Using a Process of Inquiry to teach Principles for Inquiry

Craig Rusbult, PhD - CAstem16, Session 2, 11:00 (204-B)

For more about the ideas in this page, and other topics,*
designprocessineducation.com/design-thinking/stem.htm

Goal-Directed Designing of Instruction:

- **Define GOALS** for ideas & skills for students to learn;
- **Design ACTIVITIES** to give students experience with these ideas & skills, and **Mini-Activities** (**questions**,...) that will help them learn more from their experiences.

QUESTIONS for Teachers (to help **Define GOALS**)

What is **The Science Question?** (= essence of S-Process)
The Engineering Question? (= essence of E-Process)

How do we **Make PREDICTIONS?** (how should we?)
How do we **Make OBSERVATIONS?** (how should we?)

What are key thinking/actions for **Science Process?**

What are key thinking/actions for **Engineering Process?**

EXPERIMENTS - How to **design** Exps**?** **do?** **USE?**
How to **USE** for idea-**Evaluation**? idea-**Generation**?

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my Science Question:
"Were you surprised?" (then, if yes or no, "Why?")
[why? when *compare Predictions with Observations,* how close is the match?] This is a **Reality Check**.

my Engineering Question:
"Is this Option a good Solution?" (then "why? how?")
[how? *compare Predictions with Goals* & check match, or *compare Observations with Goals* & check match, for **Quality Checks**, with Quality defined by Goals.]

EXPERIMENTS (situations that allow Pred or Obs) are central-and-essential in a Process of Design Thinking.
Experiments: We DESIGN and DO and USE-USE-USE.

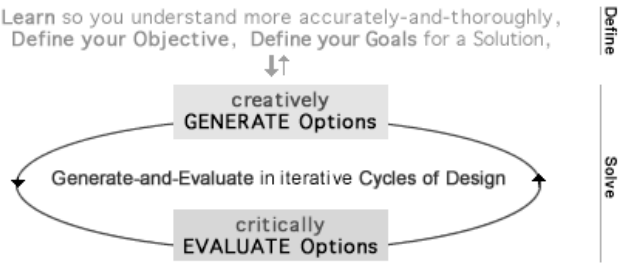
DESIGN: If each Experiment is Option-in-a-Situation, to get more Experimental Information (Pred or Obs) can keep Option same, put into different Exp-Situations; or keep Exp-Situation same, but with different Options.

DO: imagine in Mental Exp, actualize in Physical Exp. Make Obs (with human senses & measuring instruments), Make Pred (by just assuming "what happened before will happen again" and by using a Model of Exp-System).

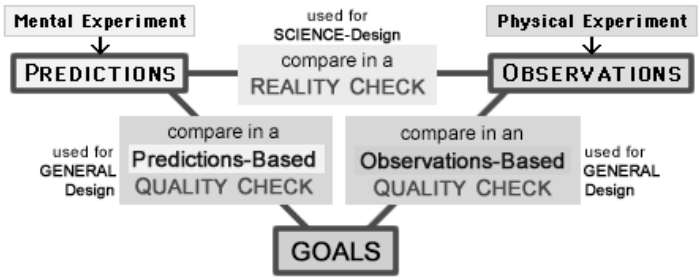
1) **USE** Exp - to Make *Exp-**Information*** (Pred and Obs).
2) **USE** *Exp-**Info*** - compare (P vs O, P vs G, O vs G) for *Exp-Based **Evaluation*** (Check for Reality, Quality).
3) **USE** *Exp-Based **Evaluation*** - ask "should I revise?" so ***Evaluation*** stimulates-and-guides ***Generation***.

Look for these USES (123) in Diagrams (ABC) at right:
1 is in B and C, 2 is in B and C, 3 is in C (and A).
Symmetry: Mental Exp (left) and Physical Exp (right).

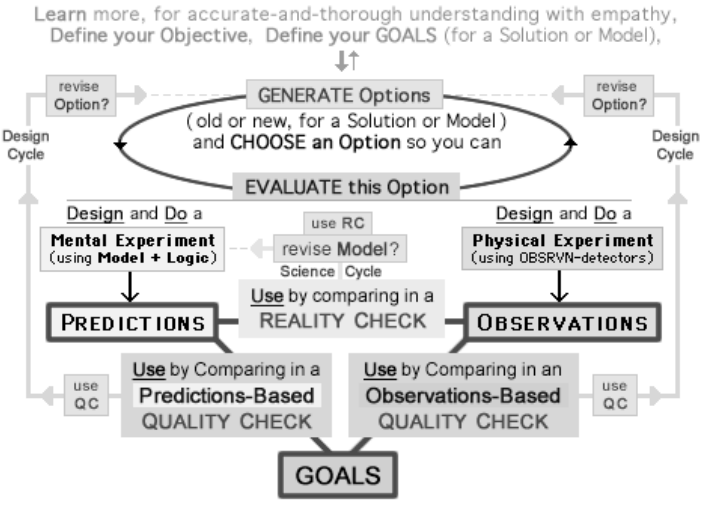
A - Simplicity: You use Design Thinking whenever you **Define a Problem** (Learn, Define Objectives + Goals), and **Solve this Problem** (Generate-and-Evaluate Ideas).



B - 3 Elements (P, O, G) are used in **3 Comparisons:**



C - Use Exp-Info to compare/**Evaluate** and revise/**Generate:**



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* In stem.htm, "other topics" include strategies to generate **Questions for Students** to help them discover Goals like *Process-Principles for Experiments* on left side, thru wise decisions by creative teacher who observes, has empathy.

My Home-Page briefly explains these ideas:

- **Experience + Principles:** Students learn more if inquiry-***experience*** is combined with ***reflections***-on-experience + ***principles***-for-inquiry.
- Use DT for **Thinking Strategies** to learn more from experience. How? Regulate Metacognition (to optimize Performing+Learning+Enjoying) in cycles of Plan-and-Monitor: Plan a strategy; Monitor (actualize the strategy, observe); re-Plan (using observations); Monitor; ...
- **Design Process** (my model for problem-solving process) can be used with another model-for-process, to give students the benefits of both.
- Wide Scope of Design (used to solve problems in all areas) lets us build life/school bridges for better skill-transfers, attitude-transitions, equity.