

Using Design Method for Problem Solving & Metacognition

Problem = an opportunity to make things better

Problem Solving = moving from NOW-state to desired GOAL-state



Design = solving problems by designing better products, activities, strategies, theories; this includes almost everything we do in life.

Design Method = way to improve Understanding & Teaching, to

- accurately describe the methods used in design & science, thus improving our UNDERSTANDING. (achieved? yes)
- help students improve their thinking skills & thinking methods, thus improving our TEACHING. (achieved? potentially yes)

ACTIVITIES for INSTRUCTION

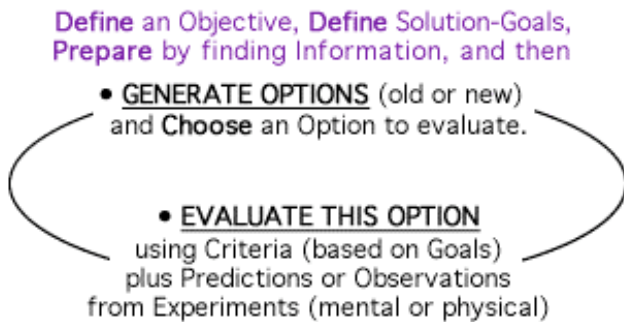
Inquiry = activity where students explore, try to solve problems:

design-inquiry — if the objective is a product, activity, or strategy,
science-inquiry — if objective is a theory (= guided discovery?),

design activities — first-hand experience (students solve problems) and second-hand experience (case studies of other problem solvers)

Teaching Design Method with a Simple-to-Complex Progression:

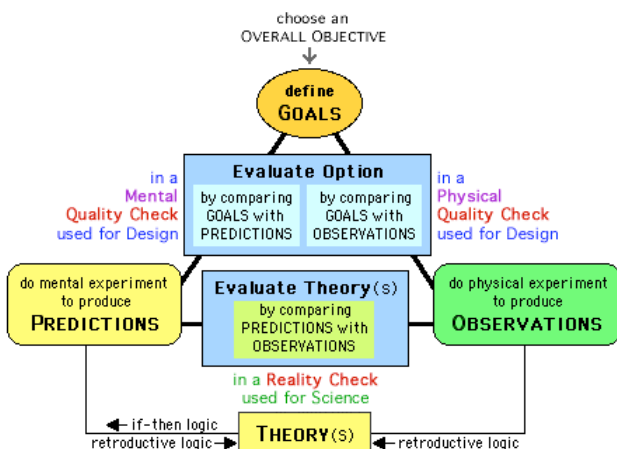
1. **Two-Step Cycle** — Generate Options & Evaluate an Option,



2. **Three Ways to compare Goals, Predictions, Observations:**

Quality Check – compare Goals with Predictions or Observations

Reality Check (Theory Check) – Predictions versus Observations



3. in an optional stage (a teacher decides how much to explore), explain the 9 Modes for Improvised Thinking-and-Action:

DEFINE — choose a design-objective, define goals for solution

GENERATE — old info, new options, predictions, observations

EVALUATE — by using Quality Checks & Reality Checks

COORDINATE — by making action-decisions for all 9 Modes

Here are the 9 modes of thinking-and-action used in the process of design:

- DEFINITION**
- 1A. **CHOOSE AN OVERALL OBJECTIVE** (what you want to design) for a design project
 - 1B. **DEFINE GOALS** (for the desired properties of a satisfactory problem-solution)
- GENERATION**
- 2A. **FIND** (SEARCH for old information about solution-options and relevant theories)
 - 2B. **INVENT** (to generate ideas for new options, usually by modifying old options)
 - 2C. **PREDICT** (mental experiments produce predictions that are new information)
 - 2D. **OBSERVE** (physical experiments produce observations that are new information)
- EVALUATION**
- 3A. **EVALUATE OPTIONS using QUALITY CHECKS** (compare goals with predictions or observations)
 - 3B. **EVALUATE THEORIES using REALITY CHECKS** (compare predictions with observations)
- COORDINATION**
- 4A. **EVALUATE THE PROCESS and MAKE ACTION-DECISIONS** (for what to do & when in modes 1-4)

In addition to decisions about progressions (especially re: modes), a teacher can also decide how to teach about **optimal blendings of creative-and-critical thinking & cognition-and-metacognition.**

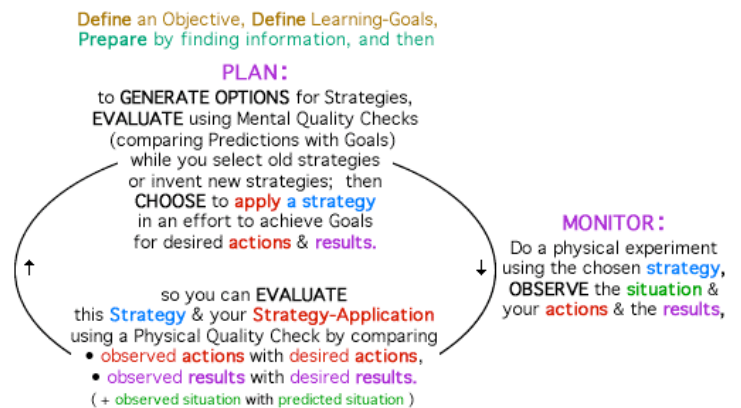
• A teacher can also decide how to explore **optimal blendings of creative-and-critical thinking & cognition-and-metacognition.**

Using Metacognition in Education for Problem Solving:

metacognition = “thinking about thinking” with the objective of improving your thinking-and-learning skills.

Metacognitive Self-Education = when students are motivated to use a problem-solving approach to personal education, to improve their lives by moving from their **now-state** (of current knowledge) to a future **goal-state** (of improved knowledge).

Learning Strategies — combine cognition-and-metacognition in a design process to observe and improve learning/thinking **strategies** (in **Quality Checks**) & **strategy-applications** (in **Quality Controls**):



Teaching Strategies — a teacher (or coach, supervisor,...) can

- motivate students to **use Self-Education**, help them **do it better**;
- use design-process to **improve teaching**: define Goals for ideas-and-skills we want students to learn, design **Learning Activities** to provide experiences with ideas/skills, and **Teaching Methods** (guiding to adjust difficulty level and direct attention to learning opportunities,...) to help students learn more from experiences.