

# Educational evaluation as adaptive management

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***If we knew what it was  
we were doing, it would  
not be called research,  
would it?***

*Albert Einstein*

Are there bad decisions?



# How could decisions be made?

- By edict from a dictator
- By a group of experts
- By a group of stakeholders and experts
- By popular vote



# Decision making involves values

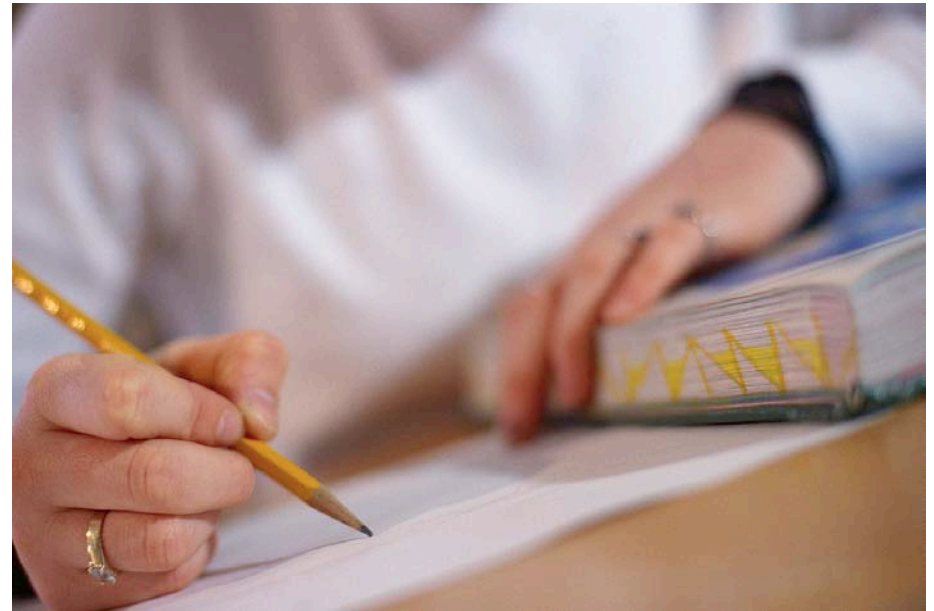


# What is the goal of decision making?

- To solve problems?
- To reach consensus?
- To go through a process?
- To make decision makers happy?

# What is the goal of educational evaluation?

- To go through a process?
- To make supervisors happy?
- To comply with a law?
- To improve education?





# Adaptive management

- **Active adaptive management:**  
management plans are modified based on the results of well-designed experiments that collect data on factors or variables that are demonstrably important for conservation or management
- **Passive adaptive management:**  
managers use historical data or data from uncontrolled experiments to come up with “best guess” management recommendations, the fate of which may be studied.



# Controls in active adaptive management

- ***Essential***
- After-Before, Treatment-Control designs are particularly effective
- They allow effect of manipulation to be isolated
- They control for ontogenetic change
- Design comes from 'learning' experiments

# Controls in active adaptive management

- Not routinely used
  - Too few animals
  - Many factors may have to be manipulated
  - Ethical issues: mortality risk associated with control groups
  - Lack of familiarity with experimental design
- Rather, managers use conventional wisdom, or monitor and modify their management activities accordingly

# Educational evaluation as adaptive management

- **Goal:** To effectively optimize teaching
- **Process:** Conduct a 'learning experiment'



# How to conduct a learning experiment

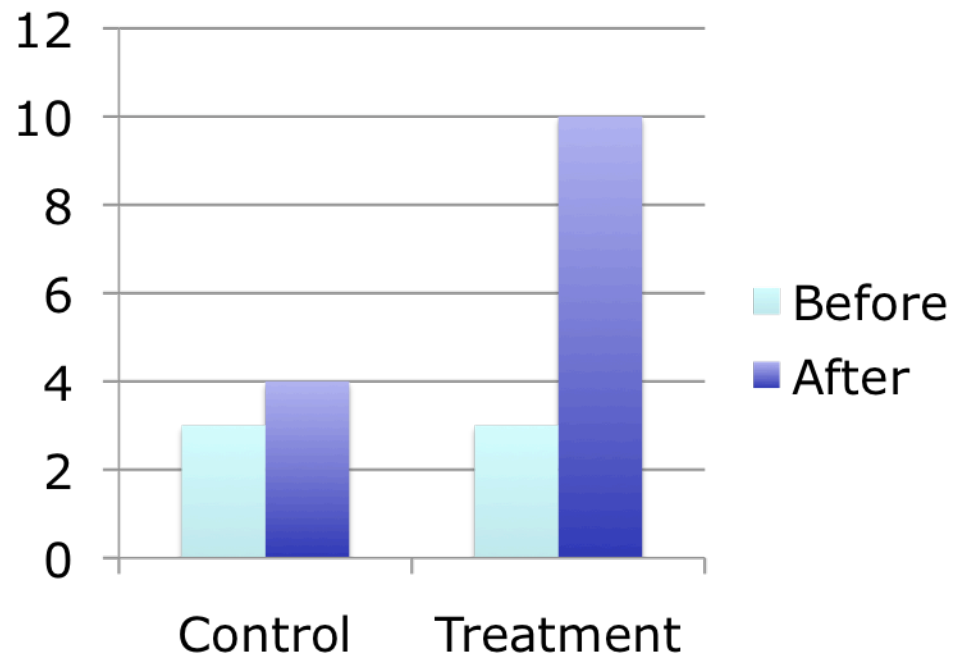
- Classroom T (*for treatment*) is the one exposed to the educational experience
- Classroom C (*for control*) is not
  - A better 'learning' control is to have them have the same experiences, but not paired, this is often difficult to achieve in an educational situation
- *Key comparison* is the difference after-before compared across the treatment and control

# After-Before compared across Treatment & Control

Control:  $4 - 3 = 1$

Treatment:  $10 - 3 = 7$

7:1 is a large effect of the educational intervention



# After – Before, Treatment- Control designs are superior to post-experience evaluation

- Evaluation only AFTER some experience fails to isolate the effect of the desired lesson
- After – Before only misses the idea that students are always learning
  - i.e., you have to control for other experiences and ontogenetic change
- Without a control, it's impossible to isolate the effect of the lesson

# The 'spacing effect': a lesson in impediments to application

- **Spacing effect:** for a given amount of study time, studying in small pulses is much better than cramming.
- One of the most robust findings from decades of research in learning and experimental psychology
- *Not widely used*



# Some impediments to application

(modified from Dempster 1988 Am. Psych.)

- The phenomenon has not been known
- The phenomenon has not received recent documentation
- The phenomenon cannot be linked to issues of current concern to educators
- The phenomenon has not been demonstrated satisfactorily in school-like activities
- The phenomenon has not been demonstrated satisfactorily in the classroom
- The phenomenon is not sufficiently understood

# Why are 'learning experiments' not often performed?

- Don't know about them
- Never done them before
- No interest/will/ability to have proper control
- ***Lack of clearly identified learning objectives***

# Learning objectives

- What are the key outcomes of an educational experience?
  - Simply to provide an experience
    - no evaluation required
  - To teach
    - What?
- Once goals/objectives/outcomes are identified, then it's possible to design proper evaluation
- An after-before, treatment vs. control design will help efficiently and effectively improve environmental education

**Life is like a sewer,  
what you get out of it  
depends on what you  
put into it.**

*Tom Lehrer*

# Asking the *right* questions

- It's hard
- It's value laden
- It's political
- It's *essential*



# What are the right questions?

- Those that evaluate the learning objectives
- Ideally, learning objectives will enable students to make sustainable decisions when faced with complex, real-world data
- Environmental education should be much more than simply teaching environmental awareness, it should teach citizenship, awareness, and sustainability (Blumstein & Saylan 2007 *PLoS-Biology*)

# Conclusions

- Proper evaluation is an effective way to improve education and meet learning objectives
- After-Before, Treatment vs. Control designs are a powerful evaluation tool
- Many disciplines are reluctant to use such evidence-based approaches for evaluation
- The *crux of the matter* is **developing the right learning objectives** and then **asking the right questions to evaluate them**