International Statistical Institute

Strengthening Statistical Usage for Decisions and Innovation – Moving Forward

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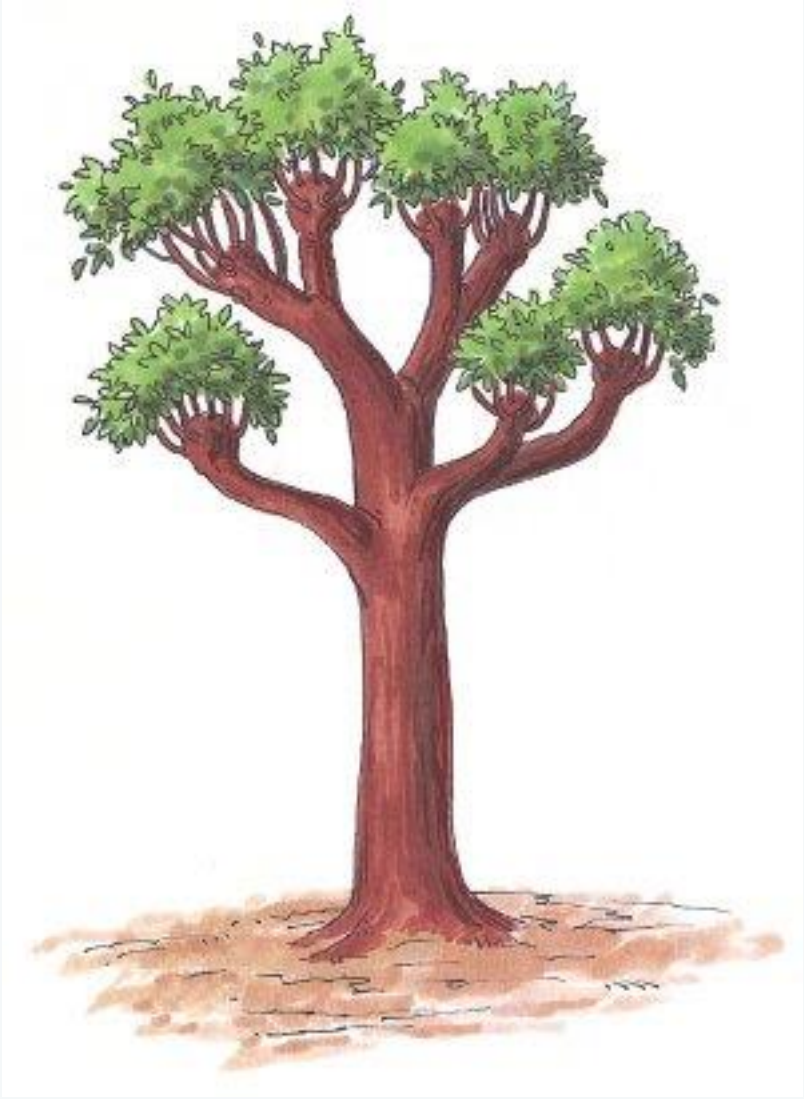
Strengthening Statistical Usage

- **Today we have heard about**
  - **Sources and applications**
  - **Needs of industry players**
  - **practice of official authorities**
  - **Statistical methodologies and applications**
  - **Increasing awareness**
- **General: “Data science”, “Big data” “Data literacy”**
  - **The UN Sustainable Development Goals (SDG's): “Expansion of data ecosystems”; “new data sources”; “improve user-engagement”**
  - **Rapidly increasing technological power and massively increasing amounts of data**
    - **Professional statisticians and information scientists long been aware of opportunities, challenges, implications**
    - **For example: technologies for model choice - ongoing problem**

Strengthening Statistical Users

- **Symposia in Statistical Thinking for Postgraduates across disciplines, 2005-2013:**
  - **Statistical thinking, core concepts, role of statistics**
  - **Planning, collecting, handling & exploring data**
  - **Many variables: types, analyses, assumptions, visuals**

- **Pre- and post-symposia surveys showed**
  - **Common core needs across disciplines**
  - **Need for strengthening of foundational thinking**
  - **Many problems in backgrounds**
    - **No or non-authentic experience of whole statistical investigation process**
    - **1 and 2 variables only**
    - **Rigid, discipline-embedded approaches, top-down case studies**
    - **Research hypothesis vs statistical investigation**
    - **Emphasis on measures rather than visuals**
    - **Little understanding of assumptions and models**



Strengthening users in workplaces or research

- Approach of symposia described here is strengthening common ‘trunk’ of tree
- ‘Branches’ are special topics
- ‘Leaves’ are individual applications/problems
- ‘Roots’ are the various prior learning backgrounds

Strengthening roots in all undergraduate curricula

- Service courses in statistics should go to many variables as quickly as possible & avoid focus on 2-sample & simple linear regression
- Experiential learning
- Whole data investigation process
- Investigations/projects should avoid design-for-procedure & encourage choose-for-data
- Focus on essential concepts of statistical inference & data modelling
- Contexts must not dominate statistical learning
- Contexts must be familiar/readily accessible to students
- Must use technology as used in practice of statistics
- Real data and no toy datasets
- Staff research interests must be controlled
- Beware teacher-centred or complex case studies

Strengthening the 'roots' in undergraduate curricula for future statisticians

- **Heed long-time advocacy of professional statisticians**
  - **Barnett (1986)**
  - **"we see, tied up together, the role of the statistician as consultant, consultancy as the stimulus for research in statistics, and consultancy as the basis for teaching statistics".**
  - **Authentic experience of full statistical investigation process:**
  - **Cameron (2009) builds on Chambers' (1993) 'greater statistics'**
  - **Kenett & Thyregod (2005) also describe 5 similar steps in statistical practice/consulting**
    - ***"important to take part in collection of data, or at least have the opportunity to watch data being collected or generated."***
    - ***"encourage academic courses to cover the full 1–5 cycle....especially steps 1, 2 and 5."***
- **Real, large contexts and data: simple within complex**
- **Maths as servant of statistics**
- **Technological and data systems know-how**

Strengthening roots in school curricula

- **Analyse what's gone wrong in statistical education 'reform' over 2-3 decades**
  - New dogma for old
  - New ways of learning old content & old sequencing e.g. inference for means before proportions
  - Domination of 1 and 2 variables and measures
  - Toy datasets
  - Lack of coherent development
  - Domination of psychology thinking e.g. analysing understanding of sampling distributions
  - 'The' question & 'the' answer

- **Need**
  - Variables, variation, visualisation
  - Coherent development built up around types of variables
  - Authentic full statistical data investigations – from simplest
  - Simple within complex

Thank you and here's to statistics!