ANALYTICS LITERACY THROUGH VISUALIZATION

"Involve me and I'll understand"

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Editor-in-Chief, IEEE Computer Graphics & Applications
Prof. (Adj.) in Computer Science, University of Iowa

Your data is irrelevant

if the customer cannot derive *insight*.

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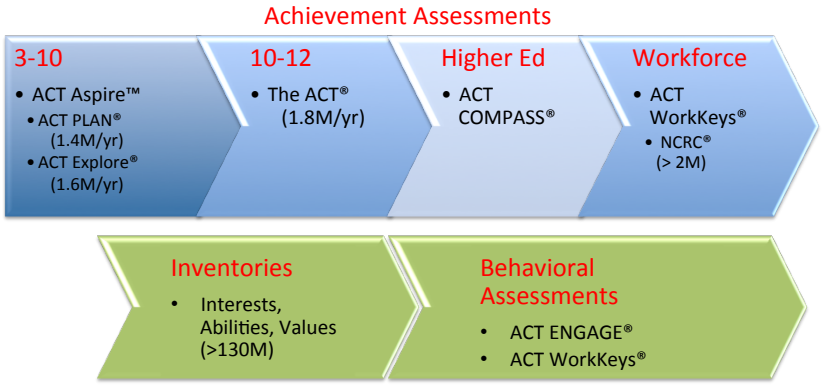
Data is our Cause

http://www.act.org/research-policy/

The ACT Longitudinal College and Career Readiness Assessment Framework



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Data isn't everything

"The purpose of computation is *insights* not numbers"

– Richard Hamming

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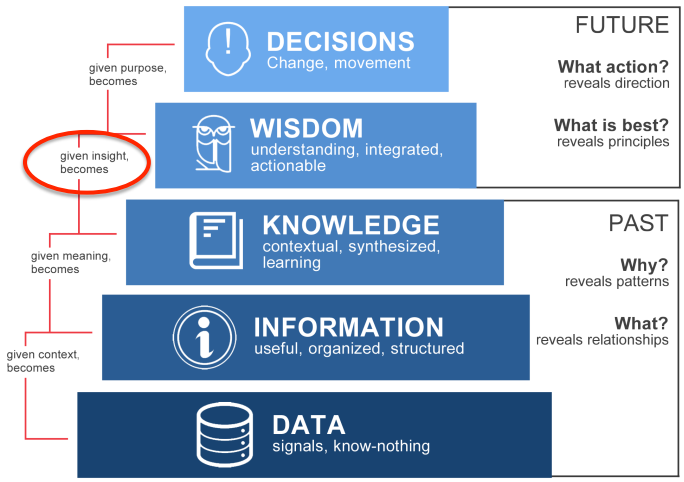
So what IS an insight?



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So what IS an Insight?

- ***Insight****:* The sudden grasp of new relationships that are necessary to solve a problem and that were not learned in the past.

– Bernstein et al., Psychology, 6th Edition, Houghton Mifflin Company, 2006.

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Where's the Insight?

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A comment on the right to failure

Learning from failure is extremely important, but …

Based on the economics of U.S. higher education, opting into the luxury of failure better come as an informed choice rather than a derailing surprise.

25% freshmen drop out of college
40% of students who start college will not earn a degree
$30,000 average student loan debt after graduation
$1.1 trillion outstanding loan debt among **37 million** Americans
more than 10% of students default on their student loans

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It's about data-driven decision making

3 fundamental challenges

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Who has good data access?

Producers (that's us!)

- ✓ IT
- ✓ Researchers & Scientists
- × Administrators
- × Communicators
- × Subject-Matter Experts

Consumers (our customers)

- × Students
- × Parents
- × Teachers
- × Counselors
- × Principals
- × Decision makers
- × Subject-Matter Experts
- × Policy makers
- × …

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Who's good at analytics?

Producers (that's us!)	Consumers (our customers)
× IT	× Students
✓ Researchers & Scientists	× Parents
× Administrators	× Teachers
× Communicators	× Counselors
× Subject-Matter Experts	× Principals
	× Decision makers
	× Subject-Matter Experts
	× Policy makers
	× …

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Who's good at communication?

Producers (that's us!)	Consumers (our customers)
× IT	× Students
× Researchers & Scientists	× Parents
× Administrators	× Teachers
✓ Communicators	✓ Counselors
× Subject-Matter Experts	× Principals
	× Decision makers
	× Subject-Matter Experts
	✓ Policy makers
	× …

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Traditional communication doesn't do it either

Reports

Generalized, impersonal and convoluted

Parents & peers

Subjective and out-of-context

Traditional Media

Generalized, out-of-context and sensationalized

The Internet

Incomplete, inaccurate and overwhelming

➠ **Confirmatory and trends only; little actionable**

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A Need for Analytics Democratization

Access + Literacy = Democratization

Producers (that's us!)

- ✓ IT
- ✓ Researchers & Scientists
- ✓ Administrators
- ✓ Communicators
- ✓ Subject-Matter Experts

Consumers (our customers)

- ✓ Students
- ✓ Parents
- ✓ Teachers
- ✓ Counselors
- ✓ Principals
- ✓ Decision makers
- ✓ Subject-Matter Experts
- ✓ Policy makers
- ✓ …

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Why is it important?

Democratization of Data Analytics

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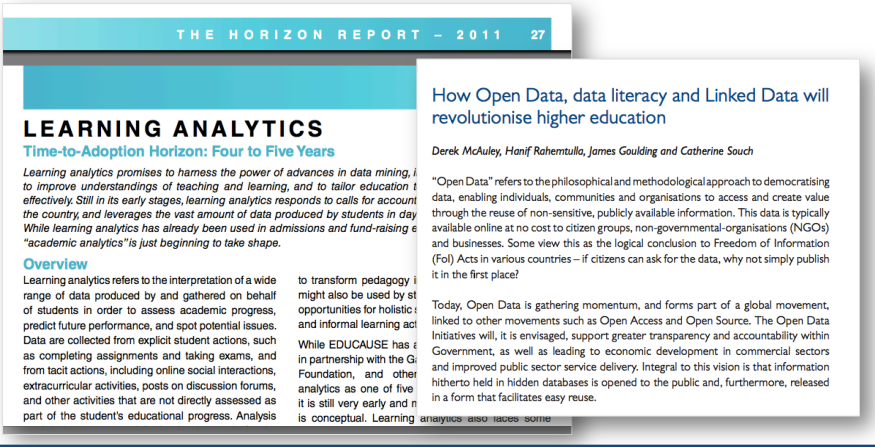
Education

The need for formal instruction in key new skills, including **information literacy**, **visual literacy**, and **technological literacy**, poses a continuing challenge to educational programs.



THE HORIZON REPORT – 2011 27

LEARNING ANALYTICS

Time-to-Adoption Horizon: Four to Five Years

Learning analytics promises to harness the power of advances in data mining, i to improve understandings of teaching and learning, and to tailor education t effectively. Still in its early stages, learning analytics responds to calls for account the country, and leverages the vast amount of data produced by students in day While learning analytics has already been used in admissions and fund-raising e "academic analytics" is just beginning to take shape.

Overview

Learning analytics refers to the interpretation of a wide range of data produced by and gathered on behalf of students in order to assess academic progress, predict future performance, and spot potential issues. Data are collected from explicit student actions, such as completing assignments and taking exams, and from tacit actions, including online social interactions, extracurricular activities, posts on discussion forums, and other activities that are not directly assessed as part of the student's educational progress. Analysis

to transform pedagogy i might also be used by st opportunities for holistic and informal learning act

While EDUCAUSE has in partnership with the Gi Foundation, and other analytics as one of five it is still very early and n is conceptual. Learning analytics also faces some

How Open Data, data literacy and Linked Data will revolutionise higher education

Derek McAuley, Hanif Rahemtulla, James Goulding and Catherine Souch

"Open Data" refers to the philosophical and methodological approach to democratising data, enabling individuals, communities and organisations to access and create value through the reuse of non-sensitive, publicly available information. This data is typically available online at no cost to citizen groups, non-governmental-organisations (NGOs) and businesses. Some view this as the logical conclusion to Freedom of Information (FoI) Acts in various countries – if citizens can ask for the data, why not simply publish it in the first place?

Today, Open Data is gathering momentum, and forms part of a global movement, linked to other movements such as Open Access and Open Source. The Open Data Initiatives will, it is envisaged, support greater transparency and accountability within Government, as well as leading to economic development in commercial sectors and improved public sector service delivery. Integral to this vision is that information hitherto held in hidden databases is opened to the public and, furthermore, released in a form that facilitates easy reuse.

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Workforce

Data Analytics as 21st century skill

"As the use of analytics grows quickly, companies will need employees who understand the data. A May 2011 study from McKinsey & Co. found that **by 2018, the U.S. will face a shortage of 1.5 million managers who can use data to shape business decisions**."

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K-12 Assessment

- **Common Core State Standard**
  - High School Math Standard
    - "Emphasize mathematical modeling, using mathematics and statistics to **analyze** problems, understand them better, and improve decisions"
  - Reading Standards for History/Social Studies, Science, and Technical Subjects
    - "**Synthesize** quantitative and technical information, including facts presented in maps, timelines, flowcharts, or diagrams"

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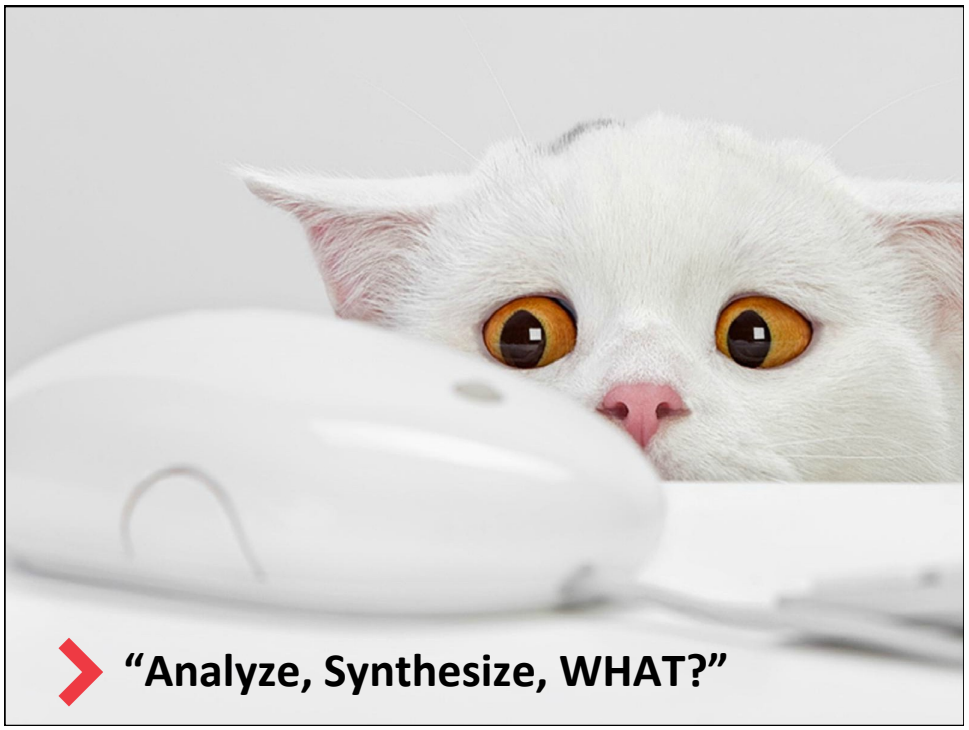

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Interactive Data Visualization to the rescue

Tell me and I'll forget.

Show me and I may remember.

– Chinese proverb

Involve me and I'll understand.

Reporting

Infographics

Visual Analytics

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Visual Data Analytics

Means for Success

Structured **user-centered** process
of
transforming **data**
into
actionable **insights** to inform **decisions**

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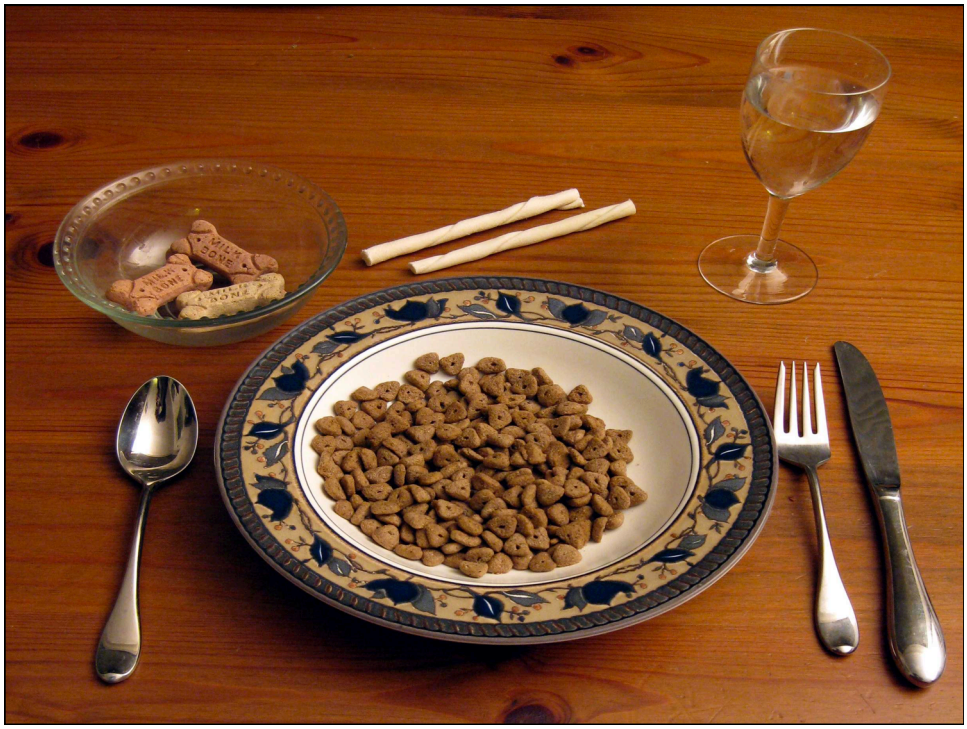

What we needed to do

01 Advance literacy

02 Create a talent pipeline

03 Develop Champions

04 Create an analytics community of practice

05 Democratize the use of data

06 Experiment through prototypes

07 Ensure sustainability

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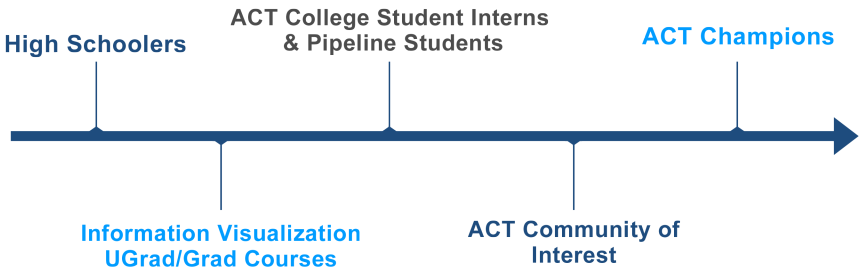
ACT's Analytics Talent Pipeline



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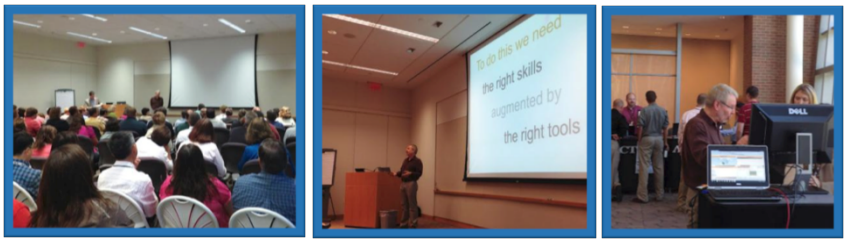
LEARNING: Visual Analytics week, June 2012



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LEARNING: Experts

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Developing Champions

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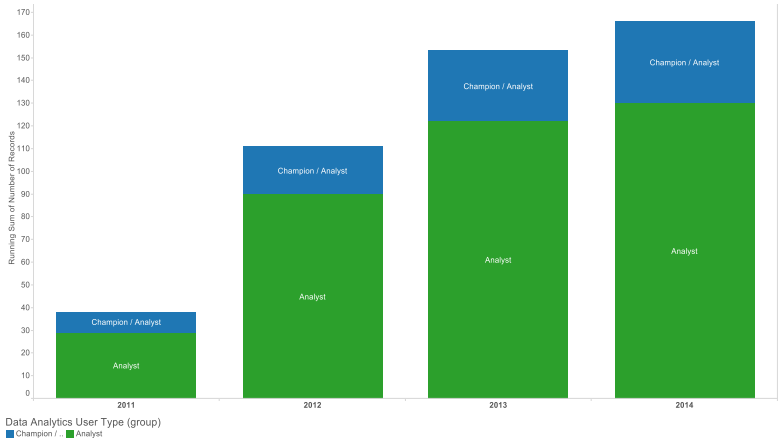
Growth of the ACT Analytics Community

Evolution of Internal Capability



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ACT Analytics Talent Pipeline

- ACT Student Pipeline is for students to support **Visual Communication projects** across ACT under the direction of the Office for Innovation.
- Student activities include conducting **data analytics**, **shaping data** and developing **data visualizations** for both quantitative and unstructured text data sources.

We stress:

- Sense-making, data-driven storytelling, data and analytics literacy development
- Applying best practices of information design and visual communication

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ACT Analytics Talent Pipeline 2013

Yannik
Junior, Iowa City West
Senior High School

Gordon
ACT ATM and PHD Program
University of Maryland
College Park

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ACT Analytics Talent Pipeline 2013

Spencer
Data Analyst Intern at ACT
Senior, The University of Iowa

David
Graduate Student at
The University of Iowa

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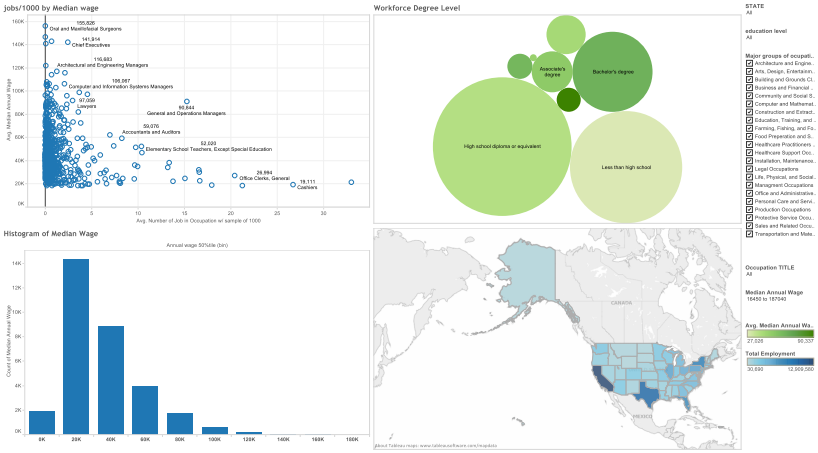
ACT Analytics Talent Pipeline 2013

National Day of Civic Hacking



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Ensure Sustainability

Adopt Success Assurance Best Practices:

- Support **continuous communications**.
- Recruit a core group designated as an **internal "help desk."**
- **Implement on-demand Q&A** from product experts to allow people to get their questions answered as they arise.
- Establish an **internal group** to share experiences and ideas.
- Support attendance at product **user conferences**.

Literacy as Quality Assurance Process

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Learning & Sustainability: Symposium April 2014

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Advance Literacy: Experts

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Advance Literacy: Experts

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Advance Literacy: Experts

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Advance Literacy: Community

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Tangibility: Showcasing Visual Analytics

- Visual analytics competitions
- Entries judged by ACT staff
- Prizes to top entries
- Participation awards to all entrants

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Showcasing Visual Analytics

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Showcasing Visual Analytics

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Next Phase

Reaching the Customer

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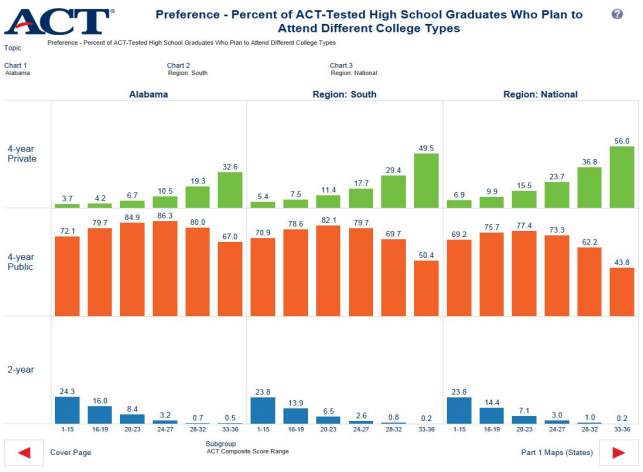
Customer-side: Data-driven Engagement

College Choice Report: Available on Tableau Public



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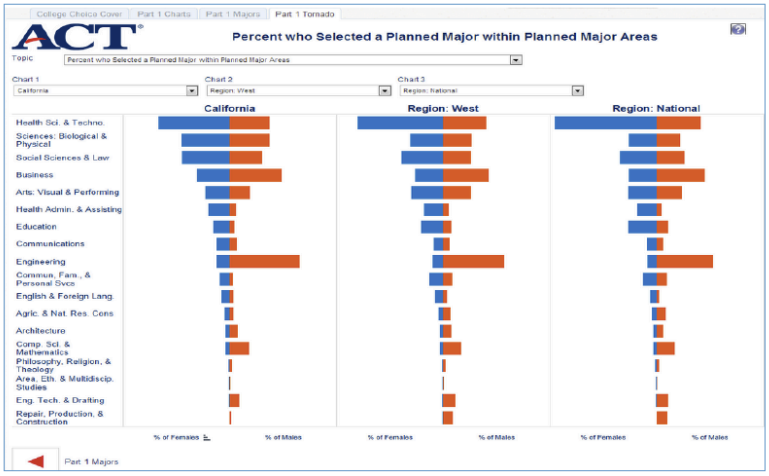
Consumer-side: Data-Driven Storytelling

Source Data



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Data-Driven Storytelling: The Value of a Story

Percent who selected a Planned Major wi

Summary:

Science based majors and Business majors within C differences in popularity when compared to Nation Science based majors are most popular within Calif Technology lags national and regional averages for Business is a more popular major selection for both compared to Western Region and National Averages.

Key Highlights:

- Health Science & Te California; Engineer
  - California ha Technology
  - Both the We with regards Technology.
  - Percentage of California males choosing Engineering is larger than the Western Region.
  - A higher percent of males are choosing Engineering within California and Western Region when compared to the National average.
- A higher percentage of males and females choose Biological and Physical Science Majors within California wh National Averages.
- Percentage of Californian males and larger than the National and Region
- Students selecting Education within National Averages for both males and females.
- Percentage of males in Commun, Family & Personal Services in California is significantly lower than males nationally.

Science based majors and Business majors within California show the largest differences in popularity when compared to National and Western Region averages.

California has a lower percentage of females who opt for Health Science & Technology majors compared to the overall Western Region.

Percentage of males in Community, Family & Personal Services in California is significantly lower than males nationally.

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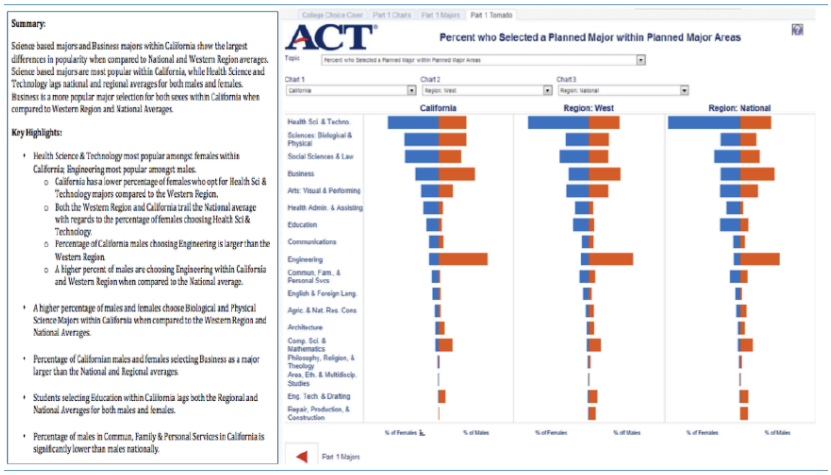
Data-Driven Storytelling: Personalized Insights



Summary:

Science based majors and Business majors within California show the largest differences in popularity when compared to National and Western Region averages. Science based majors are most popular within California, while Health Science and Technology lags national and regional averages for both males and females. Business is a more popular major selection for both sexes within California when compared to Western Region and National Averages.

Key Highlights:

- Health Science & Technology most popular amongst females within California; Engineering most popular amongst males.
  - California has a lower percentage of females who opt for Health Sci & Technology majors compared to the Western Region.
  - Both the Western Region and California trail the National average with regards to the percentage of females choosing Health Sci & Technology.
  - Percentage of California males choosing Engineering is larger than the Western Region.
  - A higher percent of males are choosing Engineering within California and Western Region when compared to the National average.
- A higher percentage of males and females choose Biological and Physical Science Majors within California when compared to the Western Region and National Averages.
- Percentage of Californian males and females selecting Business as a major larger than the National and Regional averages.
- Students selecting Education within California lags both the Regional and National Averages for both males and females.
- Percentage of males in Commun, Family & Personal Services in California is significantly lower than males nationally.

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To end with yet another Quote…

"The Small Data Revolution is the Real Revolution.

The growing capacity of individual users to process smaller data packages will drive the future of computing."

– Rufus Pollack, Founder and Director,
The Open Knowledge Foundation

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Thank You!

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