

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?

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**.

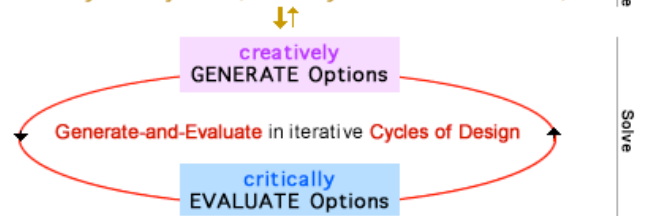
Look for these USES (123) in Diagrams (ABC) at right:

1 is in B and C, 2 is in B and C, 3 is in C (and A).

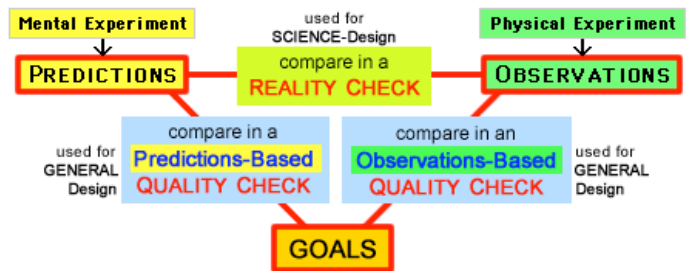
Symmetry: Mental Exp (left) and Physical Exp (right).

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

Learn so you understand more accurately-and-thoroughly, Define your Objective, Define your Goals for a Solution,

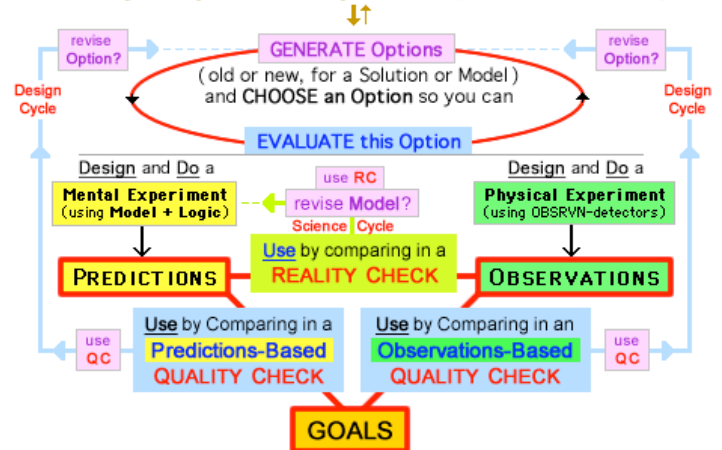


B - **3 Elements (P, O, G)** are used in 3 Comparisons:



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

Learn more, for accurate-and-thorough understanding with empathy, Define your Objective, Define your GOALS (for a Solution or Model),



* 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.