Accessible Data Dashboards & Visualizations as Pragmatic Planning Tools for Educators

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Data and IT Security in the "New Now"
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TECH TACTI
THE JOURNAL CAMPUS TECHNOLOGY IN EDUCATION

A little about me…

- David Amiel, Research Associate, Rutgers
- MS in Statistics (Data Science)
- BA in Biomathematics (CS, Econ)
- Research Interests
  - K12 Computer Science Education, Ed. Partnerships
- Academic Interests
  - Causal Inference, Natural Language Processing
- Personal Interests
  - Photography, Astronomy, Harry Potter *(go Ravenclaw!)*

RUTGERS

…and a little about you.

- In your neighborhood of tech tacticians:
  - Introduce Yourselves
    - Name, Location, Role
    - How your work intersects with educational data
  - Begin to Ponder
    - How do you define “data” in education? Elsewhere?
    - Is there a general enough definition or broad enough characteristics to capture any type of data inside a working conceptualizati

Talking about data

Some theoretical underpinnings.

Idea 1

Data is packaged.

- Data is a source of truth – we'll consider it as a package of three components
  - Information
  - Level
  - Format

- Example: Test scores
  - information – Standardized test scores
  - level – Student
  - format - numeric results in a spreadsheet

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Idea 2

Data can be acted upon.

- With a “box” of data, an agent is empowered to act:
  - Contribute to data through additions/revisions
  - Interpret data to understand meaning
  - Analyze data for a deeper understanding
  - Repackage data for easier future use
  - Aggregate data to simplify and summarize
  - Redact data to protect student privacy
  - Act on data to initiate changes to practice
  - Synthesize data to support recommendations/actions

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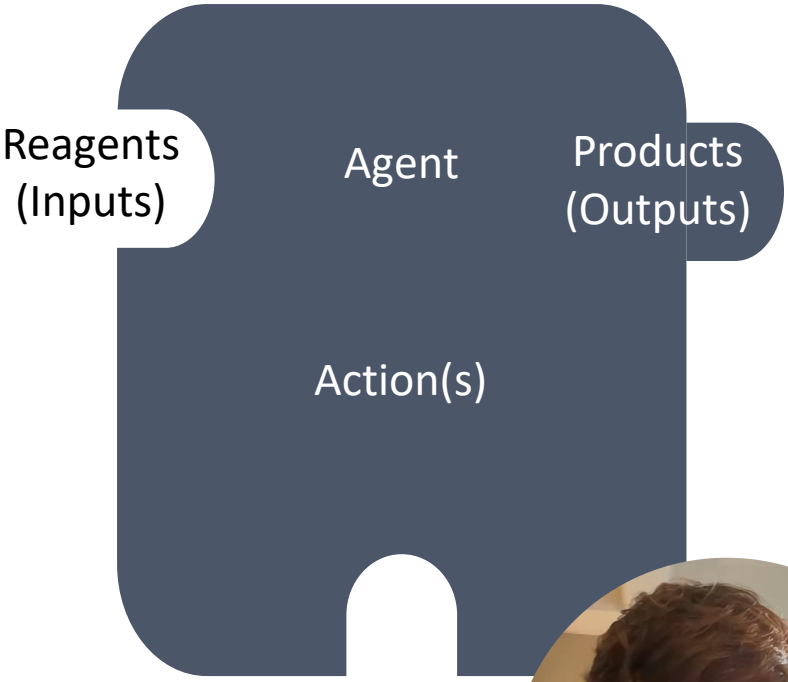

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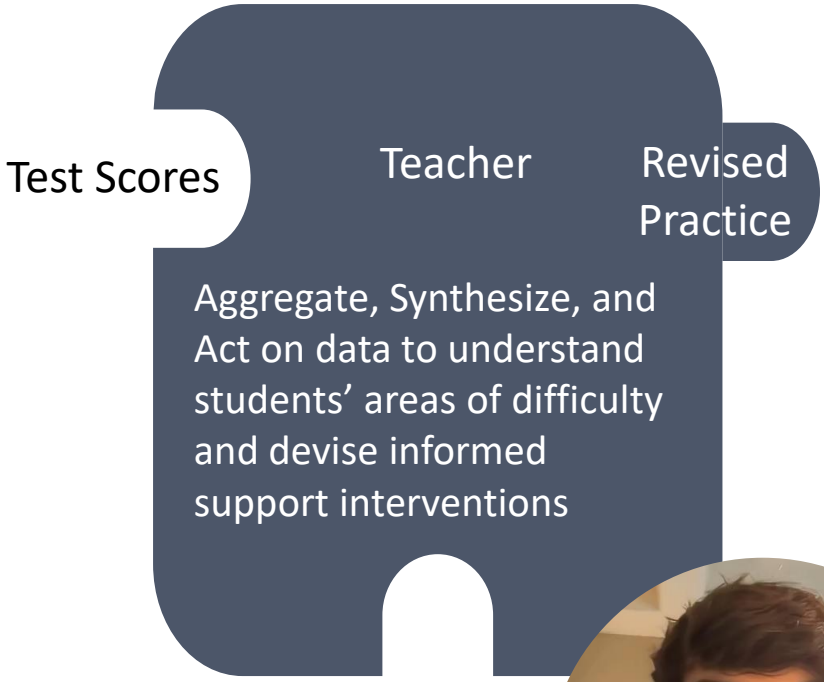

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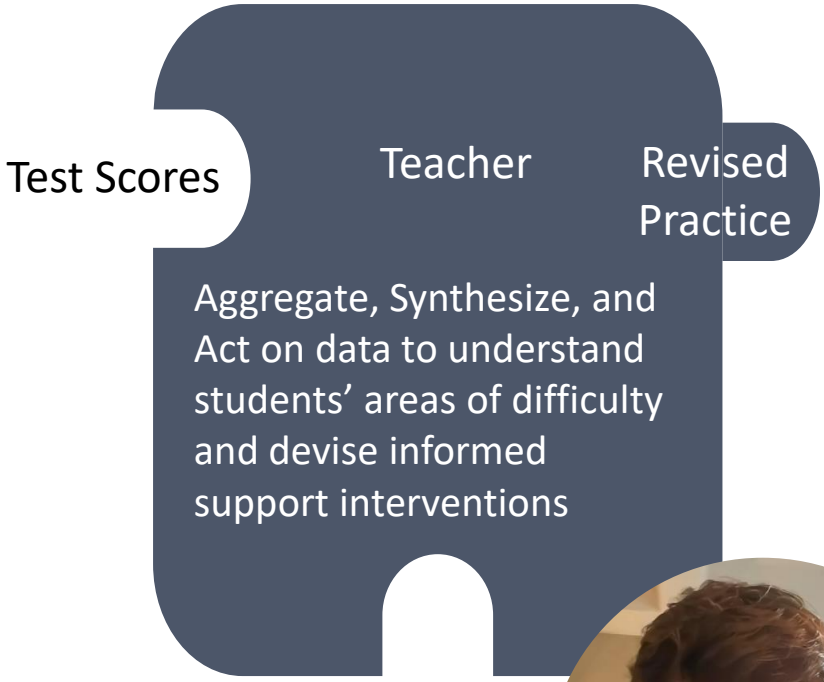
  - Synthesize data to support recommendations/actions
  - Send data to others for their own use



Idea 3

Actions can be strung together.

Learning Standards

Teacher

Use learning standards and prior knowledge to understand expectations of students to develop informed curricular materials, lessons, assessments.

Assessments

Teacher/ Students

Students receive instruction using developed curricular materials and complete periodic formative and summative assessments.

Academic Achievement

Teacher/ Administrator

Aggregate, Synthesize, and Act on data to understand students' areas of difficulty and devise informed support interventions

Revised Practice

Idea 3

Actions can be strung together.

Student Outcome Data

Learning Management Specialist

Using standard reporting metrics, tech specialist notices a trend for low retention rates for female students in a MS computer science course.

Findings Report

Department Lead(s)

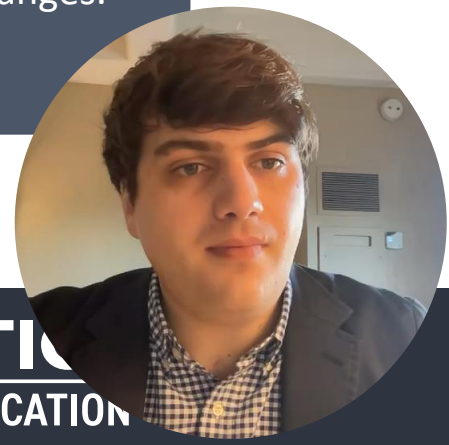
Department leads examine trends in grades and performance, speak to students, to identify reasons why students leave CS pipelines.

Collected Data

Departments/ Teachers

Culture of ongoing review to monitor engagement, interest, and retention of at-risk students established. Ongoing data review to assess impact of changes.

Revised Practice



Idea 4

Action can be catalyzed and inhibited.

Teacher

Revisions to practice based on formative assessments.

- Historical data for comparison
- Knowledge of spreadsheets and statistics
- Red tape to get access to data

Tech Specialists

You tell me!

Idea 5

Mapped workflows give us planning power.

Step	#1: Planning & Design	#2: Administering Assessments	#3: Analyzing Results	#4: Mobilizing Findings to Practice
Description	Development of thoughtful assessments	Students take assessments	Understanding student responses, performance	Putting revisions into practice
Agent	Teacher	Teacher, Students	Teacher, Administration	Teacher (& Administrator)
Reagents	Curriculum Goals, Standards	Developed assessments from Step #1	Student response data from Step #2	Curriculum and instructional revisions
Inhibitors & Catalysts	Data silos – inhibitor Data management system to centralize standards – catalyst	Online LMS – catalyst Connectivity	Data visualizations – catalyst Complex datasets, inaccessibility – inhibitor	
Products	Data-informed assessment strategies	Student responses Student grades	Findings from data analysis, plan to revise	Ongoing cycle improvemer
Action	Design	Generation	Aggregation & Analysis	Mobilizati

Idea 5

Mapping workflows give us planning power.

- Activity – take a few, map out a *problematic or interesting* data workflow you are directly or indirectly involved with.

Step	#1	#2	#3	#4
Data				
Agent				
Reagents				
Inhibitors & Catalysts				
Products				

Data Dashboards & Visualizations

Thoughtful design, engineering, and implementation.

Idea 6

Dashboards and visualizations enhance work.

- They constitute the “format” piece of our data package
  - Leaves flexibility open in level and information
- Can be a reagent (input), product (output), catalyst, or *inhibitor* within workflows
  - Reflects how adaptive they can be, and the potential for over/misuse
- Several types (non-exhaustive): logistic, reporting, persistent

Idea 7

Dashboards must be thoughtful.

- User needs and requirements
- Ease of use and quality of life
- Scalability and reliability
- Integration with existing systems
- Pilot testing, dissemination and training

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Dashboards must be thoughtful.

User needs and requirements

Ease of use and quality of life

Scalability and reliability

Integration with existing systems

Pilot testing, dissemination and training

Remember our theoretical dis

Where in a data flow does it ***make sense*** to have a

What ***data*** will it display, what ***purpose***

Technical Considerations

Statistical Caveats, Gains of Salt

Dashboards are not controlled experimental environments.

Dashboards can showcase trends (period).

Control, Power, Causality	Generalizability	Repeated Experiments	Confidentiality & Privacy

Wrapping Up

Bringing it all back together.

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Supplementary Materials

Will be uploaded to the conference agenda page as well!

Visualization & Dashboard Techniques

Manual Techniques

- PivotTable, Excel
- Python
- R
- External Resources (Fiverr, Upwork, etc.)

Please reach out!
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AI-Based Techniques

- I'd like to create a visualization in Python that shows the relationship between class size and average student performance. My data is saved in a file named "data.csv" and contains the following fields:
  - *Class_ID* a unique identifier for the class
  - *Class_Name* the name of the course
  - *Teacher_ID* an identifier for the course teacher
  - *Class_Size* the number of students in the class
  - *Average_Grade* students' average grade in the c
  - *Semester* the semester the course was offered as "Fall 2021" as an example

Our Big Ideas

1. Data is packaged.
2. Data can be acted upon.
3. Actions can be strung together.
4. Action can be catalyzed and inhibited.
5. Mapped workflows give us planning power.
6. Dashboards and visualizations (can) enhance work.
7. Dashboards must be thoughtful.
8. Research and technical considerations.

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Thank You for Attending!

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