efforts described here led to a variety of things we never would have imagined otherwise.

There was a concern with burdening already overstretched students and instructors, but they appreciated being involved in the processes.
Special thanks to the LEARN PhD students who spearheaded work on the projects described today

Yeonji Jung

JP Saramiento

Fabio Campos
Thank you and I’m happy to answer any questions