

Authentic Learning and Assessment in Applied Statistics

Elke Thönnnes,
University of Warwick

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ASA Curriculum Guidelines

for undergraduate programs in statistical science (2014)

The main goal of our recommendations is to ensure undergraduate statistics students remain useful in a world with increasingly more complex data.

Pedagogy should emphasise **authentic real-world data** and substantive applications related to the statistical analysis cycle.

Authentic achievement

Archbald & Newmann(1988) *Beyond standardized testing: Assessing authentic academic achievement in the secondary school.*

Does the information collected (in assessment) present an accurate estimate of worthwhile knowledge and (meaningful) forms of mastery?

Characteristics of *authentic achievement*:

- disciplined enquiry
- integration of knowledge
- value beyond education

Authentic assessment

Wiggins (1990) The case for authentic assessment. *Practical assessment, research & evaluation*, 2(2), 1-6.

- based on tasks that mirror priorities and “ill-structured” challenges in “real-world” tests of ability;
- expects polished, thorough and justifiable answers, performances or products;
- achieves validity and reliability.

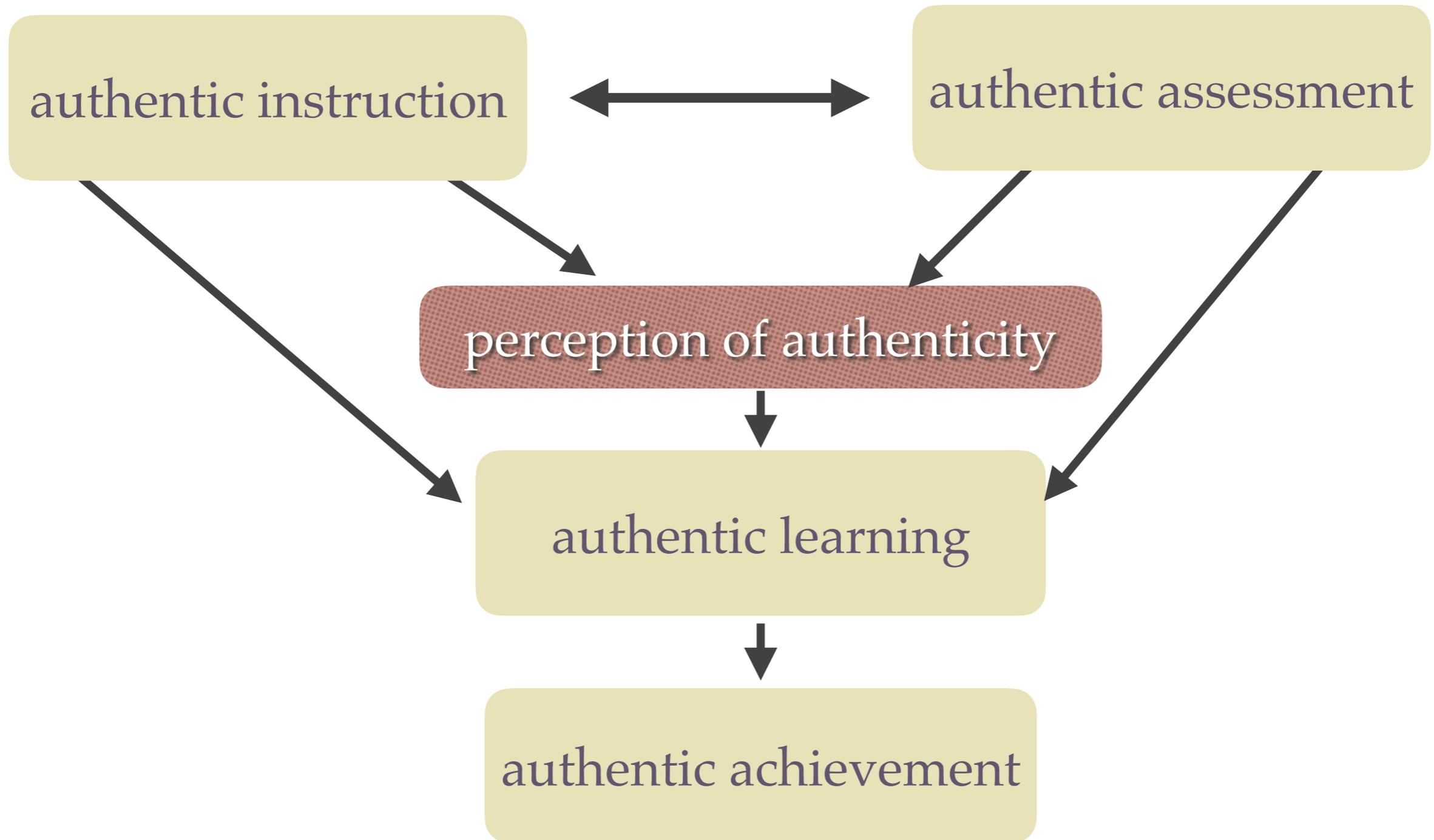
Elements of authenticity

Cumming and Maxwell (1999) Contextualising authentic assessment.
Assessment in education: Principles, Policy & Practice, 6(2), 177-194.

- higher order thinking
- specific domain knowledge
- emulation of 'real-world' activities
- communication of understanding
- complex holistic activities
- mastery and emulation of expert performance

Framework for authenticity

Gulikers et al (2004): A five-dimensional framework for authentic assessment. *Educational technology research and development*, 52(3), 67.



ASA Curriculum Guidelines

for undergraduate programs in statistical science (2014)

Practical skills learned should include:

- technical writing, presentation skills, and visualizations
- *teamwork and collaboration*
- organisation and management of projects
- ability to interact with and communicate with a variety of clients and collaborators

Applied Statistics at Warwick

ST404 Applied Statistical Modelling (joint with D. Rossell, R. Crossman)

ST344 Professional Practice of Data Analysis (joint with D. Firth)

Aims:

- introduce the art of data analysis and statistical model-building
- give students an appreciation that real problems may not have precise clear-cut solutions;
- provide the skills to translate technical know-how into professional practice.

“Math is Music; Statistics is Literature”

De Veaux and Velleman (2008) *Amstat News*, 378, 54-56.

Set-up

- MORSE, Maths & Stats, Data Science.
- sizeable proportion of international students
- ST344/ST404: 100% coursework assessed
- data analysis / statistical modelling projects;
- data set provided, but large and messy; students may source additional data;
- projects run over 4-5 weeks; ~50% based on group work;
- support:
 - ST404: lectures throughout term, computer practicals timed with assignment, discussion forum;
 - ST344: initial lectures and computer practicals, online material, weekly non-structured supervisions;
 - workshop on teamwork + digital workbook;

Framework for authenticity

Gulikers et al (2004): A five-dimensional framework for authentic assessment. *Educational technology research and development*, 52(3), 67.

Degree of resemblance to professional practice in 5 dimensions:

- physical context
- **social context**
- assessment task
- assessment result or form
- criteria and standards

Social context

Students are allocated to teams by module leader to ensure diversity.

For ST344: stratified sampling based on criteria agreed with students.

In my experience ...

- Students often need **support** to establish a functioning team and manage diversity;
- **Reflection** tasks help students to turn experience into learning;
- Students need to be able to communicate their teamwork competencies to **employers**.

A digital resource for multinational student teams

Joint with Sophie Reissner - Roubicek, Thomas Greenaway, Xiaozhe Cai

- To promote inclusion and integration in multinational student teams
- To provide an interactive tool to support their reflections on their teamwork experiences
- Four core components:
 - **Communication patterns**
 - **Trying out ideas**
 - **Work patterns**
 - **Giving feedback**

Who do you trust?

Oxfam GB (2007): *Building Trust in Diverse Teams: The Toolkit for Emergency Response*

- 10 trust criteria
- swift trust versus deep trust
- high context versus low context



Photo by Kazuend on Unsplash

Framework for authenticity

Gulikers et al (2004):

Degree of resemblance to professional practice in 5 dimensions:

- physical context
- social context
- **assessment task**
- **assessment result or form**
- **criteria and standards**

Assessment form

ST404:

- Reports with a findings section addressed at lay audience and a methods section and technical appendix for a peer audience
 - Oral presentation for a peer audience
 - Poster presentation for mixed audience
 - Anonymous feedback to team members
 - Reflective writing on team work experience
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ST344:

- Project plan
- 1 x report addressed at a lay audience; 1 x report addressed at a peer audience
- Technical appendices in RMarkdown
- Oral presentation for peer audience
- Data storyboard for lay audience
- Reflective writing on team work experience

Authentic assessment

Herrington, Reeves, and Oliver, R. (2010) A Guide to Authentic e-Learning. Routledge, New York.

- Have **real-world** relevance, are ill-defined
- Comprise **complex** tasks investigated over time, using variety of resources
- Create **polished products** valuable in their own right
- Allow **competing solutions** and diversity of outcome

Criteria and Standards

Students may decide on differential weighting (within limits) of the group mark across team members.

- Sound and well explained statistical analysis supported by appropriate numerical and graphical evidence.
- Clear and well structured presentation appropriate to the target audience.
- Clear, well documented and functioning code in RMarkdown document.

Criteria and Standards

Adapted from **James and Brookfield (2014)**. *Engaging imagination: Helping students become creative and reflective thinkers*. John Wiley & Sons, 2014.

- Checking the assumptions that inform your actions and judgements.
- Trying to understand how another person reasons.
- Looking for blind spots and omissions in your thinking.
- Identifying what is justified and well grounded in your thinking.
- Integrating emotions and intuitions into a cognitive analysis.

Challenges

- assessing process versus assessing product
- task orientation
- time frame
- sequential nature of tasks
- team roles
- comfort zones