Quantitative Literacy:
It Starts with Faculty Development

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NNN Fall 2012 Conference

BbK Broad-based Knowledge
Evaluating Technology Innovations in Education

ICPSR

TeachingWithData.org
Pathway to Quantitative Literacy in the Social Sciences

ssdan.net

NSF

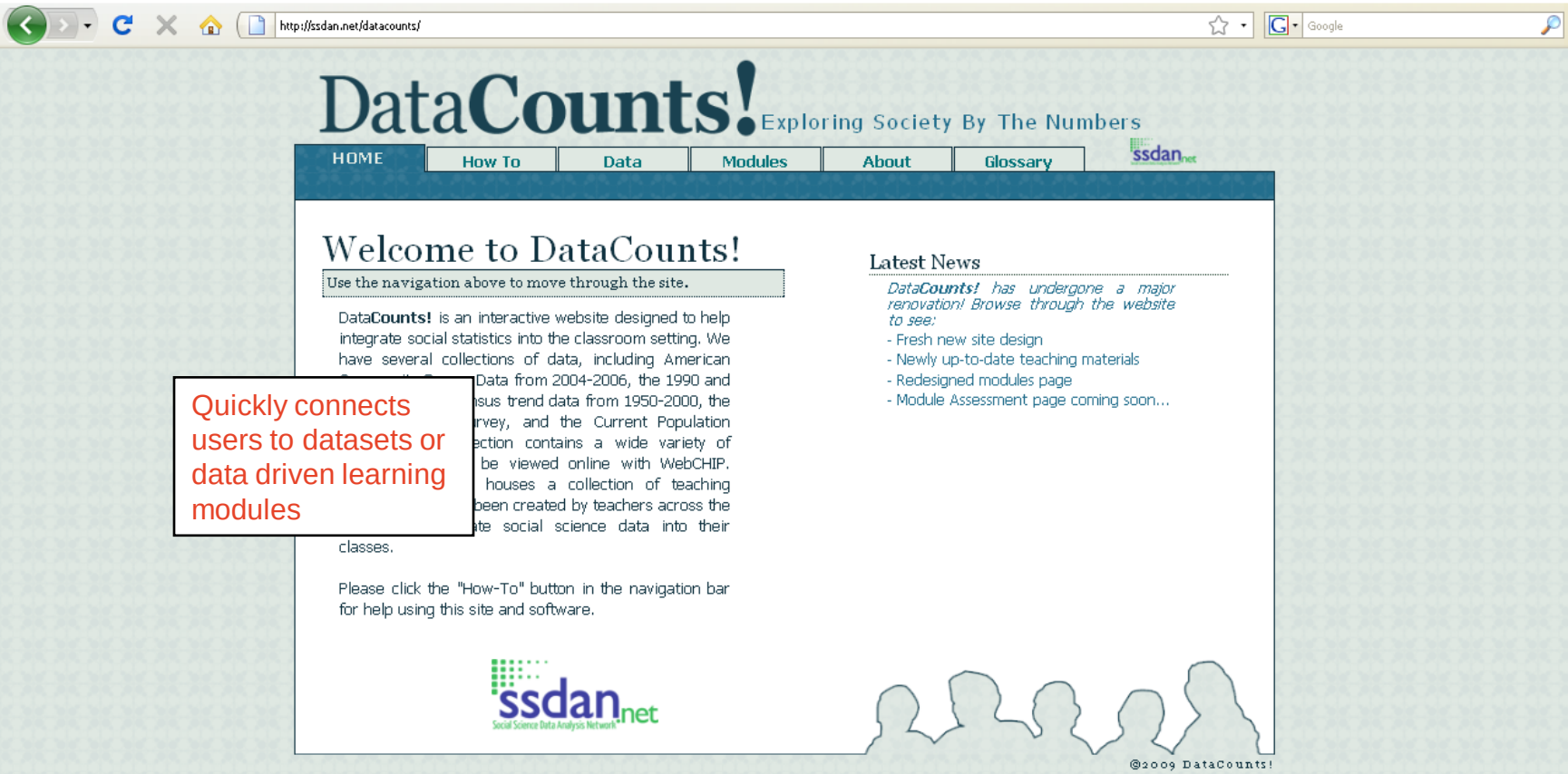
National QL Faculty Development Effort

- NSF TUES dissemination grant
  - Build on previous and current efforts to improve education in SS by infusing teaching and curriculum with QL
  - Design and conduct faculty development focused on use of QL in teaching lower division courses using online resources
  - Assess outcomes and impact on student learning based on use of online resources
  - Determine how to effectively disseminate innovative, online QL resources

Project Components

- Faculty Development (FD) for social science instructors using QL modules
- Survey of instructors on use of social science digital resources
- Dissemination webinars re: QL modules
- Update existing and introduce new analytic datasets using American Community Survey data (previously decennial census)
- Closely linked to TeachingWithData.org development and design

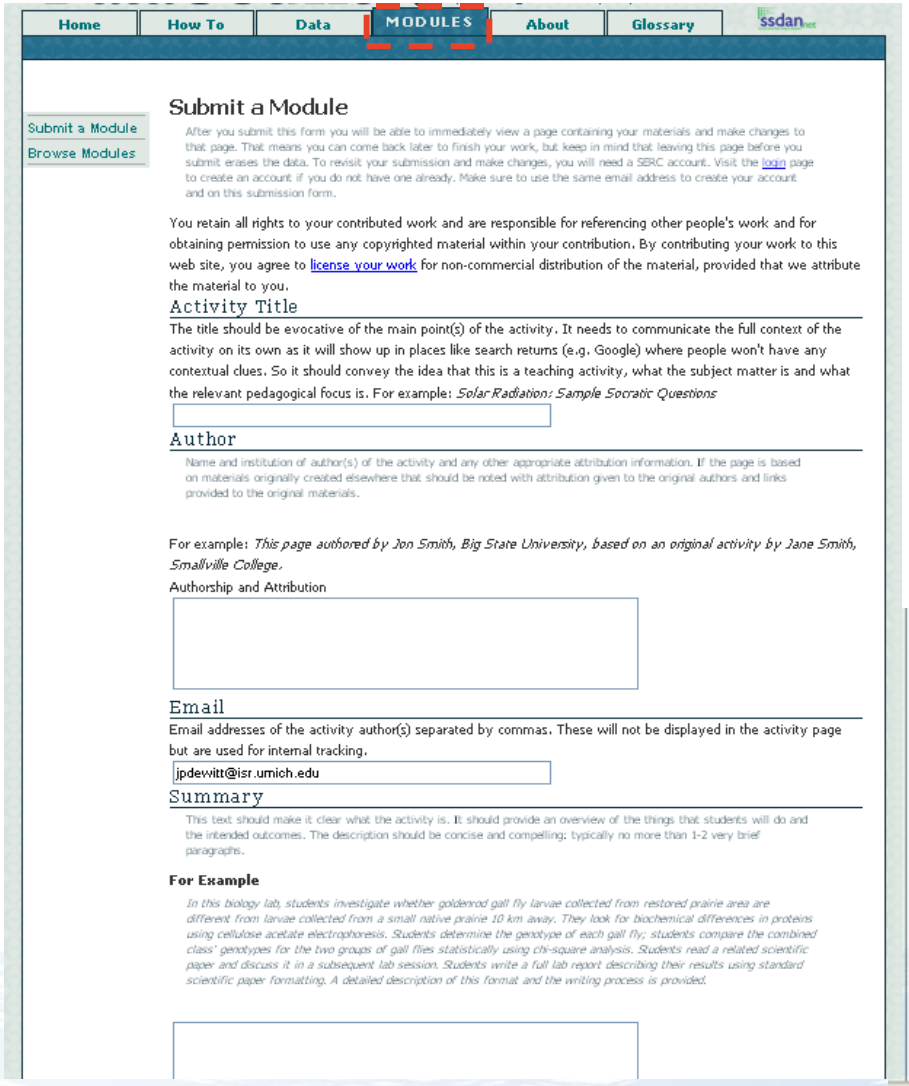
SSDAN: DataCounts!



Quickly connects users to datasets or data driven learning modules

http://ssdan.net/datacounts/index.html

SSDAN: DataCounts!



Module Components

Activity Title

Author

Summary

Learning Goals (Skills & Substance)

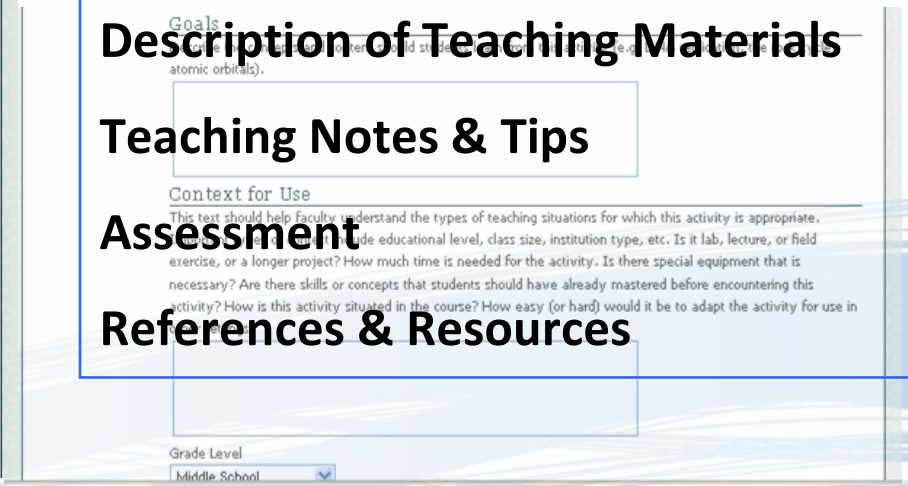
Context for Use

Description of Teaching Materials

Teaching Notes & Tips

Assessment

References & Resources



Outcomes of Faculty Development

- Rubric for assessing QL student learning outcomes in sociology
- Two cohorts (A & B) of faculty members from 4-year institutions and community colleges
- Revised course assignments & classes with QL learning outcomes integrated
- QL assessment plans and tools based on rubric developed & tested

Assignment Level QL Rubric

- Calculation
- Interpretation
- Representation
- Analysis
- Method Selection
- Estimation Reasonableness Checks
- Communication
- Find – Identify - generate data
- Research design
- Confidence
- Content Learning Outcomes

Dimension	Unacceptable	Acceptable	Accomplished	Exemplary
Calculation: Ability to perform mathematical operations	Performs few/less than half of calculations correctly.	Successfully performs many calculations but patterns of errors are evident.	Successfully performs most calculations, errors are rare.	Consistently performs all calculations successfully.
Interpretation: Ability to explain information presented in mathematical forms (e.g., tables, equations, graphs, or diagrams)	Incorrectly explains information in key forms of presentation or with many errors across types of data.	Correctly explains information in some forms correctly (but not others) or makes several errors across various data forms.	Correctly explains information in most forms consistently or makes few errors across various data forms.	Correctly explains information presented in a variety of forms consistently.
Representation: Ability to convert relevant information from one mathematical form to another (e.g., tables, equations, graphs or diagrams)	Unable to convert data from one mathematical form into any other form or makes significant errors when doing so.	Able to convert data from some mathematical forms into some, but not all, other forms or converts among all forms with several errors.	Able to convert data from most mathematical forms into other forms, or converts among all forms with a few errors.	Able to convert data from any mathematical form to any other form with no errors.
Analysis: Ability to make judgments based on quantitative analysis	Rarely or never makes correct judgments based on data presented.	Generally makes correct judgments based on data presented.	Often makes correct judgments based on data presented.	Reliably makes correct judgments based on data presented.
Method selection: Ability to choose the mathematical operations required to answer research question	Consistently unsure of the correct mathematical operation (e.g., correct measure of central tendency or bivariate tests appropriate to the level of measurement) to answer research questions.	Accurately chooses the correct mathematical operation to answer research questions some of the time.	Accurately chooses the correct mathematical operation to answer research questions most of the time.	Accurately chooses the correct mathematical operation to answer research questions each time.
Estimation/Reasonableness Checks: Ability to recognize the limits of a method and perform reasonable predictions of unknown quantities	Unable to assess the limitations of a method or to predict quantities that are reasonable based on relevant data.	Able to assess the limitations of some methods or under some circumstances. Predicts reasonable quantities in many cases.	Able to assess the limitations of most methods under most circumstances and typically predict reasonable quantities based on relevant data.	Able to assess the limitation of virtually all methods and under all circumstances and reliably provides reasonable estimates based on relevant data.
Communication: Ability to use appropriate levels and types of quantitative information (data, reasoning, tools) to support a conclusion or explain a situation in a way that takes the audience into account.	Fails to develop an argument or bases it on weak or incorrect quantitative information. Presents the information without taking the audience into account.	Develops an argument using quantitative information that is incomplete, irrelevant, or somewhat misinterpreted, therefore weakening the argument. The argument may not take the audience into account.	Develops an argument using quantitative information that is either slightly incomplete, not the most relevant, or with slight misinterpretations, or presents the argument in a way that does not fit the intended audience.	Develops an argument using appropriate quantitative information and uses it properly in a way that is suitable for the intended audience.

Based on AAC&U Quantitative Literacy VALUE Rubric

What We Learned: Cohort A Faculty Development

- Participants selected based on past support for QL
  - Instructors did not include specific QL learning outcomes in course design, activities or assessment
- After faculty development, participants
  - Successfully applied rubrics in re-design of courses and modules
  - Learned new assessment methods and its use in curriculum re-design efforts
- Challenges
  - Student resistance to new teaching methods
  - Technology confounded measuring learning

What We Learned: Cohort A - Student Learning

- Students showed improved learning
  - Improvement related to specific tasks, e.g., a specific type of table or graph
  - Inconclusive about student ability to apply skills in new situations
- All instructors reported gains in student self confidence in QL

  "I worked a lot in this class, and was always taken to the brink of overwhelmed but not crossing over....The data analysis we did was a particular challenge. I came away from the exercise knowing I learned something completely out of my comfort zone." (CC student)

Faculty Development Program (Cohort B)

- Re-implement FD program with broader group of instructors
  - Cohort A participants recruited partners (Cohort B) from own school or different schools to adopt & test modules
  - Cohort A mentored Cohort B to
    - Revise curriculum to include online modules
    - Teach with modules
    - Assess results
- Based on mentor part of the program, design & implement online Faculty Development program

What We Learned: FD Program - Cohort B

- Adoption challenges are formidable; peer pressure not enough to make change
  - Only 2 new instructors participated
  - Without mentors new instructors may not have overcome barriers to implementation
- Rubric was useful for grading multiple choice tests & writing assignments
- Size of class hindered use of writing-intensive assessment methods (time to score, lack of scorers)
- Rigid curriculum approval requirements made experimentation almost impossible
- Similar changes in student learning and confidence observed
- Involvement at national level energized Cohort A who became engaged ambassadors for QL – but not in the way we intended

Lessons Learned - Project

- Use of (QL) student learning objectives in sociology is nascent
  - No agreed-upon definition of QL among practitioners
- Implementing innovations with assessment can be ‘too much’
  - Assessment activities may confound adopting an innovation (even when instructors say they support adopting an innovation)
  - BUT, Linking assessment to innovation can uncover resistance to adoption of the innovation
  - Use of rubrics is a significant hurdle for instructors new to writing intensive assignments

Lessons Learned (continued)

- Online learning modules need to be designed from the beginning to include QL learning outcomes, especially for assessment purposes
- Types of campuses/students make a difference
  - Community college instructors often can only implement changes if approved by curriculum committee
- Unreasonable to expect untenured instructors to participate fully
  - Learning to use a module and redesign a course to address learning outcomes took significant time; assessment activities added to time burden.
- Mentoring is new to teaching culture in sociology

Recommendations for Faculty Development

- Focus training on (re) designing modules specifically created to promote QL and linked to rubric
- Link Bloom's taxonomy to rubric to strengthen assessment
- Scaffold training to better link curriculum change to support QL, assessment, and technology
- Group instructors by course – social sciences especially difficult because courses often aren't sequenced – no single set of outcomes that can be expected from any one course or level

Survey Results (2010)

- 1,037 instructors responded (22% economics; 26% political science; 26% sociology)
- QL skills important for non-methods/stat courses:
  - Explaining information presented in a mathematical form
  - Making judgments based on quantitative analysis
  - Identifying or generating appropriate information to answer a research question
  - Understanding the links between theory and data
- Most significant differences found among community college or economics faculty
  - Follow on interviews confirmed differences in how they perceive teaching, role of QL in courses.
- 65% of faculty use digital resources by others with little or no modification at least somewhat frequently

Final Observations - Questions

- How do we overcome systemic obstacles to change?
  - Class size
  - Rigid curriculum requirements
  - Competing priorities of academic role
- How do we encourage instructors to appreciate need to integrate QL into learning activities?
  - Include QL in student learning objectives, class activities
  - Get over ‘not my job’
- How do we overcome barriers adoption of innovations?
  - Technology (lack of access, knowledge about resources)
  - Assessment (over reliance on multiple choice to measure learning)