Reconceptualising Statistical Literacy

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PCS is about Civic Statistics

SO… what should students and citizens

know

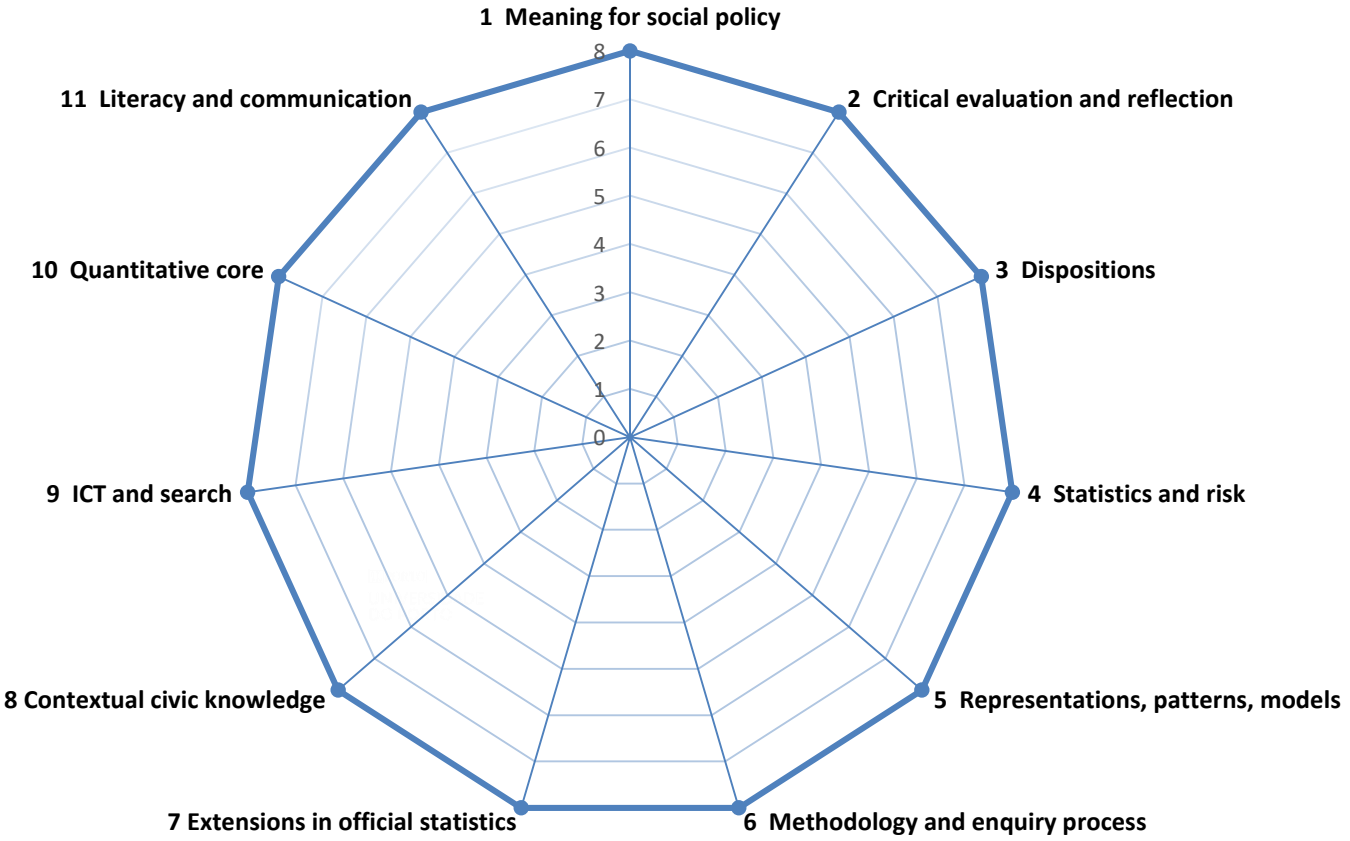
understand

and be able to do?

Dimensions of Statistical Literacy

- **Engagement & Action**
  - Facet 1: Meaning for social policy
  - Facet 2: Critical evaluation & reflection
  - Facet 3: Dispositions
- **Knowledge**
  - Facet 4: Statistics & Risk
  - Facet 5: Models, patterns, and representations
  - Facet 6: Methodology & enquiry processes
  - Facet 7: Extensions in official statistics
  - Facet 8: Contextual civic knowledge
- **Enabling Processes**
  - Facet 9: ICT & search
  - Facet 10: Quantitative core
  - Facet 11: Literacy and communication

Dimensions


1 Meaning for social policy
2 Critical evaluation and reflection
3 Dispositions
4 Statistics and risk
5 Representations, patterns, models
6 Methodology and enquiry process
7 Extensions in official statistics
8 Contextual civic knowledge
9 ICT and search
10 Quantitative core
11 Literacy and communication
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Facet 1: Meaning for social policy

The heart of statistical literacy!!!!

- What could and should be done to address some policy issue (evidence-informed decision making)?
- Decisions require weighing existing evidence, and understanding risk – probabilities, costs and benefits, expected values, and subjective utilities
- The immediate impact of any proposed policy change is? The knock-on effects could be…

Facet 2: Critical evaluation & reflection

'Post-truth' and 'alternative facts' are attacks on the heartland of informed decision making

Critical evaluation and reflection should be habits of mind e.g.

- What is the story – whose story, and why are they telling it?
- Has the problem been identified appropriately?
- What evidence is being presented? From a credible source?
- Have appropriate statistical models been chosen (e.g. is it OK to assume data are normally distributed? Has linearity been assumed?)?
- What else could be going on – a confounding variable?
- Are the conclusions consistent with the evidence?

Facet 3: Dispositions

Dispositions are emotional responses associated with a willingness to engage in evidence-based argument

- Negative dispositions are e.g. 'lies, damn lies and statistics'
- Positive dispositions are e.g. fact checking organisations such as Africa Check and Chequeado

Great skills with statistics won't be useful unless the citizen:

- is willing to share interpretations with others
- has high self-efficacy and confidence

Healthy dispositions are exemplified by positive habits of mind – routinely asking questions such as:

- can I play with the data myself?
- can I find other information to confirm or disconfirm these stories?
- do I need to boost my own knowledge (e.g. of some new technique) and, how?

Facet 4: Statistics & Risk

- Commonly taught in introductory statistics courses: e.g. samples, populations and representativeness; variability; describing and comparing distributions; association and correlation; regression; non-linearity; signal and noise; interaction; Bayesian inference; bounded estimates; effect size
- Understanding risk relies on probability and conditional probability (including Bayes' theorem), expected values, utility and subjective utility
- Civic Statistics also requires an understanding of some of the ideas around Big Data - such as familiarity with a wide variety of data sources and associated techniques of analysis, notably those used for detecting patterns

Facet 5: Models, patterns, and representations

All models are wrong, but some are useful (Box & Draper, 1987, p424)

- Statistics is the application of mathematical models to situations of interest
- There are (almost) always rival models e.g. an economist and a sociologist might have quite different theories and methods for defining and studying "poverty" and have quite different theories of causality
- Do students understand the use of models? Can they challenge the fundamental assumptions made by any model?
- Representation is a core skill! Students need to be familiar with sophisticated representations - including those that are dynamic and facilitate interaction. They need to be able to understand and critique novel representations

Facet 6: Methodology & enquiry processes

What are the strengths and weaknesses of different discovery methods?

- Topics include:
  - Design (experiments and observations, RCTs); sampling; measurement; questionnaire and interview design; web scraping; descriptive studies
  - text and image analysis; analyzing social media (e.g. Twitter, Facebook)
  - AI approaches
- Ethical issues in the production of data
  - confidentiality and data protection

Facet 7: Extensions in official statistics

- Core ideas:
- survey design (e.g. non-response or respondent bias); measurement (metadata definitions)
- Techniques (moving averages, seasonal adjustment, case weighting)
- synthetic methods (e.g. combining survey data with mobile phone traffic data)

Facet 8: Contextual civic knowledge

To model, one needs to have an understanding of the phenomena being modelled. Components include:

- factual knowledge – factoids such as sizes of populations, GDP, national debt and resources; demographics
- contextual civic knowledge - history and geography; regional- and geo- politics

Advantages of contextual civic knowledge:

- Easier to conduct alternative data analyses using knowledge of plausible covariates
- To do anything about social injustice, one needs to understand communication channels and governance

Facet 9: ICT & search

Major data providers (NSOs, Eurostat and OECD) make data publicly available – BUT…

Big Data (e.g. from wearable devices, transactional data from mobile phones, scraped data) – BUT…

So students need skills associated with:

- ICT and search
- use of interactive displays
- ICT-based tools such as statistics packages
- analytic techniques suited to accessing and analysing high-volume unstructured data

Facet 10: Quantitative core

Quantitative skills underpin all aspects of statistical literacy

Components include:

- rates, fractions, ratios, percentages and number sense
  - number sense is having a feel for numbers

Facet 11: Literacy and communication

Media present information as text and image. Text is often very dense SO…

Students need to be able to:

- read fluently

New forms of communication are emerging (social media, new ways to visualize data) SO…

- Students need to be able to understand and deconstruct novel messages

For *engagement* students need to be able to communicate in new ways

Pro Civic Stat

Erasmus+

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