The Practice of Statistics at School: YES, We can do it at School!

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Wild & Pfannkuch, 1999: PPDAC
Based on analysis of the work of their applied statistician colleagues

Statistical Enquiry Cycle

Problem
Collect
Data

Analysis

Conclusion


Variation – differences everywhere in life
Expectation – harnessing variation: typical value, probability
Distribution – lens for exploring variation to look for expectation
Randomness – phenomena starting with variation and leading to expectation in the long term
Informal inference – evidence based decision-making for a population, balancing variation and expectation in sample data

Building a foundation in early grades
Variation in Grade 3

Making Licorice Sticks (Grade 3)

- Make by hand – 8 cm long, 1 cm diameter, weigh and record mass.
- Make with a Playdooh “extruder” factory, 8 cm long, 1 cm diameter, weigh and record mass.

Comparing Results

... and Making Predictions


Extending Variation to Expectation
Grade 4

Testing and Improving Catapults in Grade 4
- Discussion of energy and force as teacher built and demonstrated the catapult.
- Introduction to the 4 steps of the Practice of Statistics.

Agreement on the class questions.
“How far does the ping pong ball travel?”
“How consistent are we at launching the ping pong ball?”

How can you tell from the plot if the catapults have been improved or not?
- Appropriate evidence, e.g., “Because in the first throws were a bit behind but when we turned the string handles, because it got tighter it flung much more harder, so it went further. So on the screen the orange dots were further.” (70%)
- Without reference to data, e.g., “Because the first turn we didn’t turn a bit so then it wouldn’t go as far compared to the second. The second went forward more because we made the string tighter.” (24%)

Data Collection
Rules were agreed and trials were carried out.


Linking to STEM and Engineering Design
Grade 5

Seed Dispersal by Wind in Grade 5
- S – Seed types and dispersal methods
- T – TinkerPlots
- E – Design Process: design, creation, test, redesign, and retest
- M – Measurement and data

Groups of 3:
- Individually design, create, test
- Group chooses one to redesign, create, and test
- Type of dispersal:
  - Helicopter, parachute, or sail

Testing

Learning the Enquiry Cycle and completing and investigation
Grade 5

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In Grade 5
Twice around the Enquiry Cycle

| Students had had 3 activities in Grade 4: |
| Problem Solving (in the playground) |
| Variation (measuring arm length) |
| Modelling Uncertainty (tossing two coins) |

Question:
"Are we Environmentally Friendly?"

- Plan data collection.
- Collect data from the class.
- Analyse the data.
- Draw a conclusion for class.
- What about all of Australia?
- Collect random sample from large
  "population''.
- Make a decision for Australia.

Survey questions from the ABS Census@School site

<table>
<thead>
<tr>
<th>Am I environmentally friendly?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your household a water tank?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use share Chowieve, all rice, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn the tap off while brushing your teeth.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toss all appliances e.g., TV, computers, growing grass etc. as the power point.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My household practices methods.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students have to decide criteria:
Percentage "yes" for 5 questions for the class to be environmentally friendly.

Student A: My criteria is 3/5-4/5 environmentally friendly as I believe all questions are of equal value.


Challenging a claim in the media about eye color and reaction time in Grade 6

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Grade 6

- Question: Do brown-eyed Australian students in
  Grade 6 have faster reaction times than students with
  eyes of other colors?
- Plan and Collect Data:
  From the class
  From the ABS CensusAtSchool "population" of 1786

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- Analyse class data, comparing distributions
  of two groups, e.g., middles, speeds, hats
  (variability documented)

From 4 random samples of "population"

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Australian Grade 6 "Population" of 1786


My personal opinion:

- I don’t think we need to wait until we have fancy statistics to talk about the underlying concepts.
- I think, historically, this has meant that we have missed opportunities to use visual representation and intuition to look at the “big ideas” underpinning statistics.


