iou – I'll continue revising this file during March 7-14, so it will be better by the middle of March. Now you can think of it as a **framework,** a **source-of-ideas,** a **sampling of what will be here later.**

Most of its pages have fairly high quality now, but some need to be improved, and later they will be better. Also, I will add content in some areas, and will add a few new sections.

two Summaries: This **Details-PowerPoint** summarizes most of the main ideas in my website about **Education for Problem Solving** and it will be useful for helping you helping you construct **a quick-yet-thorough overview,** a "big picture" understanding, so it can be studied by anyone (including educators who attend a talk) at any time (and others) **after** a talk (or before it), to get **a quick-yet-thorough understanding.** But **most slides are TMI for a talk,** so I'll make another version. A shorter **Talk-PowerPoint** (with fewer slides and less average information-per-slide) will be designed for use **during a talk,** so (with careful planning & editing) the main ideas (plus some discussion) will “fit into” the available time.

iou — I'll continue developing-and-revising this PowerPoint, and during March 7-14 when it will become better than it is now.

external links (to a page-section in my website) **will have underlined GOLD TEXT.**

Here is a "big picture overview" of 3 main topic-areas in my talk:

why Design Process has **two wide scopes** (for **Activities** & **Process**);
why the wide scopes **promote transfers Across Areas** & **Thru Time;**
how these transfers **are educationally beneficial** if we use them to **build bridges** [from School into Life] **that increase motivation** (I want to do) **and confidence** (I can do) with **growth mindset.**

learning my model for **Design Process** (for Problem-Solving Process);
metacognition (**what** it is & **why** it's useful, **how** Design Process can help students develop-and-use **metacognitive Thinking Strategies**).

general principles of education & **strategies for effective teaching;**
questions, re: Design Process **from POV's of students & teachers.**

The **background colors** of slides (**yellow, white, blue**) tell you the topic-area, and **you can study the topics in any order you want.**

This slide summarizes main ideas from the "yellow slides" topic-area:

- my verbal-and-visual model for **Design Process** (for **Problem-Solving Process**) **accurately describes the creative-and-critical Process that most people use** for **most of the Activities we do in most areas of life.**

evidence-based logic (from *How People Learn,* NRC 2001) supports my claims that

- **these wide scopes** (for Process & Activities) **increase Transfers-of-Learning,** both **Across Areas** (between School-Areas, and **between School-Life & Whole-Life**) and **Through Time** (from Past to Present, and **from Present into the Future of students**);
- **these Transfers** (of Learning & Performing) **are educationally beneficial** by producing **Direct Benefits with Transfers-of-Learning** (Across Areas & Through Time) and also **Indirect Benefits with Transitions-of-Attitudes** (better **Motivations** & **Confidences**).

A student increases their Motivations when we help them build Transfer-Bridges from School into **their Life,** and from Now into **their Future,** so **they are expecting that** "if I improve my School-Life Now, **it will** (due to Transfers) **improve my Whole-Life Later,** and I want a better Life." This helps them **develop a Growth Mindset,** with **expecting to improve their Learning** (Now) **and Performing** (Now & Later)." They **WANT to improve** (with **Motivation**) and they **EXPECT to improve** (with **growth-mindset Confidence**).

The previous slide is a “big picture” overview. *Below you'll see details for each part* — about **Wide Scopes** (for Activities & Process), **Transfers** (Across Areas & Thru Time), **benefits** (Direct by Transfers, Indirect by Motivations & Confident Growth Mindset) — *beginning with* **the main reason that Problem-Solving Activities have a Wide Scope:**

broad definitions → a wide scope for **Activities:**

PROBLEM can (and should?) be defined as…
an opportunity to **make something better.**
(better in **any way,** in **any area of life**).

PROBLEM SOLVING therefore occurs
whenever you do **make anything better.**

Mostly due to these broad definitions,
PS-Objectives (and thus **PS-Activities**)
include **almost everything people do.**

This broad definition differs from a common perception that a **problem** always begins with “a bad situation” because in my definition your feelings about the current now-situation could be anywhere within a wide range:

dismal ---------- lukewarm ---------- wonderful ---- awesome

If you produce “a move toward a better place” anywhere within the range, whether from dismal to lukewarm, or wonderful to awesomely spectacular, **this is problem solving** because **you have made the situation become better.**

In a similar way, I broadly define the **designing** that is **problem solving,** that happens when we **design** a **problem-solution** to make something better.

motives: **People solve problems** because **we want to make things better.**
Or **we want to do actions** (and/or **avoid actions**) **to make things not get worse.**
We can “make things better” in two basic ways,
by **promoting beneficial change** or **resisting harmful change,**
by **increasing quality** or **maintaining quality.**

It can be useful to think about
your **Problem-Solving Objective**
(it's **the thing you want to make better**)
in categories with "kinds of things" — for example, you can decide
to ***design*** (to *invent* or *modify* or *find,* or *find-and-modify*) a better

product or **activity** or **relationship** or **STRATEGY**
in a Problem-Solving Project for **General Design**
or a **theory**
in a Problem-Solving Project for **Science-Design.**

With overlaps, your Objective(s) can be **activity-and-relationship-and-STRATEGY,**
or other combinations; many combos include a **STRATEGY**, as explained in the next slide.

other ways to categorize: **You may want to define another set of categories,**
customized by you **so it's a better fit for the students in your educational situation.**
You want the Objectives to closely match the life-experiences of your students, so **they**
will recognize the personal relevance of school activities, and **will be motivated** by thinking
that "**my learning in School-Life will improve my Whole-Life** (= School-Life + NonSchool-Life)
and I want a better Whole-Life, so I want to proactively pursue my own Personal Education."

our **PS-Objectives** (and thus **PS-Activities**) **include almost everything we do;**
this is mainly due to **the wide scope** of **STRATEGIES** (so I've capitalized it),
and the **Decision Making** that often is **the purpose of STRATEGIZING.**

During every day, your **most common decision**
is your answer when **asking Lakein's Question,**
"**What is the best use of my time right now?**" to
Design Your Everyday Experiences
and **in some cases** (rare) to
Design Your Major Life-Experiences
with decisions that are an important part of how you
Design Your LIFE
by asking "what do I really want?" to define Goals for Life,
and "what experiences will help me achieve my Life-Goals?"

{ These time-questions are one kind of **metacognitive *self-questioning.*** }

We can help students Design Their Lives by asking them to…
think about their Goals for Life (for themself + others)* and to…
develop a proactive Problem-Solving Strategy for their education,
asking "how can I **solve a problem** – by **making my education better**
to **make my life better** – so **this helps me achieve my Goals for Life**?"

* We can encourage **win-win Goals** so "making life better" includes better for themself and also others, so **they want win-win Results.**

When students design strategies to connect their time-perspectives (short-term and longer-term) by asking "how will my daily Activities (today, this week, for the semester) help me achieve my Life-Goals?" this can motivate students **to pursue their own Personal Education.**

But… this **is important** for students, so Life-Designing Activities should be carefully designed so the probable overall results (for all students) will be optimized, trying to maximize positives (probable benefits) and minimize negatives (probable downsides). Maybe a good way to do this is to keep things general, just persuading students that their future Whole Life will improve if they improve their Knowledge-and-Skills now.

iou – In February I'll write a page-section describing essential factors to consider, then will condense its main ideas into a slide that will link to the longer page-section.

My claims for **two wide scopes** are that...

A) our **PS-ACTIVITIES** **include** **almost everything we do,**

B) our **PS-PROCESS** is **similar** for **almost everything we do,**
is similar but is not identical because
each of us can choose different Action-Sequences
to metacognitively coordinate our PS-Process.

Combining **A** and **B** produces my claim that **most people**
use a PS-PROCESS that is similar (but **not identical**) **for**
almost everything we do in life, for our PS-ACTIVITIES.

Here is **a logical analysis of my claims** about The Two Wide Scopes:

A) A wide scope for Problem-Solving **OBJECTIVES** logically occurs when we use **a broad definition** for **Problem** (and thus **Problem Solving**) so it includes Strategies (e.g. decisions about "what should I do now?") plus Products & Activities & Relationships (for General Design) and Theories (personal & scientific) for Science-Design.

This wide scope occurs always — whether we use Design Process or another model-for-process, or no model — **IF we choose to broadly define** "problem solving" as "making something better". But...

B) A wide scope for Problem-Solving **PROCESS will occur only IF we use a process-model that accurately describes our PS-Process.** I'm confident that • **people use a similar process for most things we do** in life, AND that • **this general process is accurately described by Design Process,** and this is why you will recognize that **Design Process is Your Process.**

C) I also claim that **the two Wide Scopes will motivate students,** but **this motivation occurs only IF a student believes** that **Wide Scopes will improve Transfers of Learning** from **their School** into **their Life,** so they're believing that **Learning in School** is **Learning for Life.**

This slide is a transition: **what is above** (claims about Wide Scopes) **is connected with what is below** (Transfers of Learning) **because...**

claims about Wide Scopes (above) lead to **claims about Transfers** (below) due to reasons for expecting that **using Design Process will help improve**

Transfers of Learning Across Areas (in **School** & into **Life**) that involve

Transfers of Learning Through Time (between **Past-Present-Future**),

and that **these expectations will motivate students.**

When teachers are using Design Process (DP), there are logical reasons to expect Transfers Across Areas due to...

1A) the wide scope of Problem-Solving ACTIVITIES and

1B) the wide scope of Problem-Solving PROCESS.

Why? *How People Learn (Brain, Mind, Experience, and School)* describes **transfer** as "the ultimate goal of learning" so it's "a major goal of schooling," and recommends (based on strong research evidence) that **to increase transfers, we should:**

2A) teach knowledge in multiple contexts;
this is allowed by the wide scope of **PS-Activities;**

2B) teach knowledge in a form that's easy to generalize;
Design Process does this by using **a similar PS-Process** throughout **the wide range of PS-Objectives/Activities.**

3) teach for deep understanding; this is promoted by the logically organized verbal-and-visual framework of DP.

here is a summary of the previous slide:

The book ***How People Learn*** (commissioned by National Research Council in 2000 and still basically valid) describes why **transfers of knowledge-learning** (for **declarative knowledge** & **procedural knowledge**) **will increase when we**

"teach knowledge **in** **multiple contexts**",

"teach knowledge **in** **a form that's easy to generalize**"

“teach knowledge **in** **ways that promote deep understanding**”,

and

all of these ways to teach can occur when using my model

for **Design PROCESS,**

for **Problem-Solving PROCESS.**

Why should you accept a claim that **using Design Process will increase transfers-of-learning** **across areas** **&** **thru time?**

Is there "**PROOF** beyond any reasonable doubt"? — **NO.**

Are there **logical REASONS** for "**a good way to bet**"? — **YES.**

We have logical reasons (described in the previous two slides) **to expect that using Design Process is "a good way to bet" for helping us improve education,** therefore **it's worth trying to develop the potential,** so we won't miss the opportunities.

options: You can continue reading about ***Transfers of Learning,*** or jump to a section about ***Teaching for Motivations.***

Transfer-Across-Areas involves (and thus **requires**) **Transfer-Thru-Time,**
from **a past** (when it **was learned**) to **the present** (when it **is being performed**), or
from **the present** (when it **is being learned**) to **the future** (when it **will be performed**).

Perkins & Salomon *claimed* that "education can achieve abundant transfer
if it is designed to do so," and *proposed* that transfer occurs by two mechanisms:

Low Road is spontaneous (≈ automatic) and this often is extremely useful in some situations, even though it involves very little conscious **Cognition-and-MetaCognition.**

High Road that can be increased by two kinds of **C-and-MC Self-Questions,** with

- **backward-reaching** by asking "what have I learned in **my Past** that can help me **Now**?" to stimulate **intentional remembering;** in this **MC Strategy,** you **use Self-Questioning** to **improve Present Performing** when you mainly have a **Performance Objective;** and
- **forward-reaching** by asking "what can I learn **Now** (in **my Present**) that can help me **Later** (in **my Future**)?" to promote **intentional learning;** this MC Thinking Strategy helps you **improve Present Learning** when you mainly have a **Learning Objective.**

In **your Present,** you can **learn from your Past** (by **reaching backward**),
and you can **learn for your Future** (by **looking forward** for **Life-Designing**).

We can build **two-way Transfer-Bridges** of **two kinds** (**Between Areas** & **Through Time**):

Transfer-Bridges (Across Areas): Students **use a similar problem-solving Design Process** (**DP**) for almost all they do, in **all Areas of their Whole Life** (in **School and NonSchool**), so **DP-Skills will transfer from School into NonSchool, and from NonSchool into School.**

Transfer-Bridges (thru Time, Past → Present → Future): DP increases **two Time-Transfers, Past-to-Present** (**backward-reaching,** "what I **have learned in my Past** can help me **Now**"), **Present-to-Future** (**forward-looking,** "what I **am learning Now** can help in **my Future**").

We can help students combine these (by **recognizing** that **Design Process is Their Process,** used by them in **their NonSchool+School** in **their Past+Present+Future** so they're thinking "I've used DP in **my Past** in **my NonSchool-Life,** so I can use DP **Now** in **my School-Life**" to increase **their Confidence** with a **Growth Mindset** that they are improving their DP-Skills, and "I am improving DP **Now** in **School,** so I can improve DP in **my Future** in **NonSchool,** so **my Future Whole-Life** (= **School Life + NonSchool Life**) will improve, and I want this," to increase **their Motivations** for proactively pursuing **their own Personal Education.**

It's useful to persuade students that "active high-quality **thinking**" will produce INDIRECT Benefits that will happen when students **are motivated with** "active **thinking**" **by imagining** that **what they are learning in School will Transfer Across Areas** (from **School-Life** into **their Whole-Life**) and it **will Transfer Through Time** (from **their Present** into **their Future**), so **their present School-Learning will improve the overall quality of their future Life-Living in ways they want.**

These **expectations** can **motivate a student** to pursue **Personal Education** that is **Problem-Solving Education** because its goal is "making things better" in Their Life. They see Their Education as a Problem-Solving Project (with a PS-Objective of "making things better" **later**) so they proactively invest extra effort in Their Education **now** because **they are motivated by expecting** that **making Their Education better** will **make Their Life better** in **Their Future; improving Their School Life** will **improve Their Whole Life** in **Their Future.**

Student **expectations:** When students **think** they will get

TRANSFERS of Knowledge-and-Skills

ACROSS AREAS and **THROUGH TIME**,

this can produce TRANSITIONS in Attitudes:

Past **PRESENT** → **FUTURE**

SCHOOL → **my LIFE**

↓

MOTIVATIONS:

IF I improve PRESENT PS-Skills in SCHOOL,
these will be FUTURE PS-Skills in LIFE.

And student expectations for another Transfer can produce a Transition in ATTITUDE,

Past LIFE → **PRESENT SCHOOL** **FUTURE**

↓

CONFIDENCE

I've done PS-Process BEFORE in LIFE,
so I can do it NOW in SCHOOL.

Performing Goal = want **best performing NOW.**
Learning Goal = want **best learning NOW**
so you can improve **best performing LATER.**

Past	Present	Future
	Learning NOW →	**Performing LATER**

For example, a basketball team has a
LEARNING Goal in early-season practice,
PERFORMING Goal in late-season tournament game.

Maya Angelou describes **Performing** and **Learning:**

"**Do the best you can until you know better.**
Then when you know better, do better."

Or, by adding [my comments about timing],

Do the best you can [**Now** with high **Present Performing**]
until [**Later** when] **you know better.**
Then [**Later**] **when you know better** [due to **Present Learning**
during **Present-Time Experiences** between **Now & Future**],
do better [with high **Future Performing**].

Using an **Objective-to-Perform** usually is best **short-term**, but **long-term** it's best to **sometimes also** use an **Objective-to-Learn.**

We can **build motivational bridges** (**from School into Life**) as described above, **AND motivate with metaphors** by encouraging students to...

"**drive your brain**" and "use your **growth mindset** to imagine the exciting satisfaction of seeing increases in **your brain-driving skills** (like a race car driver) and **your brain's performance** (like increasing a car's horsepower & torque, drive train, and handling capabilities)"

"**be CEO of Your Thinking**" with **executive control,** by skillfully using **Metacognitive Thinking Strategies to improve cognition & metacognition, to improve operating their whole-brain system of conscious-and-subconscious.**

"**be CEO of Your Life**" – **Design your Life** with wise decisions about using your abilities and time/opportunities, to more effectively pursue your **Goals for Life.**

"**enjoy adventures with thinking**" – "explore the world of thinking" when you DO Problem-Solving Activities that are Fun and Useful, and LEARN about thinking. (as in the "levels" of my website, and in other web-pages & other ways, plus wide-and-deep AI Research Reports).

When a teacher is enthusiastic about Learning-and-Thinking, showing how much they enjoy L-and-T, **students are more likely to think "this is fun" and also enjoy it.**

iou – The section below (this slide plus the next 4)
explains the ideas clearly, but **it needs editing**
to reduce duplications, and
to "blend the result into the flow of the entire topic-area."

my personal humility: I know that you already know
(better than me, due to your teaching experience) the general principles in the following Slides, about the value of using classroom Activities that will be FUN-and-USEFUL for students, and practical strategies for designing-and-using these Activities.

What is USEFUL? This is defined by a student:

During an Activity, a student will **perceive USEFUL-ness** when they **think & feel** (in their **thoughts & emotions**) that the Activity **will be USEFUL** for **their own future life** – their **near** future (after school), **medium** future (next year), and **far** future (as an adult) – because they're believing that what they are doing-and-learning will be **Personally Useful** in their own lives, and this belief **motivates them** to pursue their own **Personal Education.**

They are being motivated by their imaginings of **TRANSFERS Across Areas** (from **School** into **Life**) and **TRANSFERS Through Time** (from **Present** into **Future**).

Because we want to build
effective Education Bridges
so students will be motivated to
pursue their own Personal Education,
we want to design PS-Activities that have
wide variety (this is possible due to **the wide**
scope-for-Activities with Design Process)
so the PS-Activities will be
FUN and USEFUL.

What is USEFUL? This is defined by a student: During an Activity, a student will **perceive USEFUL-ness** when they **think & feel** (in their **thoughts & emotions**)
that the Activity **will be USEFUL** for **their own future life** so they're believing that
what they are doing-and-learning will be **Personally Useful**
in their own lives, and this belief **motivates them** to pursue their own **Personal Education.**

A student's **perception** of **Personal Useful-ness**
provides their **motivation** for **Personal Education.**

Designing Activities that are FUN and USEFUL:

FUN (with **intrinsic experience**) happens when activity has a
fun TOPIC that *is interesting* (as **defined by student**), and
fun ACTIONS that *are interesting* (as **defined by student**).

FUN (with result-of-success) when student
anticipates success and wants it, then **achieves** success. [describe psychology of expecting success
So this happens more often, design activities with
appropriate **level of difficulty** (not too hard [so they do succeed] but not too easy [so success is valued])
a well designed **PS-Activity** is similar (re: difficulty) to a
a well designed **mystery story** — so most students are
not bored (if too easy) and **not frustrated** (if too hard).

What is USEFUL? This is defined by a student: During an Activity, a student will **perceive USEFUL-ness** when they **think & feel** (in their **thoughts & emotions**) that the Activity **will be USEFUL** for **their own future life** so they're believing that what they are doing-and-learning will be **Personally Useful** in their own lives, and this belief **motivates them** to pursue their own **Personal Education.**

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Designing Activities that are FUN and USEFUL:

FUN (with **intrinsic experience**) happens when activity has a
fun TOPIC that *is interesting* (as **defined by student**), and
fun ACTIONS that *are interesting* (as **defined by student**).

FUN (with **emotional satisfaction**) when a student
anticipates success and wants it, then **achieves** success.
To make this happen more often, we can design activities with an
appropriate **level of difficulty:** not too hard (so **they will succeed**)
but not too easy (so **success is valued**);
a well designed **PS-Activity** is similar (re: level of difficulty) to a
a well designed **mystery story,** so students will think-and-feel
not bored (it isn't too easy) and **not frustrated** (it isn't too hard).

A student's **perception** of **Personal Useful-ness**
provides their **motivation** for **Personal Education.**

Here are some useful **self-education strategies**
(that you already know) for **Personal Education:**

- develop and use (with consistency) a **Growth Mindset,**
- try to learn from every experience (good or bad)
with a proactive attitude of **Intentional Learning,**
- believe that **better Learning NOW**
will lead to **better Performing LATER,**
- develop-and-use a metacognitive **Checklist** for **Problem Solving.**

Here are some ideas that I may use somewhere, somehow:

wide scopes: integrated system of whole-brain thinking -- fast-unconscious + slow-conscious

fast-unconscious / old Observations (personal memories) – "thinking fast and slow" (book, Kanneman)

teaching for motivation: we want to show students how School Activities will help them get what they personally want in their Whole Life as a Whole Person.

motivations come from a complex blend of multiple factors that include
intrinsic fun (enjoying activities), intrinsic satisfactions (of many kinds), extrinsic (getting extra rewards), intrapersonal (for self-actualization) + interpersonal (for relationships). -- all "intrinsic" because are part of a person.

Educational Teamwork with Matching Goals occurs when teachers' goals match students' goals; a teacher can achieve better matching by adjusting to students, and persuading students;
in effective Motivational Persuasion we consider all aspects of total motivation – intrinsic, personal, interpersonal, and extrinsic, all hopefully based on good values & priorities – that contribute to how a student thinks about their strategies-and-actions aimed at “getting what they want” in their whole life as a whole person; then we use words and actions to persuade students that we have good intentions (we care for them and are trying to help them improve their lives) and we are competent (in defining worthy educational goals, and helping students achieve these goals), and with words-and-actions we share our enthusiasm for the joys of thinking & learning.

Metacognition and **Problem Solving:**

This topic-area (in "white background" slides) has two main topics, **metacognition** and my model for **Problem-Solving Process.**

It begins with **metacognition,** shifts to **my model** for awhile, then explains how **using my model** can help students improve their developing-and-using of **metacognitive Thinking Strategies** and also their **cognitive-and-metacognitive Thinking Strategies.**

We can help students **develop-and-use metacognitive thinking strategies:**

why? research shows that **this is effective for helping students improve** (in a wide variety of ways) **their academic learning and social-emotional learning.**
{top improvers, feedback & metacognition, typically add 7 months extra progress in 12 months}

what? a simple description of metacognition is *cognition about cognition* (it's *thinking about thinking*); you will see many important details later, but first we'll examine the *cognitive actions* of Problem-Solving Process.

Students can learn from **their discoveries** and **a teacher's explanations.**

your learning by discovering: When you (or they) explore 4 diagrams in my model for **Design Process** (for Problem-Solving Process), you will discover essential PS-Actions. Your learning will be easier because you... A) **are learning in easy steps,** B) **see PS-Actions logically organized** in the verbal-and-visual framework of Design Process, C) **can simply recognize familiar old Actions,** instead of learning strange new actions; B & C help you learn more easily, and also help you (or a student) be more effective in **improving-and-using your abilities to solve problems.**

your process of exploring: In each diagram, **observe** (and **think about**) the **words & colors** and **spatial relationships,** while **asking questions,** e.g. "what does this mean? what Action is being described? why is it useful?"

your process of recognizing: While you're exploring the diagrams, **think about the actions you use (naturally-and-intuitively)** while you are solving problems, and **you will recognize that Your Own Actions are The Problem-Solving Actions of Design Process** (seen in diagrams of **DP**). Your **Discovery Learning** becomes **Recognition Learning** when – while you are Learning DP with Discovery – you also Discover that you are Recognizing.

You can help students Discover-and-Recognize the main Principles of Design Process by using a process of "**Experiences + Reflections → Principles**" when students…

- get **Problem-Solving Experiences** by doing Problem-Solving Activities,
- do **metacognitive Reflections** by asking themself {or other students} questions like "what am I doing?" (during an Experience) or (after it) "what did I do?" or {in a metacognitive discussion} "what did you do?" or "what did we do?"
- learn **Principles of Problem-Solving Process** that are Principles of Design Process, with **metacognitive discovery** that is **guided by you** in a process that will be **initially divergent** (when you let students wander in their Reflections) but is **eventually convergent** (when you guide them in their learning of Principles).

How? To teach this, you design a *plan* that includes *planning to improvise* based on your "external metacognition" when you observe the doing-and-talking of students, for customized guiding when (see previous slide) they Discover by Exploring & Recognizing.

What? You **use a Process-of-Inquiry to teach Principles-for-Inquiry** in ways that are personally meaningful for students, to help them develop a deep understanding of their Problem-Solving Process — with **conceptual knowledge about procedural knowledge,** in a mutually supportive relationship — when they **Discover-and-Recognize.**

a mystery: In this model for **Problem-Solving Process,** **why does the Cycle have a right-side arrow,** pointing from Evaluate to Generate?

Discovery Learning: observe (and think about) the **words** & **colors**, and **spatial relationships**.

Recognition Learning: think about **Your Actions** when you "**make something better**" to **solve a problem,** and you will recognize that **The Diagram-Actions are Your Actions**.

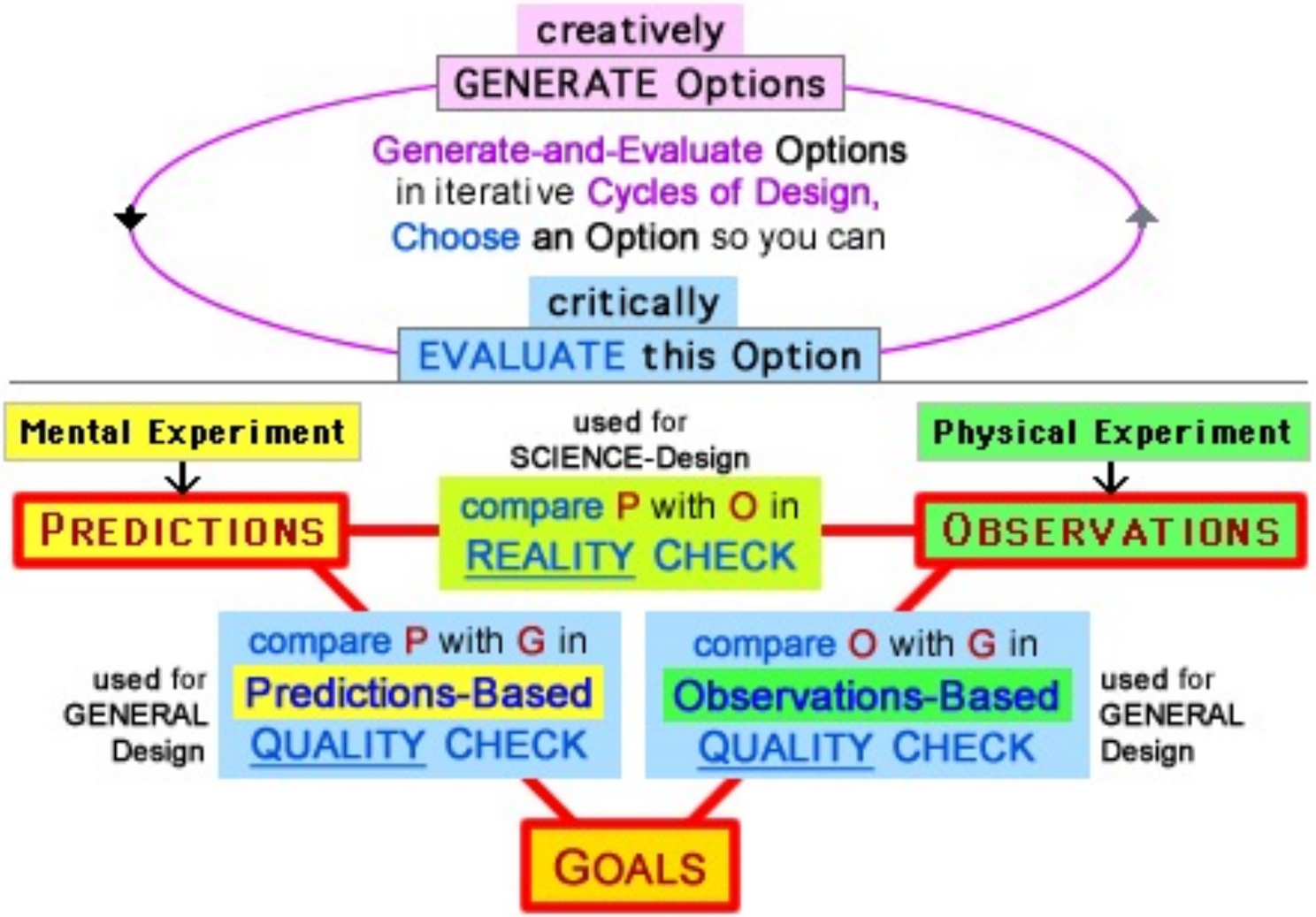
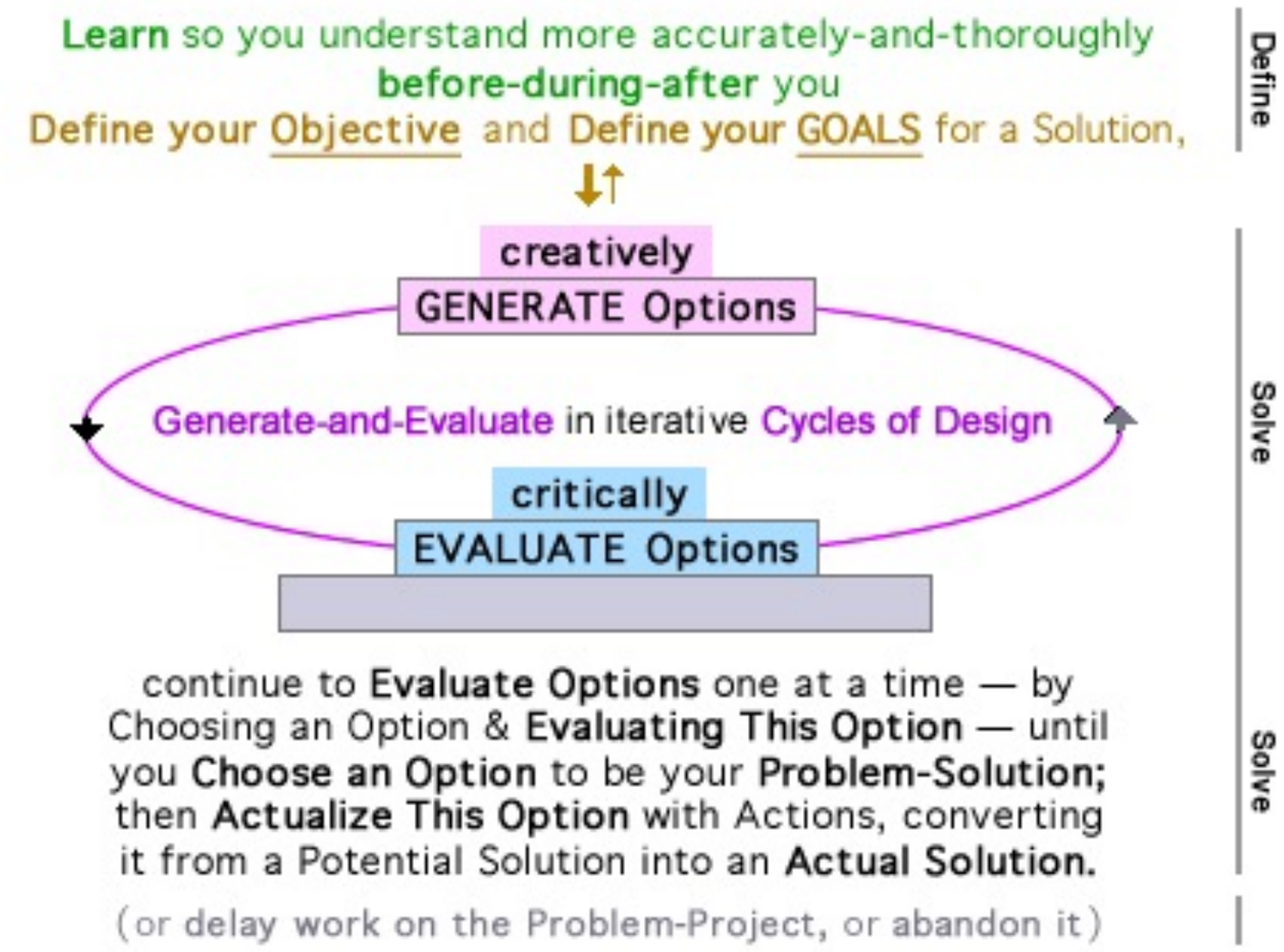


Diagram 1 — Define and Solve



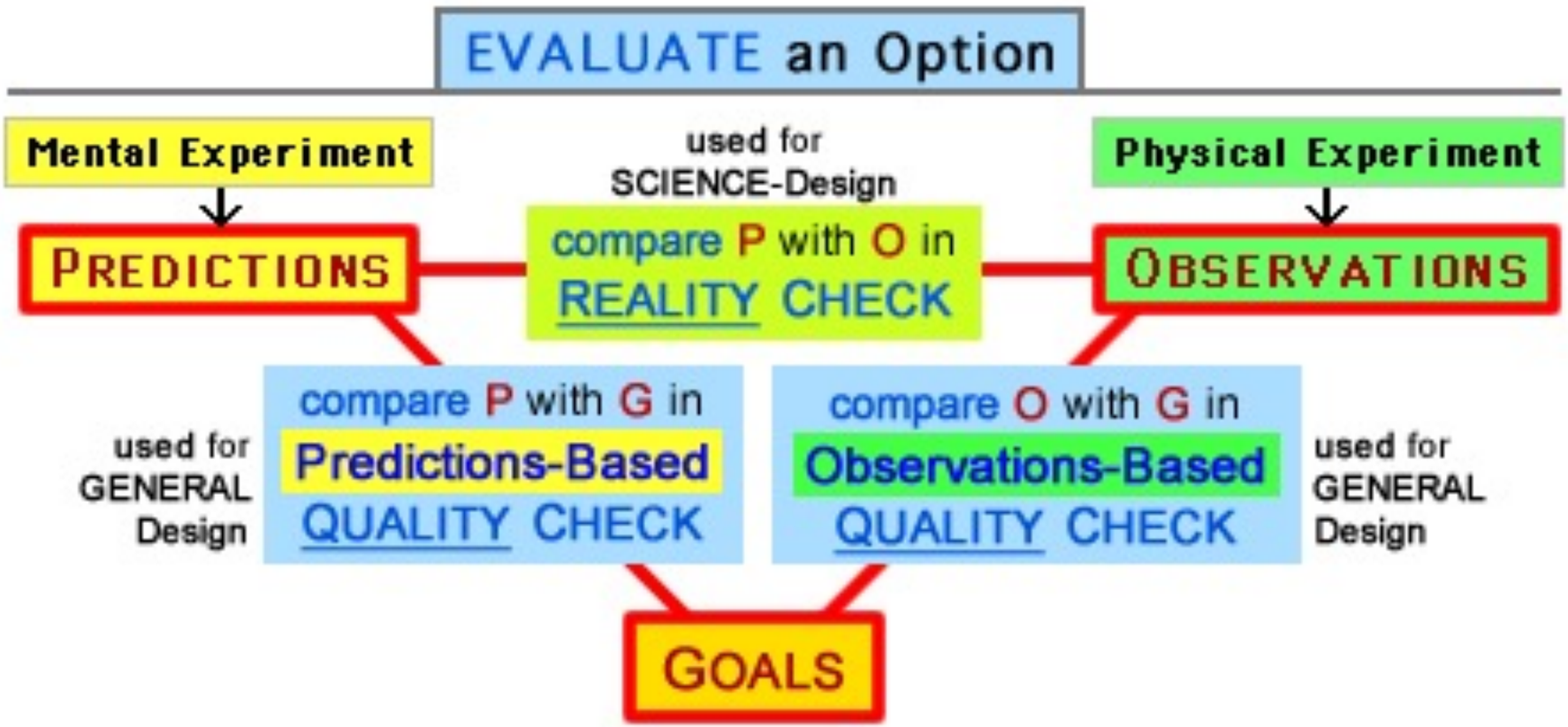
When a student sees "Experiment" in Diagram 2 (below) they may think “I don't do experiments, so for me this *is meaningless.*” Therefore you will help them understand when you explain why this actually *is meaningful* because they “do experiments” many times every day, because…

With my educationally-useful **broad definition,**
an Experiment is anything that produces Experience, that
provides an opportunity to get Experimental Information when you
make Predictions (by *imagining* “what will happen” in a **Mental Experiment**) or
make Observations (of “what happens” during the *actualizing* in a **Physical Experiment**);
With this definition, every **Prediction-Situation** and **Observation-Situation** is an Experiment, so
Experiments include most things you think-and-do, and almost everything you experience.

A useful framework for conceptualizing Experiments/Experiences is **Plan-and-Do:**
first you Plan (by imagining Options-for-Action with Mental Experiments, and Choosing an Option)
and then you Do This Option (to **actualize your Plan** with Mental Actions and/or Physical Actions).

This framework of **Plan-and-Do** is the foundation of ***Self-Regulated Learning***
that is a valuable way to develop-and-use ***metacognitive Thinking Strategies.***

Diagram 2 — 3 Elements are used in 3 Comparisons



With a **Quality Check** you are asking **The Design Question**,
"**how close is the match?**"
when you compare
This Option's **Actual Characteristics** (Predicted or Observed) with
the **Desired Characteristics** that you have defined as your GOALS.

It's a **Quality Check** because in this comparison you also are asking
"**how high is the Quality?**"
with **Quality** defined by your **GOALS** (i.e. by your **Goal-Criteria).**

With a **Reality Check** you are asking **The Science Question**,
"**am I surprised?**"
and you're answering "**yes**" if there is a mis-match
when you compare **Predictions** with **Observations**
but you answer "**no**" if there is a close match.

It's a **Reality Check** because it shows you how closely
Your Theory about "how the world works" matches
The Reality of "how the world really works."

Diagram 1+2 combines diagrams (1 & 2) that share the "**EVALUATE**" rectangle.

The Mystery Question:
to explain right-side arrow, ask “how can Evaluation help me Generate?”

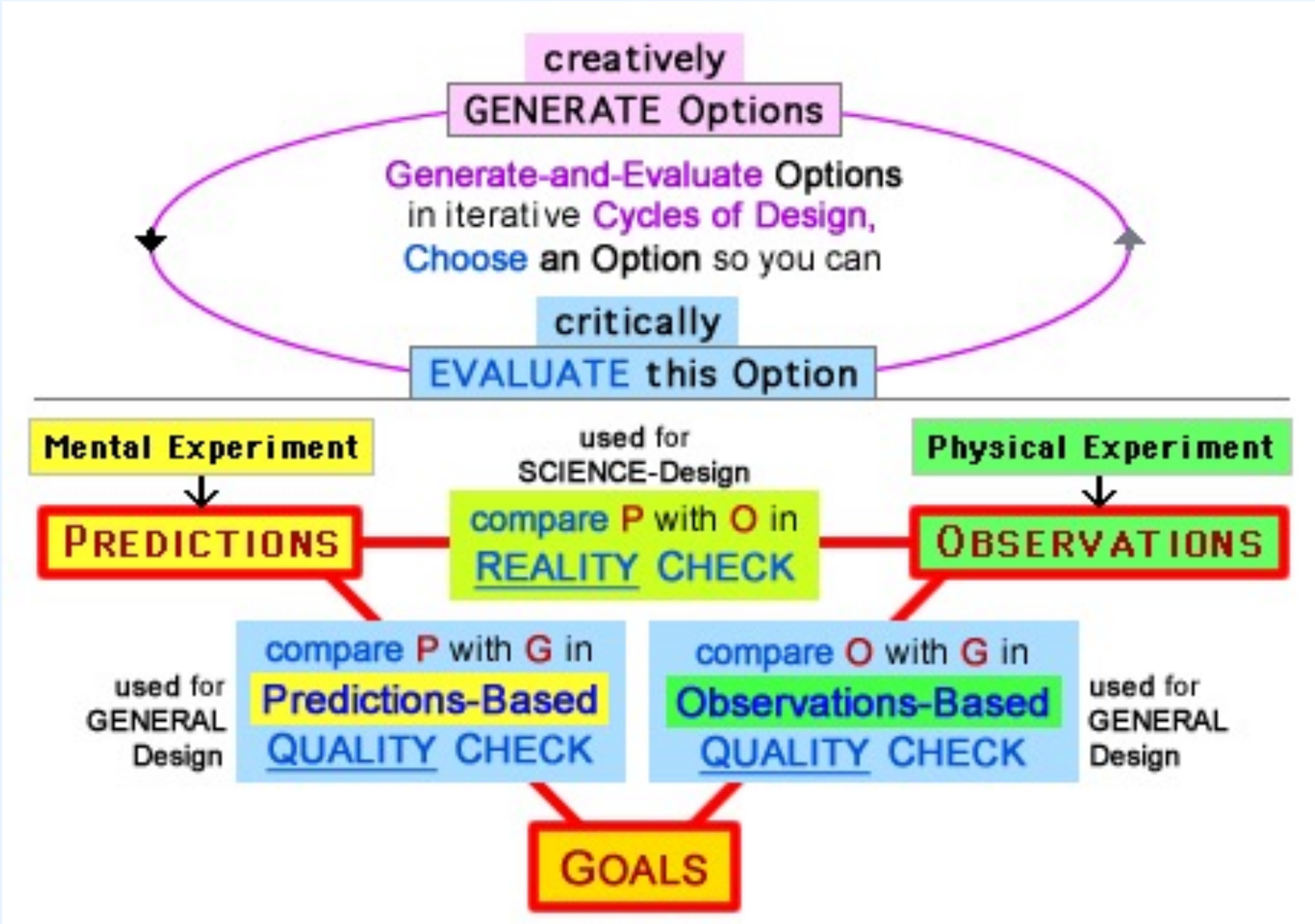
Discovery Learning:
observe (and think about) the words & colors, and spatial relationships.

Recognition Learning:
compare Your Actions with Diagram-Actions.

Recognition Learning:
To recognize that
The Diagram-Actions
are **Your Actions,**

ask: "Do I **solve problems**
by **Generating Options**
and **Evaluating Options**?"
and
"Do I **Evaluate an Option**
by comparing its
Actual Properties (that are
Predicted or Observed) with
Desired Properties (that I
have defined as Goals for
a satisfactory Solution)?"

{ **teach for/with Recognition** }

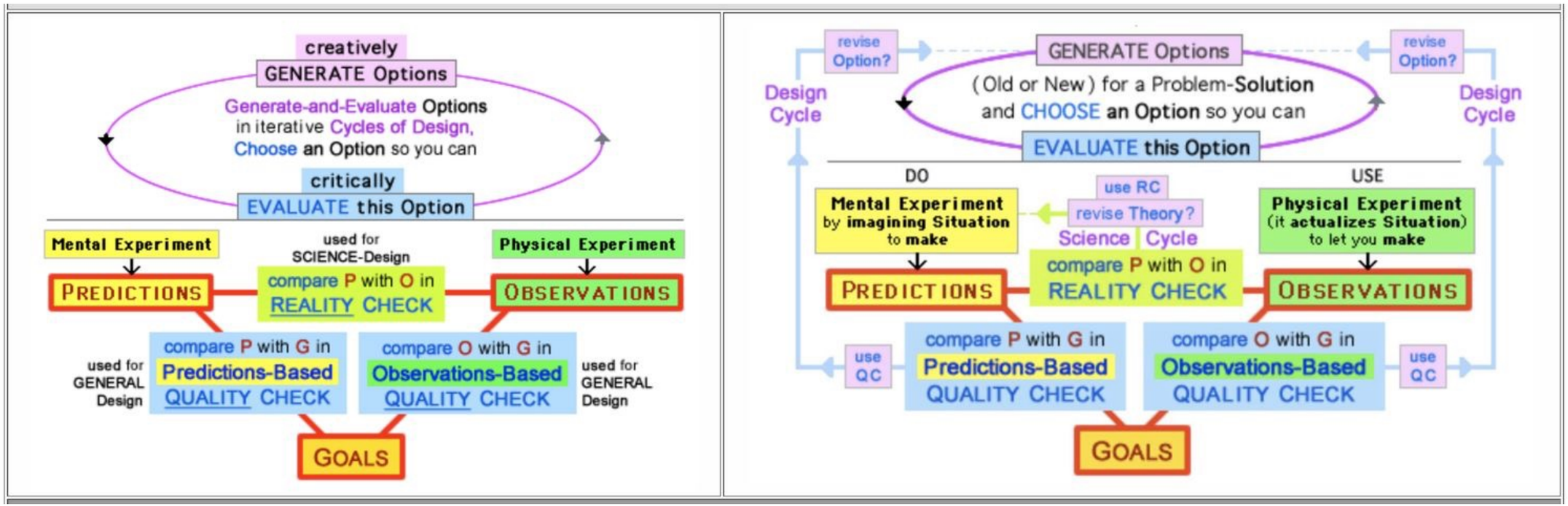


In this table, compare the left-side & right-side and you'll see that basically "**1+2 ≈ 3**".

But it's only "basically" (not exactly) because Diagram 3 has extra ideas.

The most important new idea helps you answer **the Mystery Question** when you ask "Why does the Cycle have a right-side arrow, pointing from Evaluate to Generate?"

(The answer is two slides below, after a full-size **Diagram 3** that you can study.)




Learn about a Situation so you have accurate-and-thorough understanding
before-during-after you
Define your Objective and Define your GOALS for an Optimal Solution
revise Option?
GENERATE Options
(Old or New) for a Problem-Solution
and CHOOSE an Option so you can
EVALUATE this Option
revise Option?
Design Cycle
Design Cycle
DO
USE
Mental Experiment by imagining Situation to make
use RC
revise Theory?
Science Cycle
Physical Experiment (it actualizes Situation) to let you make
compare P with O in REALITY CHECK
PREDICTIONS
OBSERVATIONS
use QC
compare P with G in Predictions-Based QUALITY CHECK
compare O with G in Observations-Based QUALITY CHECK
use QC
GOALS

In a **Quality Check, IF** there **is a close match**
between Predictions and Goals,
This Option has **high Quality**
(with **Quality defined by your Goals**)
so **This Option** might be a good **Solution.**

But what can you do if there **is not a close match?**

IF there **is not a close match** between Predictions and Goals, ask
"What are **the mis-matches?** what are **the causes of mis-matching?**"
and "**How can I revise This Option** to **get a closer evaluative-match?**"
and in this way your creative Generation of a New Option
is guided by your critical Evaluation of the Old Option.

In a typical **Cycle of Design**
first you **Generate** and **then Evaluate,**
later you **Evaluate** and **then Generate,**
(so the right-side arrow points from Evaluate to Generate),
to continue an **iterative Cycle** of Generate-Evaluate-Generate-Evaluate-...

the Mystery Question: In a **Design Cycle,** **why is there a right-side arrow pointing from Evaluate to Generate?** It's because **you are motivated to do**

Guided Generation

that uses productive interactions between

critical thinking and creative thinking

so you are being productively

critical-and-creative.

In **a critical-and-creative process of Guided Generation**
your **critical Evaluation** of **this Old Option**
stimulates and **guides**
your creative Generation of **a revised New Option.**

stimulates — **your revising is motivated** by thinking "**I want a better match.**"
guides — **your revising is guided** by asking "**how can I get a better match?**"
(by reducing the mis-matches that occur in your comparative Quality Check)

I'll temporarily shift to a focus on metacognition,
and later will return to my model for Design Process.

Slides 47-49 summarize basic concepts.

We should help students develop-and-use metacognitive thinking strategies:
why? research shows that **this is effective for helping students improve** (in a wide variety of ways) **their academic learning and social-emotional learning.**
{top improvers, feedback & metacognition, typically add 7 months extra progress in 12 months}

metacognition (**MC**) is ***thinking about thinking*** (it's ***cognition about cognition***), and **MC** can be analyzed into different types that you can choose to use or not-use:

you can **observe your thinking** and maybe think about it and **maybe evaluate it** and **adjust it,** or you can do none of these; four basic levels of MC are...

0) none
1) observe
2) observe + (**think about**)
2) observe + (**think about** & **evaluate**)
3) observe + (**think about** & **evaluate**-and-**adjust**)

You can do each type (**observe, think about, evaluate, adjust**) in different amounts (e.g. by evaluating a little or a lot) so *you can "do metacognition" in many ways* by using *different combinations of types & amounts;* each combo can help you improve your Performing and/or Learning in some kinds of Problem-Solving Situations.

An important aspect of improving your metacognitive ability is learning how to effectively **regulate your metacognition,** to flexibly adapt your MC so your PS-Skills (for "making things better") can be effective in a wide variety of situations.

[iou – in early April, I will do "polishing with editing" but as-it-is you can see the basic ideas.]

regulation of metacognition:
In the previous slide you see 4 levels of metacognition, ranging from none thru some (with observing + evaluating/adjusting.

because **effective** **MC** requires **customizing** **MC,** re: **its** **types** **&** **amounts** **and** **timings**.

MC-flexibilities ("maybe" & "maybe") **are important**
because **effective** **MC** requires **customizing** **MC,** re: **its** **types** **&** **amounts** **and** **timings**.

regulate your metacognition: stop-and-go, to **optimize** **Learning and/or Performing;**
sometimes **stimulate** hi-quality **optimal L and/or P** by **using metacognition productively,**
sometimes **allow** higher-quality **optimal L and/or P** by **avoiding metacognition,** when you
"**go with the flow**" just **think-and-do** (~~think about thinking~~) with **fully focused attention** .

in some situations it's wise to limit your MC-Actions to only observing (Level 1), consistent with...
Inner Game of Tennis, with its principle of "Performance = + Potential – Interference", a**nd**
mindfulness when the metacognitive-Action is just to **observe,** not to **evaluate** or **adjust.**

why?
develop-and-use Metacognitive Knowledge: of TASKS + STRATEGIES + SELF.
e.g. one **Knowledge of Strategies** is to **know high value of self-testing (e.g. digital flash-cards).**

LEARN about your MC, know **when & how to use MC** of **different kinds** for **different purposes.**

Slides 50-53 form a foundation for **the metacognitive strategies in Slides 54-56.**

the flexibility of Design Process:

People use a problem-solving process that **is similar** for almost everything we do, but **is not identical** because **the same Problem-Solving Actions can be combined in many different ways** by different people and to solve different problems.

The flexibility of Design Process is like the modular flexibility-and-freedom of using a few simple Lego Bricks to build a wide variety of complex structures.

A skillful using of Design Process is like **the flexible goal-directed improvising of a hockey player,** but not the rigid choreography of a figure skater.

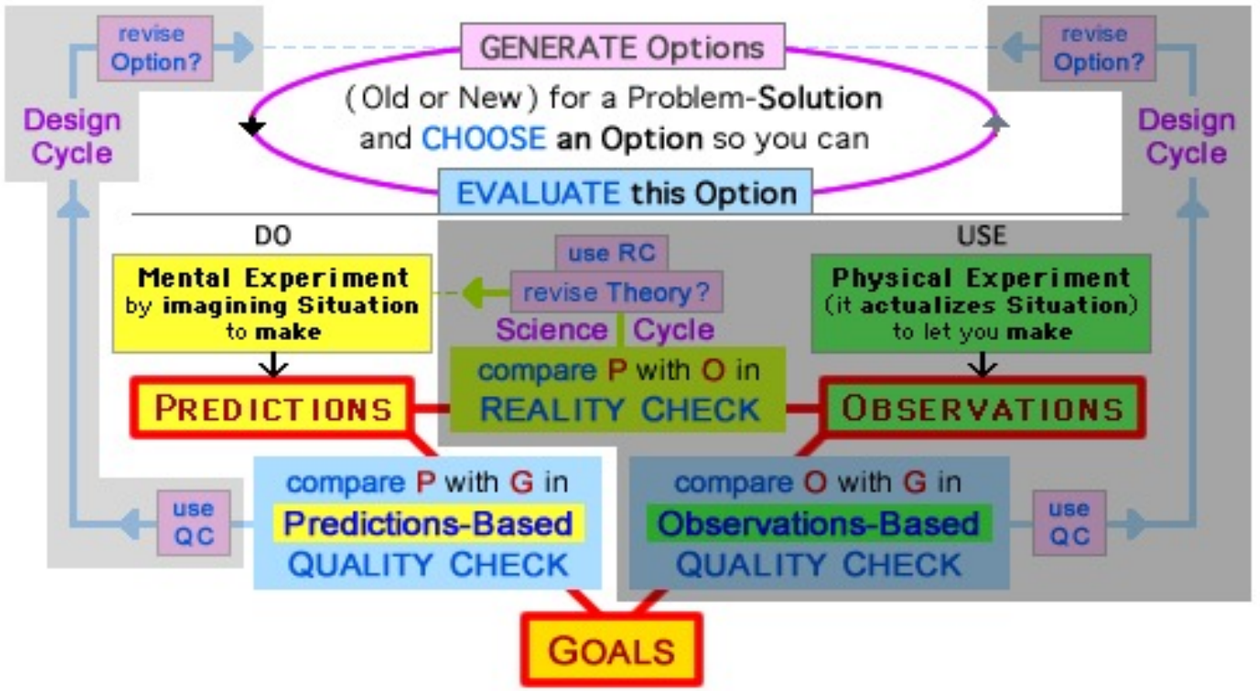
The reasons for "similar but not identical" are also why we answer "yes and no" when asking "is there A Method for *Scientific Method?*"

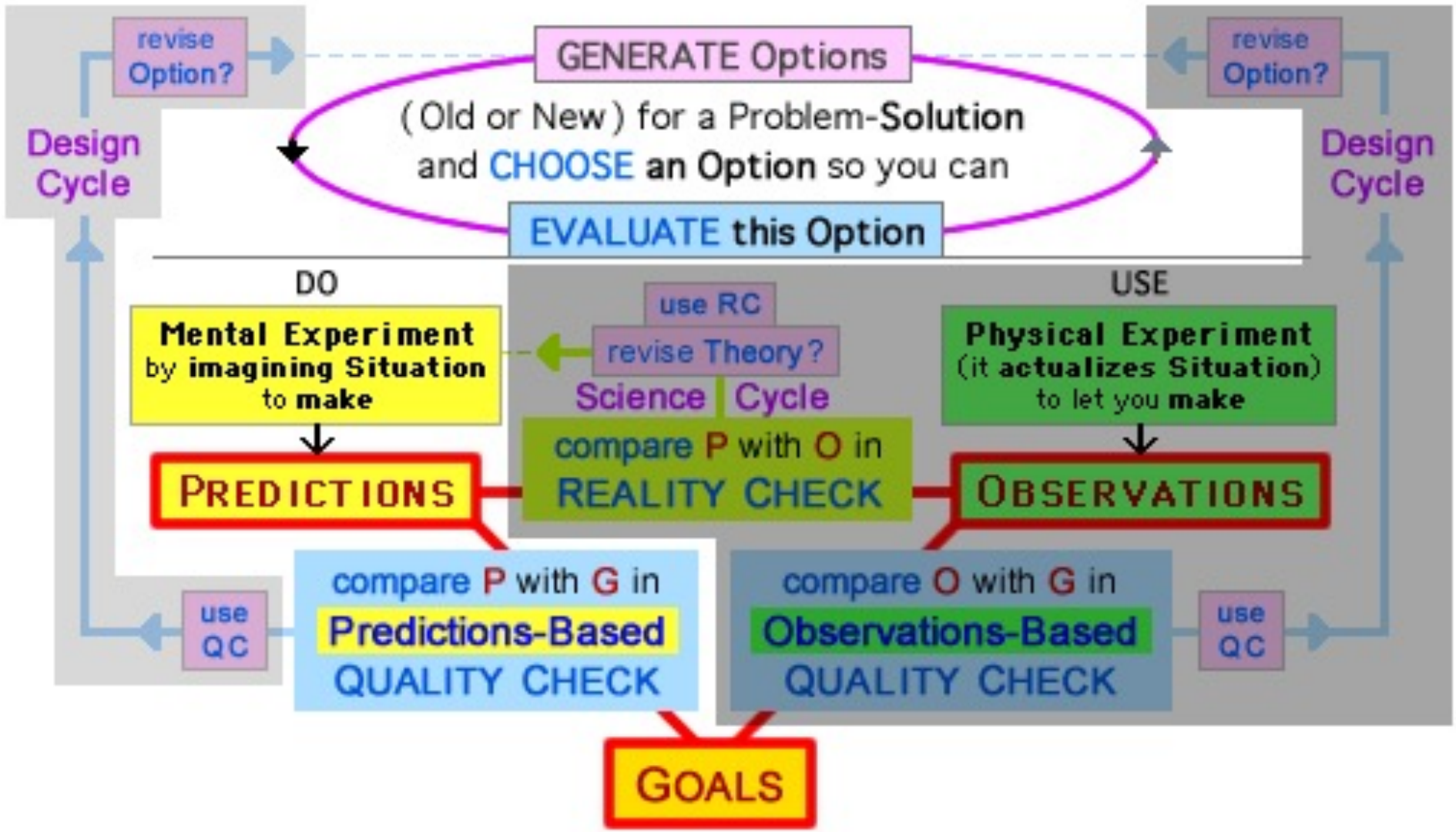
note: This flexibility always is assumed, and occasionally is explicit, as when Diagram 1 begins with "Learn… before-during-after" and has opposing arrows (↓ ↑) between "Define" & "Solve" with the larger arrow showing our usual time-sequencing; the smaller arrow is an occasional sequence.

Below, the slides show **Action Sequences** that people often use — because each sequence can be functionally useful — while we are solving problems.

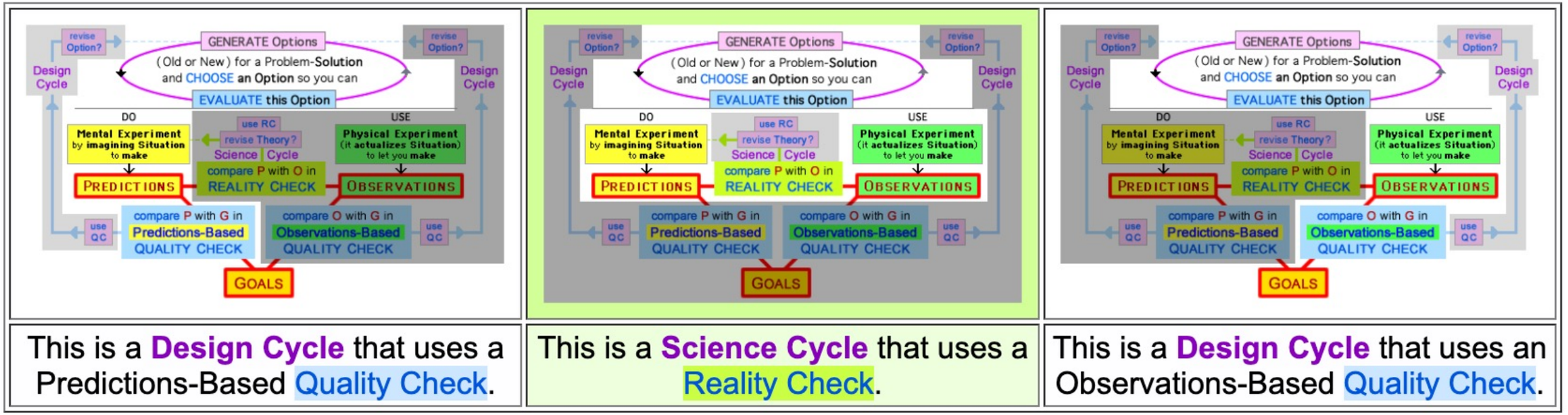
Below, in the unshaded and lightly-shaded regions you see the most common **Sequence of Problem-Solving Actions,** in the downward flow of Action-verbs — **Generate**, **Choose, Evaluate** (**DO** by **imagining** to **make**, **compare**); maybe **use**, **revise**, **Generate** — to complete a **Cycle of Design.**

It's a common **Action-Sequence** because in each pair of Actions, **one Action leads to the next Action,** when you do one Action and then ask "what should I do next?" and decide "**I can make progress** (in Solving the Problem) **if I use the results of this Action** to **do my next Action.**"




revise Option?
GENERATE Options
(Old or New) for a Problem-Solution
and CHOOSE an Option so you can
EVALUATE this Option
revise Option?
Design Cycle
Design Cycle
DO
USE
use RC
revise Theory?
Science Cycle
Mental Experiment
by imagining Situation
to make
Physical Experiment
(it actualizes Situation)
to let you make
compare P with O in
REALITY CHECK
PREDICTIONS
OBSERVATIONS
compare P with G in
Predictions-Based
QUALITY CHECK
compare O with G in
Observations-Based
QUALITY CHECK
use QC
use QC
GOALS

The **Action Sequence** above (it's a **Predictions-Based** Quality Check) is on the left side below;
on the right side is an **Observations-Based** Quality Check; in the center is a **Reality Check**.



This is a **Design Cycle** that uses a Predictions-Based Quality Check.	This is a **Science Cycle** that uses a Reality Check.	This is a **Design Cycle** that uses an Observations-Based Quality Check.

You don't have to "learn" these Action-Sequences because
you already have been using them during your PS-Process;
so you won't have to be **learning strange New Sequences,**
you can just be **recognizing your familiar Old Sequences.**

{other Sequences: you can Generate Many Options (with minimal Evaluating) as in Brainstorm-then-Edit, or... }

You can do many kinds of Action Sequences — these three (2 Quality Checks, 1 Reality Check) plus Brainstorm-then-Edit, and others — **by making different decisions at branch-points when you have Options for Actions.** These decisions about "what to do" let you...

Coordinate your Process of Problem Solving by **asking** "what is the best way to make progress in my process?" and **deciding** "what to do next" and **doing** this Action.

How? To effectively coordinate your process, you combine cognitive-and-metacognitive...

- **awareness of your process** (of "where you are" and "where you want to go" and "when you are at a branch-point so you can make a decision") and
- **Knowledge of Options** (about the Options-for-Action, and what each Action lets you do) and
- **Conditional Knowledge** (about the Conditions [situations] when each Action can be useful).

When we ask “**is there a Method?**” for Scientific Method {or “**is there a Process?**” for Design Process}, why is the best answer **No-and-Yes**?

It's **NO because** there is not a rigid long-term sequence of steps for a Method {or Process} that is used in the same way by all people, in all areas, at all times.

And it's **YES because** people do tend to be more effective when we use goal-directed *strategic Actions* in *strategic Sequences;* these *Actions & Sequences* are shown in the Action-Diagrams for Design Process.

Although it's YES for Sequences, skilled problem solvers use a flexible process that is analogous to the **goal-directed flexible improvising** of a hockey player, but not the rigid choreography of a figure skater.

Therefore an Actions Diagram **ISN'T a single fixed Action Sequence,** but **IS like a roadmap with many branch-points** where you can decide “what to do next” to coordinate your Process of Problem Solving. This concept of “a roadmap that shows branch-points” is explored in the next slide.

The *metaphor* of "**driving your brain**" is useful for motivating students to use metacognition. When this is extended to include "**using a road map**" for choosing a **driving route** (or a **Problem-Solving Strategy**), **using the external diagrams of Design Process** (**DP**) becomes analogous to **using an external road map:**

a **road map** is a **simplified model** of a city's **physical geography** & your **options for a route-to-travel;**

a **DP-roadmap** is a **simplified model** of "**problem-solving geography**" & your **Options for PS-Actions;**

it's a "**roadmap for PS-Strategy**", like a *flowchart* that shows *branch points* where *you choose PS-Actions* when **you metacognitively *coordinate* your PS-Process** with *strategic* "*what to do next*" *decisions.*

Each kind of **external map** is an **external model** that helps you construct your own **internal model** (it's a **mental model,** mental representation) when with experience in using the external model, after awhile **you will intuitively KNOW** the **physical geography** of **the city** (and **your options for driving-routes**), and **you will intuitively KNOW** the **strategic geography** of **Problem Solving** (and **your Options for PS-Actions**).

After map-using helps you **construct your own internal model** of the geography (physical or strategic) you can occasionally check a map to **improve your understanding** of the geography (or as **a reminder**), but **you don't need to use the map** for driving or problem solving, so **the map is a temporary scaffold.**

Another useful metaphor is viewing **functional PS Actions** as **functional PS Tools** — like those in the toolbelt of a carpenter (or mechanic, electrician, plumber,...) — so **metacognitively using Design Process** is a way for students to improve their **wise tool-choosing DECISIONS** and their **effective tool-using SKILLS.**

A map **will be most useful if it's an accurate representation** for the ways it will be used. I claim that **Design Process DOES accurately describe Our PS-Process,** to make my claim for **The Wide Scope of DP.**

develop-and-use Metacognitive Checklists (this is another kind of useful metacognition)

Why? When I've made a mistake and then asked "why?" — to *learn from the experience* (for *self-education*) — my answer often included "ineffective process" because I had not done some Problem-Solving Action(s) effectively, or had not even done the Action(s). To help prevent this from happening, it's useful for me (and you) to **develop-and-use Metacognitive Checklists.**

What? To minimize these mistakes (to say "oops" less often), **develop MC-Checklists,** then **use them proactively during your Problem-Solving Process,** to help Coordinate Your Process, and help you *do all essential Problem-Solving Actions* and *do them effectively.*

How? When I've asked "what caused (or allowed) my mistake?" often my self-answer has been "**I didn't creatively Generate an Option** that would have been a better Problem-Solution" and/or "**I didn't critically Evaluate the Option** that I chose to be My Solution."

How? One strategy is to **use Design Process** as a source of **useful Problem-Solving Actions** to make an initial Checklist that you revise (by adding or subtracting Actions) during your using of this Checklist, as in the **Monitoring & Evaluation** of Plan-and-Do for **Self-Regulated Learning.** You can use iterative Design Cycles (Generate-and-Evaluate) by **Generating an MC-Checklist** and **using it** for a Problem-Solving Project, **while Monitoring the Checklist** (along with other things) by Observing how you're using it and (during the PS-Project or after it) **Evaluating the Checklist** (by asking "is it helping me by providing useful reminders of useful PS-Actions? is it doing what I want it to do?") and revising the Checklist if you think this will make it more useful for you.

we can use Cycles of Design Process to teach Cycles of Self-Regulated Learning

iou – The next 3 slides need an introduction, to describe the terms — Self-Regulation, **Self-Regulated Learning** (**SRL**), **Cycle of SRL** — and the fact that **SRL often is used** for instruction in K-12 and college, and that **SRL is effective,** and other useful ideas.

It will be a condensing of these paragraphs:

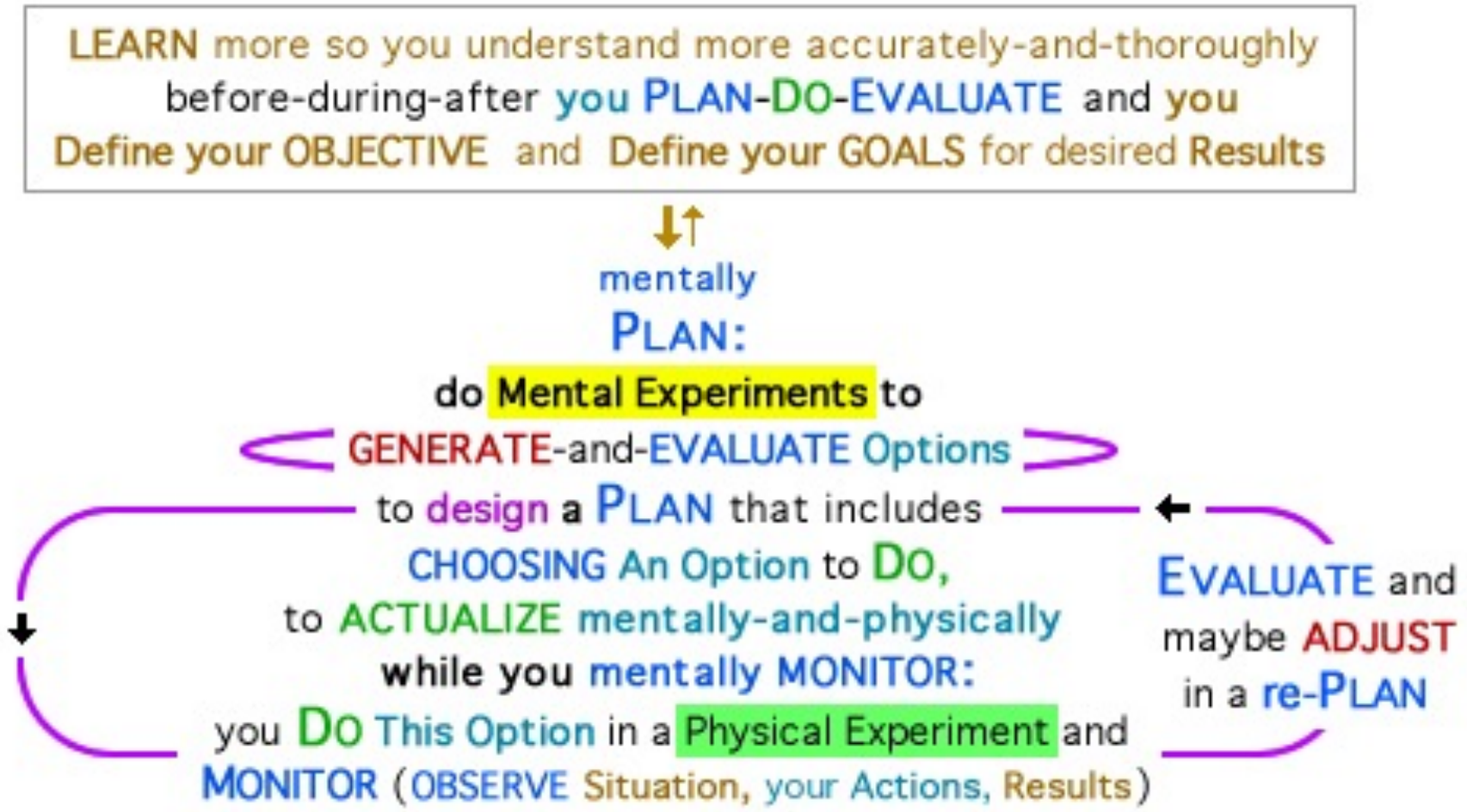
We can use Design Process to help students develop-and-apply **Thinking Strategies** for **metacognitive Self-Regulated Learning.**

why? Because this is an educationally beneficial way to use Design Process.

why? Based on abundant research, we know that **metacognitive SRL is highly effective** for **helping students improve their academic skills** (in many ways, including their scores on standardized exams) **and their social-emotional skills.**

how? We can help students develop-and-use **Cycles of Self-Regulated Learning** (**SRL**) by using **Design Process** (**DP**), because a **Cycle of SRL** is similar to a **Cycle of DP,** as you see in this version of Diagram 1 [in the next slide] that is modified for **teaching SRL-with-DP** so the diagram is **DP-for-SRL.**

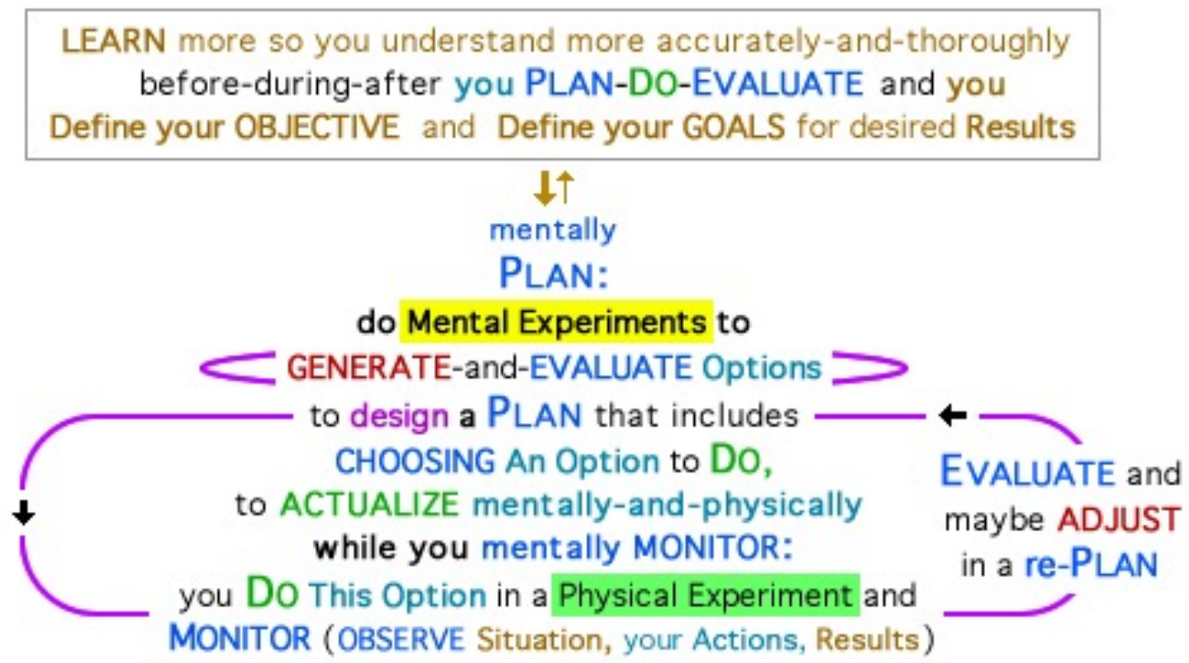
When we use **Design Process** (**DP**) to teach **SRL**-with-**DP** (as described in next two slides), this can help students **understand SRL more deeply** and **use SRL more skillfully.**



After students know Design Process, a teacher can use **Experiences + *Reflections* → Principles** to help them gradually-and-comfortably improve their **understanding-of-SRL** and **skills-with-SRL.**

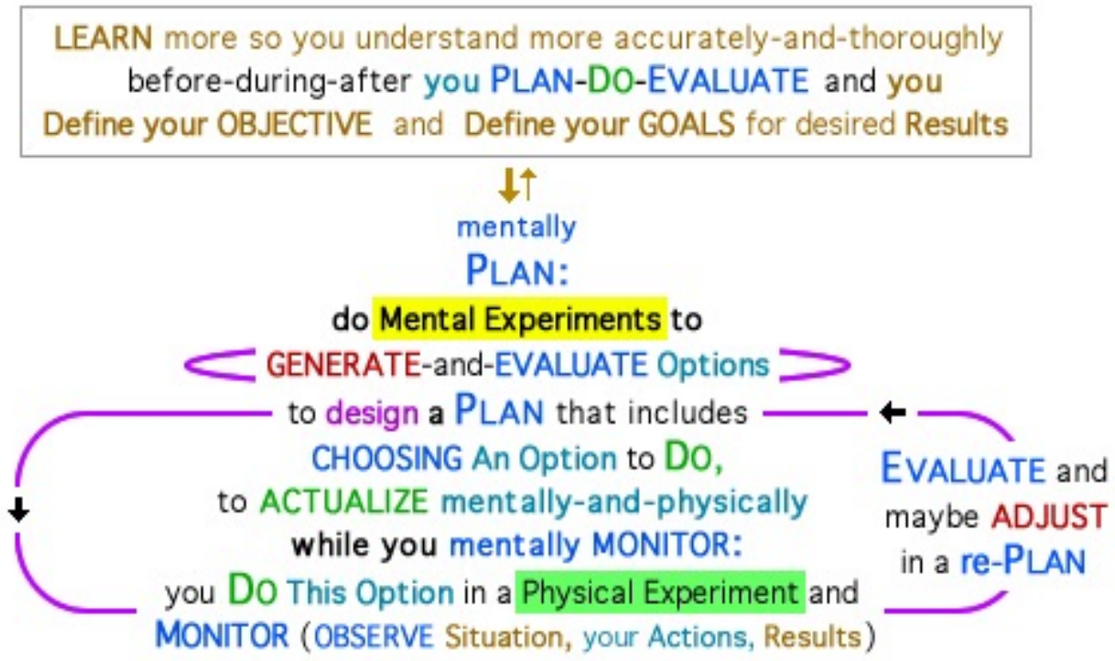
This diagram shows how a 3-part **Cycle of SRL** (**Plan - Do - Evaluate**) requires **Mental Actions** {**Plan** & **re-Plan, Adjust** to **Generate, Evaluate, Design, Monitor/Observe; Learn, Define & Define**} plus **Mental-and-Physical Actions** {to **Do** by **Actualizing Mentally-and-Physically**}.

To **Design a Plan, Evaluate Options** (by comparing Predictions with Goals) and use all of your ***Metacognitive Knowledge*** (of Task, Strategies, Self) that is old & new, first-hand & second-hand.



overlaps of Phases: in practice, **Monitor** often mixes Actions when you **Observe** **and** **Evaluate,** when **MONITOR** involves **Observe** {earlier **Situation** –(**your Actions**)→ later **Results**} **plus** **Evaluate,** so **the 3 Phases of SRL Cycle** (**Plan, Do-Monitor, Evaluate**) can overlap, without distinct separation; **Do**/**Monitor** + **Evaluate**/**re-Plan** can occur in **many short-term Cycles,** or **one long-term Cycle.**

SRL Cycles (**Plan, Do, Evaluate, Plan,** ...) use **DP's Design Cycles** (**Generate-and-Evaluate,** ...) in **upper SRL-Cycles** {Generate-and-Evaluate to **Plan**} with ≈ Predictions-Based **Quality Checks,** and **lower SRL-Cycle** {**Monitor**/Observe & **Evaluate** & **re-Plan**} is ≈ Observations-Based **Quality Check** with **old Plan** –(**re-Plan**)→ **new Plan,** either many times (in **short Cycles**) or once (in **a long Cycle**).



a transition:

This concludes the main section about metacognitive Thinking Strategies that (iou) will be developed-and-revised during early April.

Metacognitive Self-Questioning

iou for Slide 1 (of 2) — it will be developed in April.

@ lists –

CHECKLISTS – (eg my "oops" experiences → ask why did i fail? or why succeed?)

often best MC is subject-specific: use Design Process as general foundation (is ok for all A's & S's)
and then design specific self-Q's for <u>each subject Area</u>
and for <u>each kind of Skill</u>.

iou – The **green text** tells you "this is a rough-draft slide, needing to be revised."

Self-Questioning

iou for Slide 2 (of 2) that will be developed in late January.

→ @ Recognition Learning, Experience+Reflections→Principles,
inquiry for inquiry (teaching strategies)

iou – later I'll develop this slide, about the most common kind of self-questioning:

In both kinds of Experimenting (Mental & Physical)
Experiments → Experiences
and **every time they ask Lakein's Question – "what is the best use of my time right now? – they are asking "what should I think? what should I do? what should I think-and-do? what kind of Experiences do I want?" and (because Experiments → Experiences) "what kind of Experiments should I do?"**

ME = imagining "what will happen if I do this?" and if you decide "yes I'll do it" this ME produces Actions

Mental Expmts → what we **think**, and Physical Expmts = what we **do**, so **think-and-do** describes our living experiences.

ME = what you **choose** to **Think** about, PE = what you **choose** to **Do**
living ≈ what we think-and-do.

by "**choosing their Experiments**" a student can
Design their Life-Experiences
(with frequent everyday decisions + occasional major decisions)
by choosing Experiences that will help them wisely
Design their Life
by asking "**what do I want?**" to **Define GOALS-for-LIFE**
and "**what experiences will help me achieve my LIFE-GOALS?**"
[[i will link to this topic – Design Your Life – in the yellow-slides]]

{ this time-perspective can motivate students to pursue their own Personal Education }

iou – This slide needs to be revised.

What? You will find that it's useful to **make multiple Checklists** (similar but not identical) that are to use for *different kinds of Problem-Solving Projects,* and *different stages in a Project.*

is *personally customized* for you, that helps you become a more effective problem solver.

How? You {and students} can **develop** a metacognitive checklist and then **use it** consistently.

here are some extra ideas, to be revised later:

When you use metacognition proactively (with a checklist and in other ways) by sometimes "paying attention" throughout your day, usually this will help you perform more consistently so you can "do things better {in your present moments}" instead of thinking "oops" and asking "why {during past moments} did I make the mistake?"

How? Encourage your students to develop their own **checklists, customized for themself and for different skills in many areas of life.** But **it will be easier-and-better for them when you "model it" by showing your own checklist,** and **explaining how they can effectively use your list and their own variations.** And **how they can modify their list – and their using of it – by reflecting on their list-using experiences.** / iou – I'll make a short version of this checklist.

in an effort to grow by learning from experiences -- consistency

iou – This will be a "conclusion" for the long "white slides" section, with **Cognition-and-Metacognition plus my model for Design Process.**

and it will be a transition to the next set of slides, about **Combining Design Process with other Models-for-Process**

My Model plus Other Models,
Cooperation, not Competition.

My Model **with** Other Models (cooperating with other models),
not
My Model **versus** Other Models (competing against them).

We should develop instruction that **creatively combines**
different Models-for-Process, so **the relationship is synergistic,**
so **the combination is more effective than any single Model by itself.**

My Model and Other Models:

We should develop instruction that combines different Models-for-Process creatively, so the combination is more effective for teaching ideas-and-skills. We want the Models to interact in ways that are synergistically supportive, that make the combination of Models better than any Model by itself.

Structures and Strategies: Typically, a Model-for-Process is educationally useful by providing **structures** (for instruction) and **strategies** (for thinking). Each Model has structures & strategies, so each offers its own benefits for students. When we effectively combine the structures & strategies from two (or more) Models, we combine their benefits.

Using Model-Structures to provide Structure for Instruction:

Jeremy Utley, Director of Executive Education for Stanford's d.school, explains how their model [the next slide shows its 5 Modes] provides "a shared language and a shared approach" that can be "a useful scaffold to structure an experience for the purpose of learning."

When students work in groups and everyone is thinking about the first *mode* (Empathize) in d.school's model, this whole-classroom focus makes it easier for a teacher to share ideas and guide students so they can use-and-understand the tools in this mode, so they will learn how to empathize more effectively using d.school's *mindset* of Focusing on Human Values. After awhile all students move on to the next mode (Define), and so on, in their "experience for the purpose of learning." And a teacher will use "the phases" with flexibility when it's useful.

[[somewhere in "combining Design Process with other models-fir-process,
I'll describe this model:]]

In a "**public domain**" **process-map, simplicity → utility** (practical + educational).
You first **understand** "**what is**" in the present **actual NOW-State,** and
imagine "**how it could be better**" in a future **desired GOAL-State:**

iou – **The following ideas-about-science will be** revised to make **two slides (maybe three):**

refer to earlier slide explaining that Diagram 2 shows how my model is for Design-AND-Science, by contrast with other models that are either for Design (only) OR for Science (only)

3 contexts for Sci-Design/RC's: during **General Design, Everyday Life, Formal Research.**
in all **sci reasoning (esp Everyday),** ask "what **evidence-and-logic** supports claim" (by me/them);
logical reasoning, **informal** reasoning, **formal** reasoning, much overlap.
Empirical Factors (with Reality Checks and other factors, e.g. the quality of experiments), cultural-personal (also)
{ empirical Reality Checks are used in contexts of General Design, Everyday Life, formal Research Science, -- but Reality Checks are supplemented by Cultural-Personal Factors when people do rational Evaluations. } Reality Checks are the foundation of scientific reasoning, but people also consider other criteria.
3 contexts for science: while problem solving, professional, everyday;

factors affecting evaluation can be
Empirical (Reality Checks + Quality of Experiments re: reliability, significance,...) and also
cultural-personal (e.g. beliefs about climate change and vaccines are affected by political views and the "groups" that a person wants to be associated with, be considered "a member of," improve their status in. [[link to page: Understanding and Respect + Motivated Reasoning]] maintain-and-improve status within a valued group, show loyalty to theories favored by group, help us "win" in battles of Us vs Them

Quality of Experiments (e.g. especially in research about nutrition & medicine, due to complexity: multiple inputs & outputs for cause-and-effect, time lag, variability of people (genetic + personal histories + current situations with other factors not-considered in Expmt) statistics, numbers (n=5000 better than n=5)

iou – this is continuation of ideas-about-science:

summarize principles in "Modes of Thinking" (link to h.htm#dpmo0)

2C -- Designing Experiments, Experimental Design (E-Design) quick Cycles of Generation-and-Evaluation using Mental Experiments by Divergent Search by imagining "if we do _____ (in Physical Experiment), what might happen, and what could we learn?" or Convergent Search that is guided by Goals, asking "to make progress in our Process, what Experimental Information would be useful (i.e. what do we need to know), and what Experiment(s) could provide this E-Info?"

2D – Making Predictions – imagine "what will happen" with
Inductive Logic ("what happened before (in similar situations) will happen again") and/or
Deductive Logic (if-then reasoning, "IF this Theory is correct, THEN ___ will happen")

2E – Making Observations, you can do with senses (see, hear, taste smell, feel) + instruments (e.g. ruler, thermometer, ...)

3B – Scientific Logic, [[quote principles, + Emp/CP, @ISM diagrams & asa3/science+details

{ iou – **This will be Slide 2** (of 2) **with "ideas about science"** }

note: I'll link to a section in my HomePage with details about Modes of Thinking in Science and Design.

2C-2D-2E, Design **Experiments**, Make **Predictions**, Make **Observations**.
is a failed Reality Check due to **Theory**? and/or **Predns? Obsrvns? Logic?** **Exp Design**?

Old+New, to **GENERATE** Ideas, + gather/get **OBS & PRED**,
old & new, **first-hand experience & second-hand exp**

w **Empathy**, @**DesignThinking** (eg **d.school-Stanford**)

#trlife, ~~binary~~ **status** range, levels of **conf** (expectn/goal isn't **proof**, is "**good way to bet**");
don't ask "where is the **proof**?" → what is the **support**? what is **evidence-and-logic**?

DIRECT using of Design Process:

e.g. **POE** (Predict-Observe-Explain) "fit well" with the Reality Checks of Design Process.

and teaching-SRL-with-DP, as in the "metacognition" section.

Below is a summary of the main ideas that are described-with-detail
in the next two slides. Later (iou) I'll write a better summary, so it
is fairly brief but **is long enough to clarify,** to help you understand the detailed ideas.

~~**STRUCTURES**~~ (for Instruction) **+** ~~**STRATEGIES**~~ (for Thinking)

(I don't think the line-above is necessary.)

STRUCTURES (for Instruction) **+** **STRATEGIES** (for Thinking)

When we combine models for instruction, we can creatively-and-critically decide

- how to design the best **structures (and-timings)** for using the models, and
- how to combine the best **Thinking Strategies** that we find in all of the models.

iou – **This final section** (blue slides) **now is the least-developed** in the PowerPoint. But I've thought a lot about the ideas, and **they're written coherently** (although with too many words) **in my HomePage, as described below.** The ideas **will be condensed here,** so it's easier for you to learn a lot in a little time, **for time-efficient learning.**

In my website about **Education for Problem Solving,**
a major part of the HomePage is asking
"**What kind of Knowledge-and-Skills Curriculum**
will produce optimal Whole-Person Education?"
where I examine reasons for saying “yes” or “no” to
using instruction that places more emphasis on **Problem Solving,** plus
developing & using **Cognitive-and-Metacognitive Thinking Strategies.**

This PowerPoint ends with useful information about **my Talk-Questions:**

During the talk,
I'll explain ideas and
we'll discuss POV-Questions:
When we **compare the perspectives of students and teachers,**
regarding my claims about reasons for "expecting gifted students
to be **excited** about using metacognition (generally) and (specifically)
to be **fascinated** with the logic-and-art in my model for problem solving,"

do you think students will be excited-and-fascinated?

how will teachers respond to the educational possibilities?

will students be "more motivated" to use metacognition?
(when we compare students & teachers, re: my claims)

teaching WITH metacognition and **teaching FOR metacognition:**

Most teachers are skilled in **teaching with metacognition**, by using **self-metacognition** plus valuable **other-metacognition,** i.e **empathy**.

Some aren't confident in **teaching for metacognitions** by modeling, explaining, encouraging **MC.** {but they can use their growth mindset with learning by PD, and on their own, and during classroom teaching.} A teacher can "learn enough" fairly quickly, and this will help students. Then they will gradually develop skills that are wider and deeper.

re: learning **Design Process,** if they look at Diagram 3 — and think "this is complex, it will be difficult to learn" — they will self-overcome their concern when realizing it's easy because **they will learn in steps** (with Diagrams **1** & **2**, then **3**) and due to **the logical organization of Design Process,** and with Recognition Learning when they recognize that **the PS-Actions of DP** are **Their PS-Actions** so they don't have to "learn" new ideas, they can just connect familiar PS-Actions to DP.

gifted students **enjoy thinking** and
expect it to be valuable part of their life,
→ they will be **motivated to learn-and-do Metacognition**,
for their own benefit.

Teachers mainly use metacognition for the benefit of students,
because a teacher's metacognition (for self + student-empathy)
will help them become better teachers.

many **gifted students:** **excited** about **exploring** **adventures of thinking.**
teachers **also excited** about adventure, but **have time-pressures.**
I could be wrong; **if my Personal Theory fails a Reality Check** (because
My Predictions don't match **Your Observations**) **I'll want to learn from you**.
Maybe... **students** tend to be in **EXPLORING MODE** (**seek adventures, Yes**);
and **teachers** tend to be in **FILTERING MODE** (**protect valuable time/life, No**).

I want to work cooperatively with other educators
to develop our ideas for improving education,
by creatively-and-synergistically combining
MY experiences-understandings-skills
with
YOUR experiences-understandings-skills.

This talk will be mainly about education for K-12 ,
but most ideas also can be used for college education
and lifelong learning outside school, before-during-after K-12.

If you find my ideas interesting — even if (maybe especially if)
you're thinking "**yes, but...**" because you **agree partially** (yes)
but **not totally** — of course that's ok, and it could help both
of us learn if we discuss your reasons for **yes** and also for **but**.

iou – A section about **Goal-Directed Designing of Curriculum & Instruction** will include these ideas:

Motivations plus Opportunities

We want our overall **Whole-Person Education** to achieve multiple goals – by helping students improve in a variety of ways, in many areas of life – so we want to design a **Knowledge-and-Skills Curriculum** that will help students improve their **Knowledge** and their **Skills** that include **Skills-with-Knowledge.** How?

According to a theory by David Perkins — "People learn much of what they have a reasonable **opportunity to learn** and **motivation to learn**" — we should give students **Motivations to Learn** (it's a focus now in the following "yellow slides"), and **Opportunities to Learn** (it's a focus later in the "blue slides").

Goal-Directed Designing of Curriculum & Instruction:

- DEFINE GOALS for a variety of desired outcomes in our CURRICULUM, for the Knowledge-and-Skills we want students to learn and improve.
- DESIGN INSTRUCTION with Learning Activities (plus Teaching Activities) that **provide opportunities for experience** with the knowledge & skills, and **help students learn more from their experiences.** The goals are to help students **get more** experiences, and **learn more** from experiences.

What kind of Knowledge-and-Skills Curriculum will produce optimal Whole-Person Education?

multiple goals and limited resources: Above I describe a common strategy for Goal-Directed Designing of Curriculum & Instruction, as in designing a Coordinated Wide-Spiral Curriculum using Instruction with Activities that are Fun and Personally Useful. When educators are doing their goal-directed designing, they want their overall Whole-Person Education to achieve multiple goals – by helping students improve in a variety of ways, in many areas of life – but they have limited educational resources (of time, people, money,…) so they must make tough choices about goals by asking “what resources should be invested in each kind of goal?”

Educational Teamwork with Matching Goals occurs when teachers' goals match students' goals; a teacher can achieve better matching by adjusting to students, and persuading students;

in effective Motivational Persuasion we consider all aspects of total motivation – intrinsic, personal, interpersonal, and extrinsic, all hopefully based on good values & priorities – that contribute to how a student thinks about their strategies-and-actions aimed at “getting what they want” in their whole life as a whole person; then we use words and actions to persuade students that we have good intentions (we care for them and are trying to help them improve their lives) and we are competent (in defining worthy educational goals, and helping students achieve these goals), and with words-and-actions we share our enthusiasm for the joys of thinking & learning.

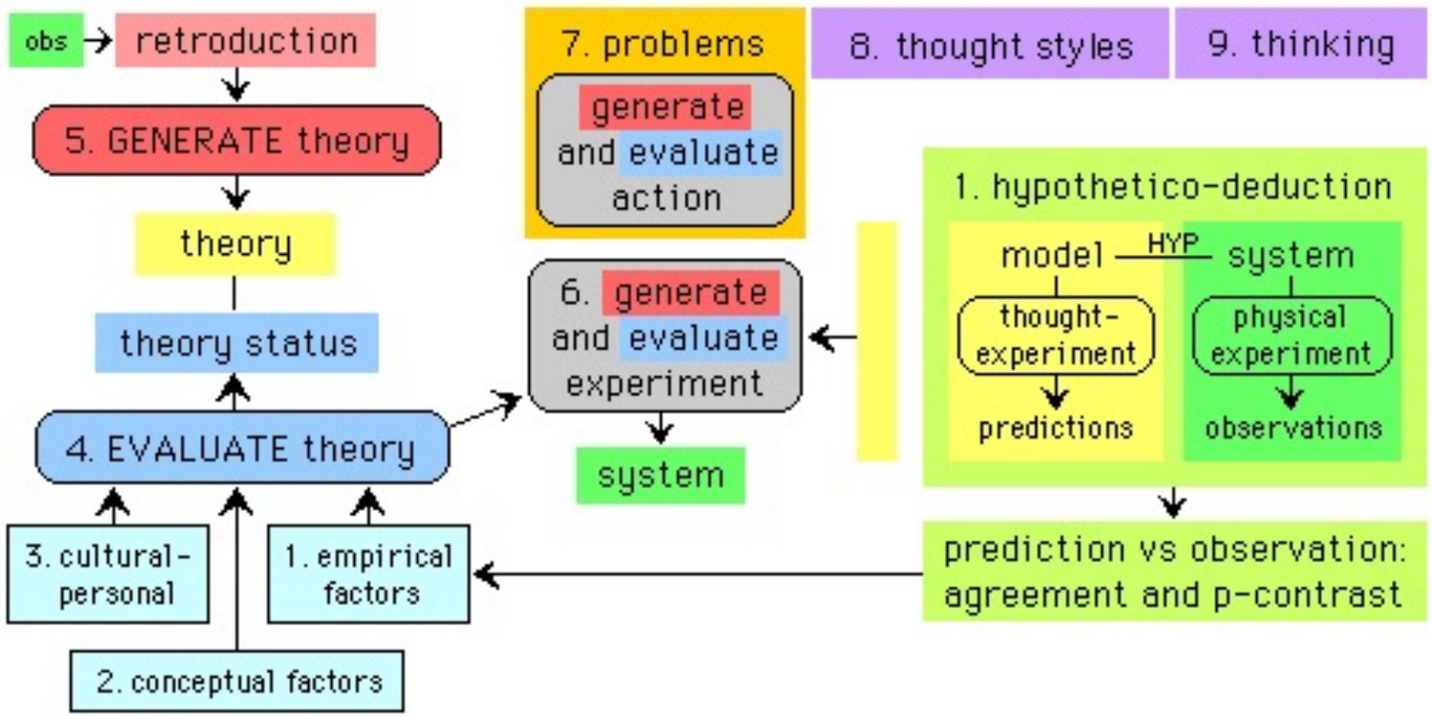
Please ignore the remaining slides, below here.

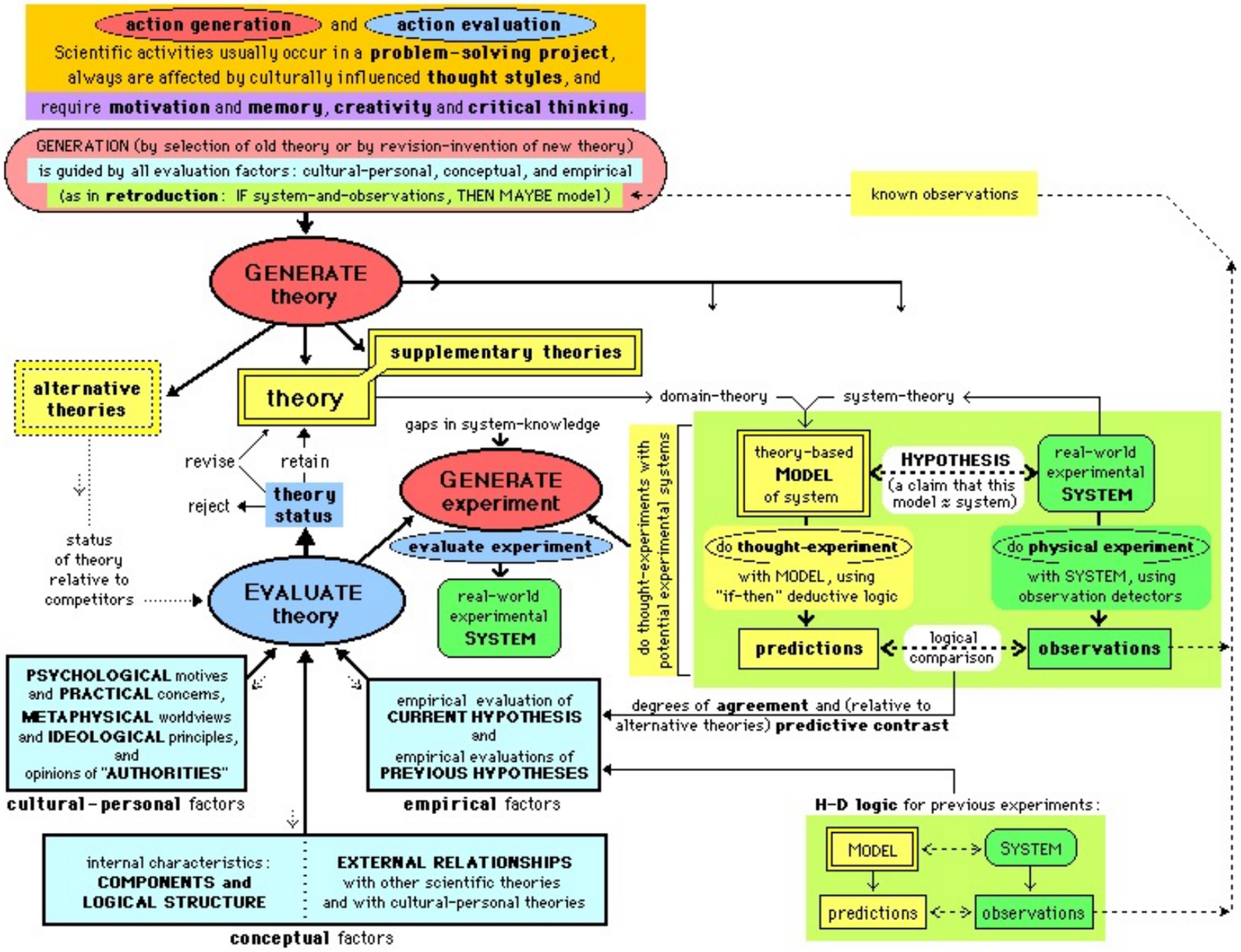
The rest of this PowerPoint is a temporary collection of ideas that **were cut from earlier versions.** Probably most will be permanently cut, but I want to "think a little more about them" before doing this.

This a condensed mini-version of the model I developed for my PhD Dissertation.
The next slide has the full-detail version of the diagram I made for

Integrated Scientific Method

that is described (briefly & deeply) in a collection of web-pages and word-documents.




action generation and action evaluation
Scientific activities usually occur in a problem-solving project, always are affected by culturally influenced thought styles, and require motivation and memory, creativity and critical thinking.
GENERATION (by selection of old theory or by revision-invention of new theory)
is guided by all evaluation factors: cultural-personal, conceptual, and empirical
(as in retroduction: IF system-and-observations, THEN MAYBE model)
known observations
GENERATE theory
supplementary theories
theory
alternative theories
domain-theory
system-theory
gaps in system-knowledge
revise
retain
reject
theory status
GENERATE experiment
evaluate experiment
status of theory relative to competitors
EVALUATE theory
real-world experimental SYSTEM
do thought-experiments with potential experimental systems
theory-based MODEL of system
HYPOTHESIS
(a claim that this model ≈ system)
real-world experimental SYSTEM
do thought-experiment
with MODEL, using "if-then" deductive logic
do physical experiment
with SYSTEM, using observation detectors
predictions
logical comparison
observations
degrees of agreement and (relative to alternative theories) predictive contrast
PSYCHOLOGICAL motives and PRACTICAL concerns, METAPHYSICAL worldviews and IDEOLOGICAL principles, and opinions of "AUTHORITIES"
cultural-personal factors
empirical evaluation of CURRENT HYPOTHESIS and empirical evaluations of PREVIOUS HYPOTHESES
empirical factors
H-D logic for previous experiments:
MODEL
SYSTEM
predictions
observations
internal characteristics: COMPONENTS and LOGICAL STRUCTURE
EXTERNAL RELATIONSHIPS with other scientific theories and with cultural-personal theories
conceptual factors

a summary of the previous slide:

the book ***How People Learn*** (commissioned by National Research Council in 2000 but still valid) says that – **to increase transfers** – we should "teach knowledge **in multiple contexts**" and "teach knowledge **in a form that's easy to generalize**"

and

both of these ("teach...") can occur with my model

for **Design PROCESS,**

for **Problem-Solving PROCESS.**

WHY does using Design Process **increase Transfers Across Areas?**

A) By using **broad definitions** for **Problems & Problem Solving,**
Problem-Solving **OBJECTIVES** include almost everything we do.

And in a second wide scope,

B) my model for **Design Process** **accurately describes** how we use
a similar Problem-Solving **PROCESS** for almost everything we do.

Terms: In my model,
Problem-Solving Process
is **Design Process**

I'll adjust the beginning of this topic-sequence by first explaining

- why Design Process has **a wide scope for Activities** & ~~Process~~;

followed by describing

- **my model for Design Process** (it's Problem-Solving Process),

plus the valuable strategy-skill of

- **metacognition** — what it is, how it's effective, ways to use it,

before continuing the **why-how-why** of the two wide scopes, with

- **why** Design Process has **a wide scope for** ~~Activities~~ & **Process;**
- **how** the wide scopes are educationally beneficial,
- **why**...

Then the topic-sequence will be **the same as in the previous slide.**

iou – during November 11-14, these two "rough draft" slides — that describe some basic concepts of metacognition — will be developed-with-details & revised; and I'll link to "MORE" in a section of my HomePage with details about MC.

metacognition (MC) often is defined as "thinking about thinking" but it's useful to define different types and levels: observe your thinking and **maybe think about it** and **maybe evaluate it** and **adjust it. MC-flexibilities** ("maybe" & "maybe") **are important** because **effective MC** requires **customizing MC,** re: **its types & amounts and timings.**

regulate your metacognition: stop-and-go, to **optimize Learning and/or Performing;** sometimes **stimulate** hi-quality **optimal L and/or P** by **using metacognition productively,** sometimes **allow** higher-quality **optimal L and/or P** by **avoiding metacognition,** when you "**go with the flow**" just **think-and-do** (~~think about thinking~~) with **fully focused attention .** maybe like **Inner Game of Tennis,** principle of "**Performance = + Potential – Interference**", or **mindfulness** when the metacognitive-Action is just to **observe,** not to **evaluate** or **adjust.**

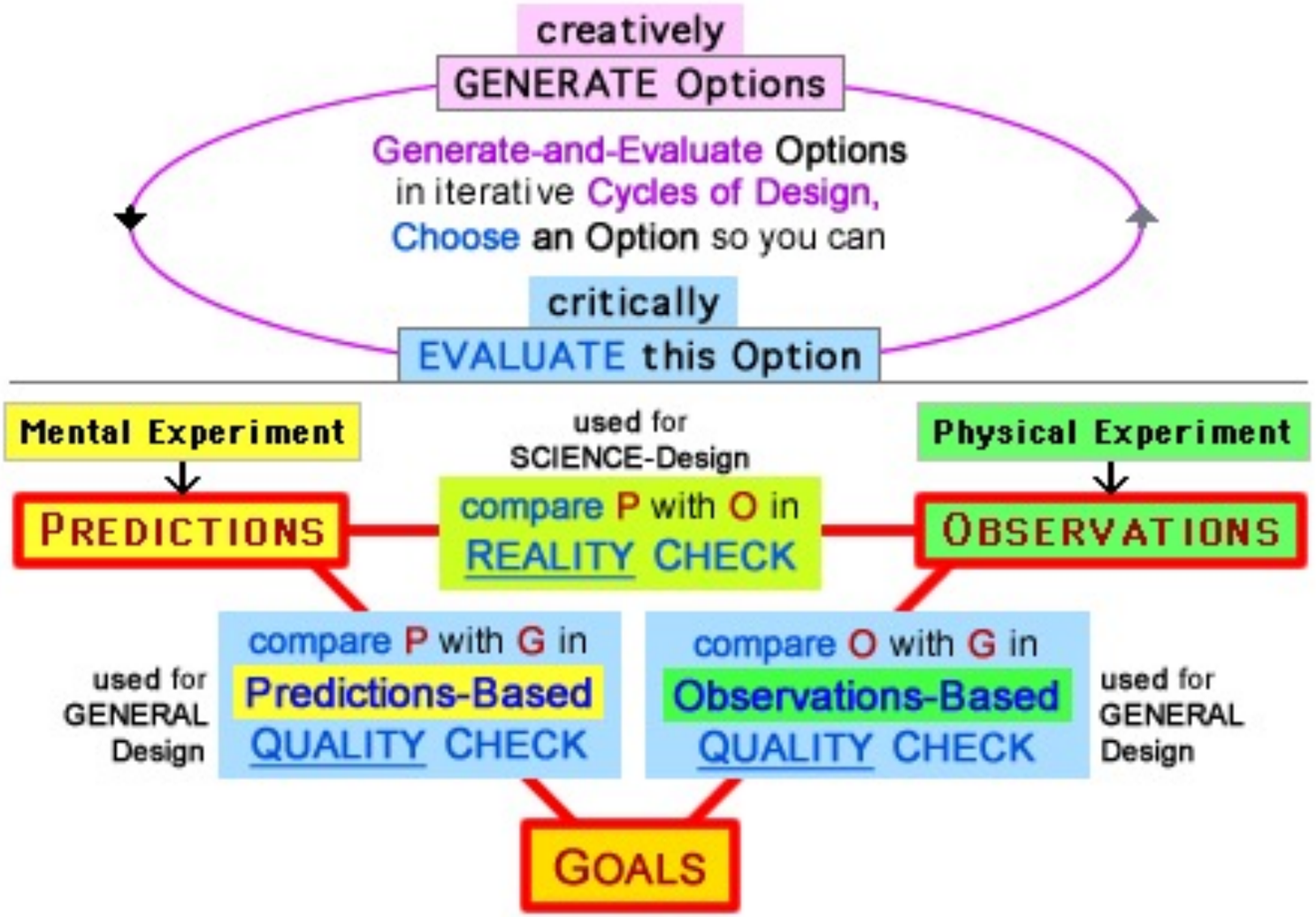
develop-and-use Metacognitive Knowledge: of TASKS + STRATEGIES + SELF.
e.g. one **Knowledge of Strategies** is to **know high value of self-testing (e.g. digital flash-cards).**

LEARN about your MC, know **when & how to use MC** of **different kinds** for **different purposes.**

a mystery: In this model for **Problem-Solving Process,** **why does the Cycle have a right-side arrow,** pointing from Evaluate to Generate?

Discovery Learning: observe (and think about) the **words** & **colors**, and **spatial relationships**.

Recognition Learning: think about **Your Actions** when you "**make something better**" to **solve a problem,** and you will recognize that **The Diagram-Actions are Your Actions**.



Use Metacognitive Thinking Strategies to improve Problem Solving and Learning

a presentation for OAGC in October 2025,
by **Craig Rusbult** – an enthusiastic educator
(with a PhD in C&I from U of Wisconsin)
who wants to find co-enthusiasts.

the summary of 50 words (+ a few more) in conference program:

Give students more experiences that are educationally useful, **and use metacognitive thinking strategies** (self-questionings, reflections, SRL, my problem-solving model,...) **to help them learn more from their experiences,** improve their knowledge and skills. **Use the wide scope of "problem solving" to build motivational transfer-bridges (from school into life) throughout the curriculum.**