Improve Educational Diversity and Equity with Transfer/Transition-Bridges for Problem Solving

Craig Rusbult, Ph.D. - in Session 2, 11:05-12:20, Room 04-B.

For more about this (links to full explanations, handout-pdf, ...), designprocessineducation.com/design-thinking/cde.htm

Every student has a story. Life-histories are unique due to differences in: gender, race, socioeconomics, location, school quality, environment/attitudes (of family, friends, community), abilities (inherited & developed), and more.

a challenge: How* can we help more students, with a wider diversity of stories, more fully develop their whole-person potentials in school and life? * by improving attitudes (of many kinds) AND curriculum / instruction

In **5 stages of instruction** beginning with non-STEM inquiry, learn how to show students that for doing almost everything in life — including engineering and science — they use a similar creative-and-critical process of problem solving. These stages [using transition-bridges] can help more students, across wider diversity, improve their confidence & motivations for STEM.

1. Activity — do familiar non-STEM Inquiry-Activities
You can use a variety of activities from existing programs.

2. Bridge — Build Bridges from Life to non-STEM and to STEM (with Engineering)

my claim: People use a similar *problem-solving process* of ***Design Thinking (DT)*** for almost everything in life, for non-STEM (in Step 1) and STEM-Engineering (in Step 3), whenever we try to "make it better" by designing a better product, activity, strategy, or theory. This wide scope of DT lets teachers build useful educational Transfer-Bridges.

The simplicity of DT (Diagram A) — Define a Problem, and try to Solve the Problem by Generating-and-Evaluating Ideas in Cycles of Design — lets us show our students how they **have used** DT in life; they can think "I have used DT for design-in-life, so I can use DT for design-in-school," to improve CONFIDENCE, self-image. For MOTIVATION, we show them how they **will use** DT in their future life, so they recognize that when they improve DT-skills *in school*, this will help them achieve their personal goals *for life*.

3. Activity — do Engineering Inquiry-Activities
Use activities from existing programs: EiE, PLTW, ...

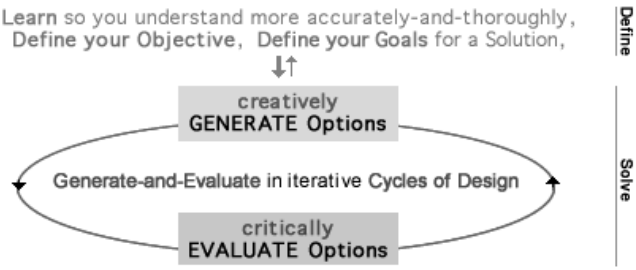
4. Bridge — Build Bridges from Engineering to Science

First, show connections of Engineering with Science. How? In Diagram B, 3 elements are compared in **3** ways; **2** ways are used for Quality Checks (with Quality defined by your Goals) of **General-Design DT** (as in Engineering), and **1** is used for Reality Checks of **Science-Design DT**.

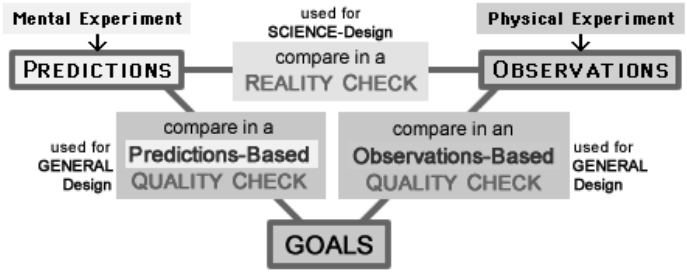
Second, show students how they're using Science-DT in Engineering-DT Activity, by asking the Science Question: In a Reality Check, is there close matching of Predictions (by imagining in Mental Experiment) with Observations (by actualizing in corresponding Physical Experiment)?

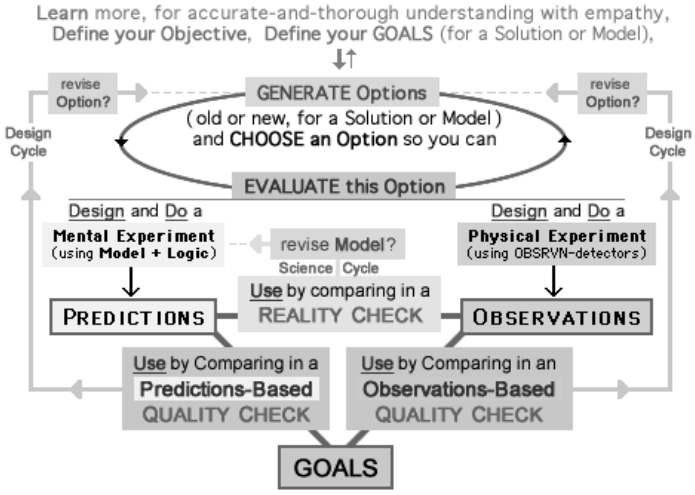
5. Activity — do Science Inquiry-Activities

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



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





- We can alternate/mix inquiry activities: 1+3,5, other kinds of STEM.
- school-life experiences happen in context of whole-life experiences.
- whole-person education: in whole life, to improve whole person.
- transfers-of-learning always occur *in time* (past-to-present, and hopefully present-to-future) and *between differing situations*.

My home-page (.../design-thinking/) briefly explains these ideas:

- Students can use a *process*-of-inquiry to learn *principles*-of-inquiry.
- 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.
- Design Process has Simplicity (for transfer-bridges) and (for deeper understanding) shows Symmetry of Mental / Physical Experimenting.