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
1. accurately describe the methods used in design & science, thus improving our **UNDERSTANDING**.  (achieved?  yes )
2. 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,
   - **Define an Objective, Define Solution-Goals, Prepare** by finding information, and then
     - **GENERATE OPTIONS** (old or new)
     - and **Choose** an Option to evaluate.
   - **EVALUATE THIS OPTION** using Criteria (based on Goals) plus Predictions or Observations from Experiments (mental or physical)

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:

   1A. **DEFINE AN OVERALL OBJECTIVE** (what you want to design) for a design project
   1B. **DEFINE GOALS** (for the desired properties of a satisfactory problem-solution)

   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)

   3A. **EVALUATE OPTIONS** using **QUALITY CHECKS** (compare goals with predictions or observations)
   3B. **EVALUATE THEORIES** using **REALITY CHECKS** (compare predictions with observations)

   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.