11. DATA LITERACY

©LITERACIES FOR THE DIGITAL AGE TO TEACH IN THE K-12 CLASSROOM

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DATA LITERACY DEFINED

- "Data-literacy is the ability to consume for knowledge, produce coherently and think critically about data."
- "Data literacy includes
  - statistical literacy
  - understanding how to work with large data sets,
  - how they were produced,
  - how to connect various data sets, and
  - how to interpret them.

- See more at:
  http://datajournalismhandbook.org/1.0/en/understanding_data_0.html#sthash.4oLwYHgy.dpuf

IMPORTANCE OF DATA LITERACY

☐ "Data literacy is the ability to ask and answer meaningful questions by collecting, analyzing and making sense of data encountered in our everyday lives.

☐ In our increasingly data-driven society, data literacy is arguably an important civic skill and one that we should be developing in our students.

☐ In addition, using data to connect school subjects with real-world events makes learning a richer and more meaningful experience. It can move students beyond simply learning facts to beginning to acquire skills in inquiry, critical reasoning, argumentation and communication."

http://www.rcet.org/twd/overview/dataliteracy.html

WEAK SCHOOLING FOR REAL-WORLD USE OF DATA LITERACY

- *"We use data every day—to choose medications or health practices, to decide on a place to live, or to make judgments about education policy and practice. The newspapers and TV news are full of data about nutrition, side effects of popular drugs, and polls for current elections. Surely there is valuable information here, but how do you judge the reliability of what you read, see, or hear? This is no trivial skill—and we are not preparing students to make these critical and subtle distinctions."* -
- Andee Rubin, 2005

http://www.rcet.org/twd/overview/dataliteracy.html

BECOMING DATA LITERATE:
Basic Skills of Data Literacy

- **"Learning key statistical terms,** like the difference between mean and median; or why a *standard deviation* or *margin of error* might matter.

- **"Knowing what questions to ask about data or a statistic** to gauge its potential relevance, quality or reliability.

- **"Performing basic statistical calculations** -- nothing fancy, just enough to do a quick reality-check whether you're understanding the story that a dataset might be telling.

- **"Putting data in context,** such as considering the local unemployment rate in the context of Census data for your community, or local vs. state/national crime statistics."

http://www.knightdigitalmediacenter.org/blogs/agahran/2012/11/becoming-data-literate-community-news-tips

USE OF DATA LITERACY IN SCHOOL REFORM
A data-driven approach to teaching literacy

- The work of Michael Fullan [2005 *Educational Forum* article "Turnaround Leadership"] used as the basis for the creation of a data driven curriculum to teach literacy by Cherry-Ann Joseph Hislop:

  - **Focus on literacy** — This was created through a skill-of-the-week approach in which students had a literacy curriculum aggregated and tailored to meet their academic needs.

  - **Use of student assessment and monitoring** — The use of weekly assessments was implemented to track student progress and assess the impact of planned strategies.

  - **Professional development** — Weekly meetings were held with teachers to plan the strategies for teaching each skill and analyze the data collected. This led not only to data-driven instruction but also to capacity building for teachers and students.

  - **Clear accountability** — Teachers were held accountable for the data generated in their classrooms.

  http://www.uft.org/teacher-teacher/data-driven-approach-teaching-literacy

USE OF DATA LITERACY IN SCHOOL REFORM
A data-driven approach to teaching literacy

- **Cycle 1 (14 weeks) —**Students are given a literacy foundation that is built on one literacy skill each week. This cycle is done grade wide, and students receive instruction based on their academic level.

- **Cycle 2 (nine weeks) —** At the end of Cycle 1, students take the acuity predictive and, **based on the data generated** from this assessment and the weekly skills analysis sheets, teachers generate the order of skills to be taught in Cycle 2.

- **Cycle 3 (six weeks) —**Teachers become a specialist in each skill, and students move to the specialists that they must see in order to succeed.

- **Cycle 4 (six weeks) —** This is the evaluation cycle where the **impact of the approach is measured** qualitatively and quantitatively.

http://www.uft.org/teacher-teacher/data-driven-approach-teaching-literacy

TEACHING DATA LITERACY WITH THE MATERIALS FROM THE 2000 US CENSUS

☐ **1) Activities, Worksheets, Teaching Suggestions:** Lessons Using Census 2000 Data

☐ **2) Making Sense of Census 2000 Teaching Kits** (Teaching guide and 4' x 6' 1990 census data wall map) United States   K-4 | 5-8 | 9-12
Other Areas   Puerto Rico | American Samoa
Northern Marianas | Guam | US Virgin Islands

☐ **3) ESL and Adult Literacy Kit** (Teaching guide and a 4' x 6' 1990 census data wall map) Census 2000 From Understanding to Participation

http://www.census.gov/dmd/www/schmat1.html

TEACHING DATA LITERACY WITH THE MATERIALS FROM THE 2000 US CENSUS

- **Census 2000 Lesson 1**

- *Skills and Objectives:*
  Read tables to gather information about the April 1, 2000 U.S. population.
  Analyze information from tables and maps. *Materials:*
  State of the States [pdf] Worksheet
  State of the States [pdf] Teacher's Answer Key
  Table T1 [pdf] Data Source

- **Census 2000 Lesson 2**

- *Skills and Objectives:*
  Read tables to gather information about the April 1, 2000 U.S. population.
  Compose a paragraph to describe population change in students' state.
  Analyze information from tables and maps. *Materials:*
  State of Your State [pdf] Worksheet
  State of Your State [pdf] Sample Paragraph
  Table T1 [pdf] Data Source

http://www.census.gov/dmd/www/schoolessons.html

TEACHING DATA LITERACY WITH THE MATERIALS FROM THE 2000 US CENSUS

- **MATH Activities** *Skills and Objectives:*
  Do math calculations (ranking, subtraction, and percentages) to complete a table showing Census 2000 population totals.
  Use Census 2000 data to create spreadsheets.
  Analyze information from tables and maps.

- *Student Data Source:*
  "Student Table 1" [pdf]

- *Teacher Data Sources:*
  www.census.gov/population/cen2000/tab04.pdf
  www.census.gov/population/cen2000/tab05.pdf

- http://www.census.gov/dmd/www/schoolessons.html

TEACHING DATA LITERACY WITH THE MATERIALS FROM THE 2000 US CENSUS

- **SOCIAL STUDIES Activities** *Skills and Objectives:*
  Construct choropleth (thematic) maps.
  Analyze information from tables and maps.
  Discuss the impact of the Census 2000 apportionment counts on their state and the nation.
  Read tables to gather information about the April 1, 2000 U.S. population.

- *Data Sources:*
  www.census.gov/population/cen2000/tab04.pdf
  www.census.gov/population/cen2000/tab05.pdf

- http://www.census.gov/dmd/www/schoolessons.html

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SOFTWARE TO HELP STUDENTS EXPLORE AND UNDERSTAND DATA

- Students use InspireData® to investigate, analyze, and represent data and information in dynamic graphs and charts.
- InspireData tools make it easy to change variables and plot types so students can explore data in multiple, meaningful ways.
- This encourages them to investigate data analytically, ask more questions, and apply their understanding of the data to form better conclusions and continue exploration. Download a free 30-day trial of InspireData today!
- InspireData helps students to successfully:
  - Build data literacy
  - Develop analytical skills
  - Strengthen critical thinking
- http://www.inspiration.com/InspireData#Develop-data-literacy

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THINKING WITH DATA
"**A Cross-Curricular Approach to Data Literacy"**

- "Thinking with Data (TWD) is a cross-curricular, middle school unit designed to be used by teachers to develop students' data literacy. It employs a preparation for future learning approach and uses real data to engage students in problem-based explorations of world water issues while they learn Social Studies, Mathematics, Science, and English Language Arts content at the same time."

- *The material in this website is based upon work supported by the National Science Foundation under Grant No. **ESI-0628122.***

http://www.rcet.org/twd/index.html

THINKING WITH DATA
"**A Cross-Curricular Approach to Data Literacy**"

- "The data literacy objectives of the TWD unit focus on
  - asking and answering data-based questions;
  - using appropriate data,
  - data manipulation tools and data representations; and
  - developing and evaluating data-based arguments, explanations and inferences.

- These objectives are addressed, in one form or another, in national standards for middle school social studies, mathematics, science, and English language arts. SEE FOLLOWING SLIDES.

http://www.rcet.org/twd/index.html

DATA LITERACY SKILL:
Asking and Answering Data-Based Questions

- ☐ Students understand how data does (or does not) fairly describe a situation/context (e.g. what is missing, what is there)

- ☐ Students understand what questions can or cannot be fairly answered by a data set or data sets.

- ☐ Students recognize that data may be transformed to create a fairer measure to be used in answering a question.

- ☐ Students understand when one can or cannot make fair/accurate predictions.

- ☐ Students can formulate relevant and answerable questions based on the context and data.

http://www.rcet.org/twd/overview/dataliteracy.html

http://www.rcet.org/twd/overview/dataliteracy.html

Data Literacy Requirement	Middle School SS Standards (NCSS)	Middle School Math Standards (NCTM)	Middle School Sci. Standards (NSES)	Middle School ELA Standards (NCTE)
Formulate and answer data-based questions	"Formulate historical questions, obtain data, question & identify gaps in data, & construct sound historical interpretations."	"Formulate questions, design studies, & collect data about a characteristic shared by two populations or different characteristics within one population."	"Identify questions that can be answered through scientific investigations. Develop the ability to refine & refocus broad & ill-defined questions."	"Students conduct research on issues & interests by generating ideas & questions, & by posing problems."

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DATA LITERACY SKILL:

Using Appropriate Data, Data ManipulationTools and Data Representations

- ☐ Students can evaluate data for credibility and relevance.
- ☐ Students can distinguish between fair and unfair representations of data for answering a question.
- ☐ Students can use fair representations for understanding a situation.
- ☐ Students understand there are instances when data should be aggregated, summarized, etc.
- ☐ Students understand there are instances in which proportional measures can be used to create a fairer comparison.
- ☐ When asked to make a fair comparison, students can identify key variables, develop required proportional measures, and/or create accurate and meaningful representations of the comparison.

http://www.rcet.org/twd/overview/dataliteracy.html

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Data Literacy Requirement	Middle School SS Standards (NCSS)	Middle School Math Standards (NCTM)	Middle School Sci. Standards (NSES)	Middle School ELA Standards (NCTE)
Use appropriate data, tools, and representations	"Use appropriate geographic tools such as atlases, data bases, systems, charts, graphs, & maps to generate, manipulate, & interpret information."	"Select, create, & use appropriate graphical representations of data; discuss & understand the correspondence between data sets & their representations."	"Use appropriate tools & techniques to gather, analyze, & interpret data, including mathematics, guided by the question asked & the investigations students design."	"They gather, evaluate, & synthesize data from a variety of sources (e.g., print & non-print texts, artifacts, people) to communicate their discoveries to suit their purpose & audience."

http://www.rcet.org/twd/overview/dataliteracy.html

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DATA LITERACY SKILL:

Developing and Evaluating Data-Based Arguments, Explanations, and Inferences

- Students can accurately interpret data representations to answer questions about a data set and make comparisons between data sets.

- Students can accurately analyze and interpret data to answer questions about a data set and make fair comparisons between data sets.

- Students can develop and interpret information from data by comparing, contrasting, and synthesizing across data sets, to understand how different data sets can shed light on an issue.

- Students can develop data-based arguments and use data in proposing solutions to problems or use data as evidence in supporting or opposing a position.

- Students can accurately evaluate and compare data-based inferences and arguments

http://www.rcet.org/twd/overview/dataliteracy.html

Data Literacy Requirement	Middle School SS Standards (NCSS)	Middle School Math Standards (NCTM)	Middle School Sci. Standards (NSES)	Middle School ELA Standards (NCTE)
Develop and evaluate data-based inferences and explanations	"Encourage increasingly abstract thought as learners use data & apply skills in analyzing human behavior in relation to its physical & cultural environments."	"Use observations about differences between 2 or more samples to make conjectures about populations and formulate new questions & studies to answer them."	"Students can formulate questions, design & execute investigations, interpret data, use evidence to generate & critique explanations, & propose alternative explanations"	"Students use spoken, written, & visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, & the exchange of information)."

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http://www.rcet.org/twd/overview/dataliteracy.html

AN EXTENSION OF DATA LITERACY: DATA MINING

- "Data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information."

- "One of the key issues raised by data mining technology is…. a social one."

- "Another issue is that of data integrity…data analysis can only be as good as the data that is being analyzed. "

http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm

USING DATA LITERACY FOR DATA DRIVEN DECISION MAKING [DDDM] IN EDUCATION

- ☐ "Data-driven decision making (DDDM), applied to student achievement testing data, is a central focus of many school and district reform efforts, in part because of federal and state test-based accountability policies."

- ☐ Rand study "Research questions addressed are:
  - ◻ what types of data are administrators and teachers using, and
  - ◻ how are they using them;
  - ◻ what support is available to help with the use of the data; and
  - ◻ what factors influence the use of data for decision making?"
  - ◻ http://www.rand.org/pubs/occasional_papers/OP170.html

USING DATA LITERACY FOR DATA DRIVEN DECISION MAKING [DDDM] IN EDUCATION

- "RAND research suggests that most educators find data useful for informing aspects of their work and that they use data to improve teaching and learning."

- "The first implication of this work is that DDDM does not guarantee effective decision making: having data does not mean that it will be used appropriately or lead to improvements. "

- "Second, practitioners and policymakers should promote the use of various data types collected at multiple points in time."

http://www.rand.org/pubs/occasional_papers/OP170.html

USING DATA LITERACY FOR DATA DRIVEN DECISION MAKING [DDDM] IN EDUCATION

- "Third, equal attention needs to be paid to analyzing data and taking action based on data. Capacity-building efforts may be needed to achieve this goal."

- "Fourth, RAND research raises concerns about the consequences of high-stakes testing and excessive reliance on test data."

- "Fifth, attaching stakes to data such as local progress tests can lead to the same negative practices that appear in high-stakes testing systems."

- "Finally, policymakers seeking to promote educators' data use should consider giving teachers flexibility to alter instruction based on data analyses."

http://www.rand.org/pubs/occasional_papers/OP170.html

NEED FOR CONTINUOUS RESEARCH IN EDUCATION ABOUT DDDM

- "More research is needed on the effects of DDDM on

  - instruction, student achievement, and other outcomes;
  - how the focus on state test results affects the validity of those tests; and
  - the quality of data being examined,
  - the analyses educators are undertaking, and
  - the decisions they are making."

http://www.rand.org/pubs/occasional_papers/OP170.html

DATA LITERACY SOURCES

- http://datajournalismhandbook.org/1.0/en/understanding_data_0.html *Data Journalism Handbook,* Become Data Literate in 3 Simple Steps

- http://www.knightdigitalmediacenter.org/blogs/agahran/2012/11/becoming-data-literate-community-news-tips *Becoming data literate: Community news tips; The Knight Digital Media Center at USC is a partnership with the [Annenberg School for Communication & Journalism](#). The Center is funded by a grant from the [John S. and James L. Knight Foundation](#).*

- http://dataliteracy.com/ [DataLiteracy.com](#) A blog on how to get you and your data on speaking terms; you can visit my channel at YouTube (www.youtube.com/bartonpoulson) for a collection of videos on working with a few statistical tools ([SPSS](#) and [StatCrunch](#), in particular) and conducting and reporting research.

DATA LITERACY SOURCES

- http://www.inspiration.com/InspireData#Develop-data-literacy
  INSPIREDATA - THE VISUAL WAY TO EXPLORE AND UNDERSTAND DATA

- http://www.uft.org/teacher-teacher/data-driven-approach-teaching-literacy   *A data-driven approach to teaching literacy* by Cherry-Ann Joseph Hislop | May 2, 2013 New York Teacher issue

- http://www.census.gov/dmd/www/schmat1.html Census 2000, Teaching Materials

- http://www.census.gov/dmd/www/schoolessons.html **Lessons Using Census 2000 Data,** *Source: U.S. Census BureauContact:* Census in Schools Last Revised: October 06, 2011 at 06:01:14 PM

DATA LITERACY SOURCES

- http://www.rcet.org/twd/overview/dataliteracy.html **Unit Overview: Data Literacy** ©2008, 2010 Research Center for Educational Technology, Kent State University

- http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm **Data Mining: What is Data Mining?**

- Marsh, Julie A., John F. Pane and Laura S. Hamilton. Making Sense of Data-Driven Decision Making in Education: Evidence from Recent RAND Research. Santa Monica, CA: RAND Corporation, 2006. http://www.rand.org/pubs/occasional_papers/OP170.