

Meta-effectiveness, Effectance, Mindware and Other Key Concepts for Understanding the Development of Adult Competence

[Luc P. Beaudoin](#), Ph.D. (Cognitive Science)

Adjunct Professor of Education

Adjunct Professor of Cognitive Science

Simon Fraser University

EDB 7505, 8888 University Drive

Burnaby, BC V5A 1S6 Canada

LPB@sfu.ca

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<http://sfu.ca/~lpb/>

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This article presents a list of concepts that are important for understanding adult development of competence (including "learning to learn") but that have not received sufficient attention in the literature on self-regulated learning.

1. Key Insufficiently Used Concepts Related to Meta-effectiveness

The key concepts include

1. **Meta-effectiveness**: a term I introduced in *Cognitive Productivity* and defined as "the skills, dispositions and manifold underlying information-processing mechanisms [*mindware*] that enable and drive people to improve themselves."
2. **Architecture-based motivation**: an extremely subtle but essential concept introduced by Sloman (2009) to explain "top level" motivation; this is related to Allport's (1937; 1961) concept of *functional autonomy* and the concept of *intrinsic motivation*.
3. **Effectance**: a term coined by White (1959) to refer to the motivation to learn. It is well known amongst educational psychologists. However, I modernized the concept in *Cognitive Productivity*, specifying it in terms of architecture-based motivation. I also use the adjective *effectant* because English lacked a term for this concept.
4. **Fluid expertise**: introduced by Bereiter & Scardamalia (1993) to refer to the skills that enable one to (further) develop expertise; this is a core part of meta-effectiveness.
5. **Crystallized expertise**: also by Bereiter & Scardamalia (1993) to refer to the static expertise that can be used to solve problems that don't require further learning. I now also use the expression "stagnant expertise" for this, to draw attention to its dangers.
6. **Mindware**: term coined by Perkins (1995) to refer to the "stuff" of which the mind is made. It is the mental

analog to matter. I find it very strange that this term doesn't have greater explicit currency as it is fundamental to cognitive science. I realize that reductive philosophers would abhor it (when they weren't relishing criticizing it). It is as real as energy, money, and software are. In my book I distinguished several uses of this term (notably by Keith Stanovich). I relate this term to Popper's *World 2*. Unfortunately, this term was used with a completely different (*World 3*) meaning by Clark (2000, 2013).

It is difficult, and perhaps impossible, to adequately characterize, understand, and communicate about, how adults learn, and "learn to learn" without these concepts and terms to refer to them. Using an information processing framework, in [Cognitive Productivity: Using Knowledge to Become Profoundly Effective](#), I modernized some of the older concepts and introduced new ones. *Meta-effectiveness*, in particular, is a critical umbrella concept for the literature on the development of adult competence. It is the central concept of *Cognitive Productivity*. That book is structured as follows.

- Part 1 (on **Challenges to Meta-effectiveness**) presents the modern challenges and opportunities (IQ) intelligent adults face in learning with technology.
- Part 2 (on **The Cognitive Science of Meta-effectiveness**) marshals literature from cognitive science (broadly conceived) that is pertinent to understanding and improving meta-effectiveness.
- Part 3 (on **Solutions for Meta-effectiveness**) presents concepts and strategies that should be helpful for improving one's meta-effectiveness with information technology.

A central theme of my book is that adult development requires the development of affective mindware (underlying "motivation", "emotion", attitudes and the mental implementation of standards). The book in this respect is an offshoot of Aaron Sloman's [Cognition & Affect Project](#) that began at Sussex University and had its heyday at the [University of Birmingham](#). Why then do I emphasize "cognitive science"? I answer this question in chapter 1. But in a nutshell, I interpret the expression broadly to include all mental mechanisms. It's the core information processing metaphor that matters. Cognitive scientists can leverage data and theory from any discipline and on any aspect of mind.

2. Ancillary Concepts for Understanding Meta-effectiveness

Here are some ancillary concepts for understanding the knowledge-based development of competence in adults that, I believe, also deserve research attention. They, too, are developed in *Cognitive Productivity*.

1. **Knowledge gems:** In introduced this expression in *Cognitive Productivity* to refer to fragments of objective knowledge (in Popper's (1979) sense of the word) that are potentially helpful sources of competence. One needs to develop motive generators to detect them and respond with an inclination to master them (which doesn't mean one should try to master every knowledge gem one encounters).
2. **Capturing knowledge gems.** Extracting knowledge gems for use in problem solving, knowledge building and or productive practice.
3. **Productive practice:** A form of *deliberate practice* and *test-enhanced learning* for mastering knowledge gems

(developing mindware for them). I introduced the concept in Beaudoin (2011, 2014).

4. **CUPA**: Introduced in chapter 12 of *Cognitive Productivity*. A set of criteria for assessing knowledge resources according to their Caliber, utility, potency and appeal. We need empirical research on adults' tacit use of these concepts, and to measure the costs and benefits of various strategies to improve such assessment.
5. **Knowledge resources**. A conceptual artefact expressing knowledge. An objective input to knowledge building and personal development.
6. **Mindware development**. If there is mindware then there is the potential for mindware development, the mental changes effected during personal development/learning.
7. **Pedagogical utility**. Bratt (2007, 2009) introduced this term to designate the extent to which software facilitates instructional design, teaching and learning. (See *cognitive potency*.)
8. **Cognitive potency**. I use this expression to refer to a component of *pedagogical utility*. It is the extent to which software facilitates the comprehension and mastery of knowledge resources. An important use of information is to program one's mind with it. Learning, in this way, is a matter of mindware development! So it is not just knowledge that can be more or less potent: so can cognitive tools. Meta-effectiveness involves selecting cognitively potent tools, recognizing their limitations, and working around them.
9. **Delving**. This is a generic term for deeply processing any type of knowledge resources. English lacked an adequate superordinate term for reading, viewing (e.g., TED talks), listening (e.g., to podcasts or radio), attending (e.g., lectures), etc. It is an opposite of "skimming" or "speed reading". The term is sometimes colloquially used in this grammatically transitive way in the context of reading; but the concept had not previously been expounded technically as I did.
10. **Fluid rationality** [emphasis mine] encompasses the process part of rational thought—the thinking dispositions of the reflective mind that lead to rational thought and action." (Stanovich, West, Toplak, 2011, p. 798). This overlaps with effectance.
11. **Motivators** are internal information processing states containing *monitors* (Sloman, 1978; also known in AI as *daemons*) that drive purposive behavior. (Sloman, 1987; Beaudoin, 1994, 2014, 2015). Similar to Frijda's (1986, 2007) concept of *concerns*. A major challenge for educational psychology and cognitive science more broadly is to explain the deliberate development of motivators.
12. **Illusions of meta-effectiveness**. I introduced this expression as an umbrella for several classes of illusions (and point to the underlying cognitive biases) that interfere with meta-effectiveness, such as: illusions of (a) helpfulness of information (e.g., being distracted by information one takes to be helpful but isn't of sufficient caliber, utility or potency [see [CUPA](#)]), (b) comprehension; (c) future ability to recall information; (d) rationality. While there is scholarly literature on these cognitive biases, they have not yet been adequately studied as part of a meta-effectiveness framework. (I hope my book will spur such research.)
13. **RD cue mnemonic** (Reconstructible-discriminative cue mnemonic). This is a mnemonic system based on several key facts about memory and Norman & Bobrow (1979). Memory is cue driven. So to remember information it helps to remember a "path" to that information which discriminates amongst all other memories, which is the cue. Because of cue overload, that path needs to uniquely lead to the memory, as

opposed to being associated with multiple targets (which would lead to the fan effect). Arbitrary cues are difficult to remember. To be effective in memory strategies, they should be easy to reconstruct based on information in memory at the time they will be needed, i.e., they should be meaningful. Hence effective cues are reconstructible and meaningful. The RD cue mnemonic is part of the meta-effectiveness / productive practice toolkit described in [Cognitive Productivity](#). The skills and dispositions to use it can themselves be developed with practice.

Some of these concepts are important for all knowledge workers. For instance, we would all benefit from (a) the term "delving" to help us distinguish, in communication and in controlling and reviewing our own information processing, between shallow and deeply processing information; and (b) the term "knowledge gems", to help us focus our attention on very helpful information (and away from "seductive distractors"). Some are mostly pertinent to cognitive scientists.

Here is an [article of mine](#) containing excerpts from *Cognitive Productivity* that deal with effectance and meta-effectiveness.

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Footnotes

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