



### Just a few next steps....



- More attention to probability and distributional modelling - across all levels of education
- Bring statistical modelling and data analysis closer together (paper in ISI)
- Alignment of objectives and curricula and assessment
- Smoother development paths for statistics majors and statistical training
- Postgraduate support across disciplines
- More involvement of "mainstream" statisticians
- Increase IASE membership
- Increase awareness & articulation of "nestedness" of statistical development across educational levels, including explicit teaching of limitations at each level
- Improve awareness of mathematical thinking rather than mathematical techniques

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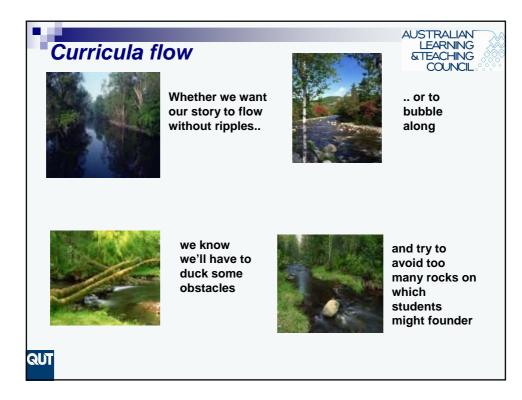
This talk briefly considers

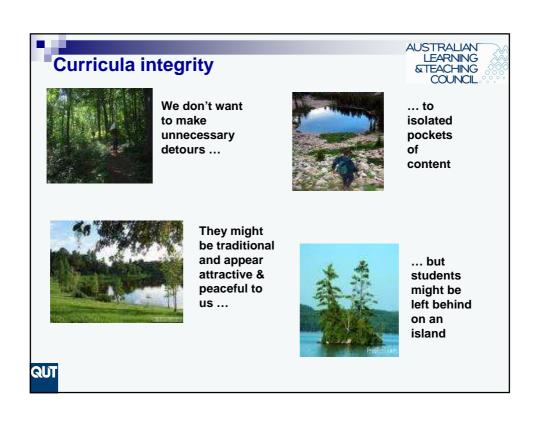


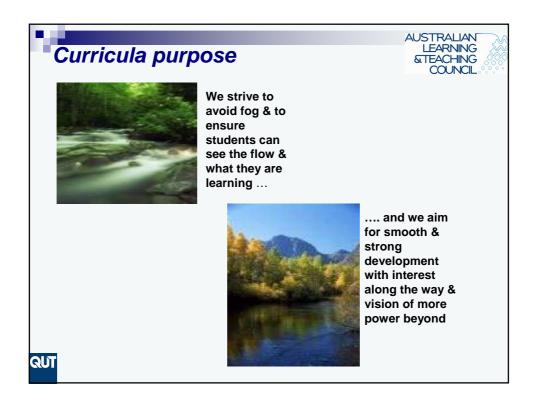
- Curricula are not "written on tablets"
- Structuring & flow of curricula
- Structuring of incremental steps within flow for learning
- Alignment of objectives and curricula
- Some examples taken from:
  - □ "first" tertiary course in data analysis & inference two contrasting stories
  - □ Introductory probability & distributions & modelling
  - Second course in modelling with probability & distributions – stochastic/statistical modelling

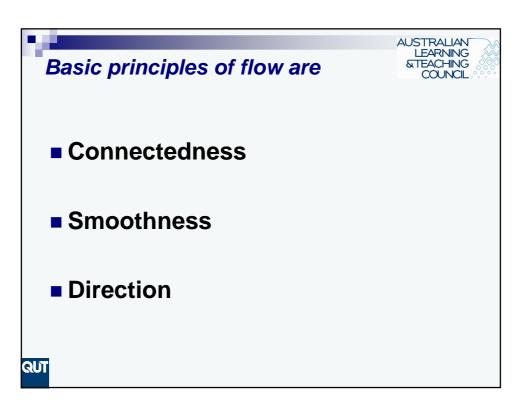
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□ Second course in data analysis & inference









# Curricula flow & integrity



- Think of an example of something that
  - interrupts the flow, or
  - is an unnecessary detour, or
  - that takes students away & prevents them rejoining the flow





# Manageable and consistently sized STEACHING COUNCIL STEPS in learning

Can you think of an example of a section of a course in which too much happens at once – usually too many concepts introduced at once – resulting in a too big & too steep step?





- From previous conversations, Michael & I had thought we taught similar courses
- Both developed with input from students, tutors, peers, research
- Indepth discussion & detail ⇒ surprise
- Discovered
  - □ Different objectives
  - □ Differences come from aligning curricula with objectives
  - □ Same principles
  - May not detect from brief content description

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### Course 1 objectives:

Develop skills, capabilities and knowledge to carry out real data investigations in life-related situations with many variables, using chisq, ANOVA, regression, t.

experiential learning of the full data investigation cycle; understand power and limitations of introductory statistical data analysis methods

#### Course 2 objectives:

Develop understanding, capabilities and knowledge in introductory data analysis, data models and statistical inference involving 1-3 variables

develop sound foundations in statistical inference for ongoing statistical learning and application in other disciplines

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### Strong agreement on



- 1. Traditional section on traditional approach to probability an unnecessary & risky detour
- Contradicts all principles of flow
  - Not connected
  - □ Not smooth
  - □ No direction within course
- Isolated island
- 2. Introduction of behaviour of sample mean + first sights of confidence intervals + tests in terms of means is too much to climb



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## Course 1 (data investigation)



- Types of investigations, data, problem, plan, collection, handling, exploring
- Categorical data: estimate probabilities of categories; introduction to testing; chisq tests
- Continuous data: estimate probabilities of intervals; revision of normal; Q-Q plots; confidence interval for proportion – technology & approx
- Continuous response, categorical predictors: ANOVA incl interval estimation
- Continuous response, quantitative predictors: regression incl prediction
- Questions left over: 1 & 2 sample t intervals & tests



## Course 2 (data & inference)



- Real-life examples and rich content to engage student interest and help students retain key ideas
- but these are not enough
- 3 basic modules:
  - □ "real" world: data, relationships and descriptive statistics;
  - "model" world: distributions, models for uncertainty;
  - relate the two worlds: decision-making or inference, in the presence of uncertainty.
- Connect the worlds through analogues and analogies for flow

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# Introductory probability & distributional modelling

#### AUSTRALIAN LEARNING &TEACHING COUNCIL

### **Objectives:**

- Develop capabilities, knowledge and problemsolving skills in introductory probability and distributions in life-related problems linking with data
- □ Continually identifying & extending prior concepts & knowledge, & problem-solving skills
- □ Facilitate students' seeing what they know & can do & building on that
- Develop awareness of real probability & of themselves as problem-solvers

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Preliminary problem-solving, collaborative learning, everyday real contexts, free choice group project stochastic data (ICOTS7, IASE 2007)

# Second course in probabilistic & distributional modelling



### **Objectives:**

- Dual development of model building and applications of stochastic/distributional models
- Identify dual components
- ☐ Separate & combine statistical & mathematical thinking
- □ "Bite-size" divisions e.g branching processes

### Second course in data analysis & inference

- ?experimental design & regression GLM?
- ?GLM then exptal design & regression
- Data investigation cycle & free choice group project
- Dual development of model building and selection/application of models

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# Summary



- Alignment of objectives and curricula
- Structuring curricula for flow & incremental steps within flow for learning

Thank you & best wishes & here's to statistics!