Use of ARTIST and CAOS assessments in introductory statistics courses

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http://www.math.smith.edu/~nhorton/artisttalk.pdf

Acknowledgements

- ARTIST team (Garfield, delMas and Chance PI's)
- NSF sponsored project
- delMas, R., Garfield, J., Ooms, A., & Chance, B. (in press). Assessing students conceptual understanding after a first course in statistics. *Statistics Education Research Journal*.
- https://app.gen.umn.edu/artist

Overview: ARTIST and CAOS tests

- online assessments
- multiple choice questions
- tap conceptual understanding of key topics
- provide quick feedback to instructor on student progress
- provide (slightly deferred) feedback to students on right answer to tough questions
- high quality
- easily integrated into course
- free!

Description and overview

- small component of assessment
- students receive full credit for making a good faith effort
- report from ARTIST website provides marginal distribution for each student, along with number of minutes spent on the assessment
- also reports marginal distribution for answers to each question
- review tough problems during next class (typically an hour after the deadline) in small groups
- provides a low-stakes, timely conceptual assessment of student progress
- fosters engagement

Description and overview

11 ARTIST topic scales (10-15 questions)

data collection	data representation
measures of center	measures of spread
normal distribution	probability
bivariate quant.	bivariate categorical
sampling variability	confidence intervals
significance tests	

CAOS (Comprehensive Assessment Of Statistics) pre and post tests (more questions)
I will focus on the ARTIST topic scales

Setup and administration process

1. set up account
2. request access code
3. send access code to students (48 hours in advance)
4. review class results (1 hour before class) and create file to display with problematic questions
5. revisit problematic questions in class

ARTIST webpage https://app.gen.umn.edu/artist

Welcome to the ARTIST Web site!

ASSESSMENT CONFERENCE ANNOUNCEMENT

IASE Satellite Conference On Assessing Student Learning in Statistics
19-21 August 2007, Guimarães, Portugal (prior to ISI 56 in Lisbon)

Home Page

Item Database [Assessment Builder]

Item Database FAQ's

ARTIST Scales and CAOS Test

Assessment Resources

Research Instruments

ARTIST Publications, Presentations, and Workshops

About ARTIST

Our goal is to help teachers assess statistical literacy, statistical reasoning, and statistical thinking in first courses of statistics.

This Web site provides a variety of assessment resources for teaching first courses in Statistics. Please use the navigation bar on your left to access these resources.

Learn more about Statistical Literacy, Statistical Reasoning, and Statistical Thinking:

- Definitions of Statistical Literacy, Reasoning, and Thinking
- Examples of Assessment Items coded as Statistical Literacy, Reasoning, and Thinking
- How Statistical Literacy, Reasoning, and Thinking are related
- How Statistical Literacy, Reasoning, and Thinking relate to Bloom's and other taxonomies
- Words that characterize assessment items for Statistical Literacy, Reasoning, and Thinking

Logging in

ARTIST Tests Log In

If you are registered to administer ARTIST online tests, and want to:

- Request an Access Code for one of the ARTIST tests
- Modify existing Access Codes
- Retrieve test reports

please enter the email address you used when you registered.

Email Address:

Then click the SUBMIT button.

Submit

Options for assessments

To request to have copies of ARTIST tests, or a report of normative statistics for the CAOS test, sent to you as email attachments, click the button on the right.	EMAIL ARTIST TESTS
To request an Access Code for an ARTIST test, click the button on the right.	REQUEST ACCESS CODE
To modify information for an Access Code (e.g., change the start or end dates), or to retrieve test reports for students who have completed an ARTIST test, choose one of the options on the right.	ALL ACCESS CODES **All Access Codes for the Past** 0 **Months** SUBMIT **Access Codes with End Dates between** Month 07 Day 12 Year 2007 **AND** Month 07 Day 12 Year 2007 SUBMIT
To return to the ARTIST Testing page, click the button on the right.	ARTIST Testing Page

Requesting access code to give assessment

Request an Access Code for an ARTIST Test

Note: You must complete a request for EACH test you plan to administer. After completing the page for a test, you will be asked if you want to request an additional test. You will have the option of using the same information that you enter on this page so that you do not have to enter all of it again.

CLEAR ALL FIELDS

Instructor:	**Nicholas Horton**
Email Address:	nhorton@email.smith.edu
Institution:	Smith College

Please fill in the following information

Course Name or Identifier

Course Section

Which of the following best describes this course?

- ○ High School Advanced Placement
- ○ High School International Baccalaureate
- ○ Introductory Statistics, No Mathematics Requirement
- ○ Introductory Statistics, High School Algebra Requirement
- ○ Introductory Statistics, College Algebra Requirement
- ○ Mathematical Statistics (College Algebra or Calculus prerequisite)
- ○ Other (please specify)

Creating more access codes

SAVE ACCESS CODE REQUEST 07/12/2007 11:53 AM

Nicholas Horton

Thank you for submitting your request for an Access Code to administer an ARTIST test. You have submitted the following information:

ARTIST Test: CAOS POSTTEST
Course: foo, Section 1
Date and Time: From 01:05 03-02-2007 to 01:05 08-02-2007 (EASTERN)

The Access Code will be sent to you automatically by email, along with the URL for a page where your students can submit the Access Code to access the online ARTIST test on the designated date during the designated testing period.

If you have any questions, please send an email to Bob delMas at delma001@umn.edu

Select one of the following buttons to request another Access Code for a different course section or a different ARTIST test.

SAME INFORMATION **Create a new Access Code Request starting with the same information**

NEW INFORMATION **Create a new Access Code Request starting with blank fields**

TESTING OPTIONS **Edit access codes, retrieve test reports, or request PDF versions of tests**

Email from ARTIST to instructor (to send to students)

You have been assigned the following Access Code for the ARTIST scale SAMPLING VARIABILITY: XGZ1613ENL

You can go to the following URL to enter and submit the Access Code:

https://app.gen.umn.edu/artist/user/scale_select.html

The test will be administered between 01:05 on 03-02-2007 and 01:05 on 08-02-2007 (EASTERN)

Getting reports

Access Codes and Available Test Reports

in DESCENDING order by Start Date (most recent Start Dates first)

Click the EDIT button below an Access Code to change the information for an Access Code, including starting and ending dates and times.

Access Code	ARTIST Test	Date and Time	Course	Number of Students	REPORT A button appears if a report is available
YHR1974NON EDIT	CAOS 4 POSTTEST	07:00 on 04-12-2007 to 07:00 on 05-02-2007	MTH346, Section 1	12	GET REPORTS
		01:05 on 03-			

```
Access Code YHR1974NON
INSTRUCTOR Nicholas Horton
INSTITUTION Smith College
ARTIST SCALE SAMPLING DISTRIBUTIONS
AVG % CORRECT 70

STUDENT NAME    % CORRECT   MINUTES TO COMPLETE
Alice Baker     80          12.02
Carmen Delray   80          20.6
Emily Finney    55          22
Gwen Hamlin     42.5        8.52
Ivory Jones     80          20.28
...
```

Integration into the lecture

- deadline 1 hour before class (or at midnight for early morning class to discourage late nights!)
- review results (marginal distribution by question and student)
- prepare questions to review in class
  - prune items where students showed mastery
  - cover answer for remaining questions
- review during lecture in small groups
- focus on getting groups to reinforce correct thinking in low-stakes manner
- repeated for each of the 11 topic scales

Example question

Suppose half of all newborns are girls and half are boys. Hospital A, a large city hospital, records an average of 50 births a day. Hospital B, a small, rural hospital, records an average of 10 births a day. On a particular day, which hospital is less likely to record 80% or more female births?

Hospital A (with 50 births a day), because the more births you see, the closer the proportions will be to .5.

Hospital B (with 10 births a day), because with fewer births there will be less variability.

The two hospitals are equally likely to record such an event, because the probability of a boy does not depend on the number of births.

Reveal the answer (Microsoft Word autoshapes)

Suppose half of all newborns are girls and half are boys. Hospital A, a large city hospital, records an average of 50 births a day. Hospital B, a small, rural hospital, records an average of 10 births a day. On a particular day, which hospital is less likely to record 80% or more female births?

62.1% Hospital A (with 50 births a day), because the more births you see, the closer the proportions will be to .5.

17.2% Hospital B (with 10 births a day), because with fewer births there will be less variability.

20.7% The two hospitals are equally likely to record such an event, because the probability of a boy does not depend on the number of births.

Has this technology changed the way you interact with students or students interact with the course?

- can flag area where conceptual understanding is weak or strong
- provides feedback to students to solidify their thinking about tough questions (without just giving them the answer!)
- can flag students with poor performance

What hurdles had to be overcome to implement this technology?

- need to set up at start of semester for 11 assessments (1 hour)
- need to budget some time before class to review results and prep file (15 minutes)
- need to budget time to review questions in class (typically 10-15 minutes for 4-5 items)
- few additional costs in time and money

Have you discovered any clear advantages to implementing this strategy in your course(s)?

- students do not find them particularly onerous
- much clearer sense of limitations of my students' conceptual understanding of key ideas!
- some of the tricky problems are wonderful teaching tools
- fosters class discussion and group problem solving
- modest correlation between post-test assessment and final grade (r=0.46 for 6 of my most recent intro classes)
- appropriate technology that builds on GAISE framework

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