

### 4E Cognition Overview

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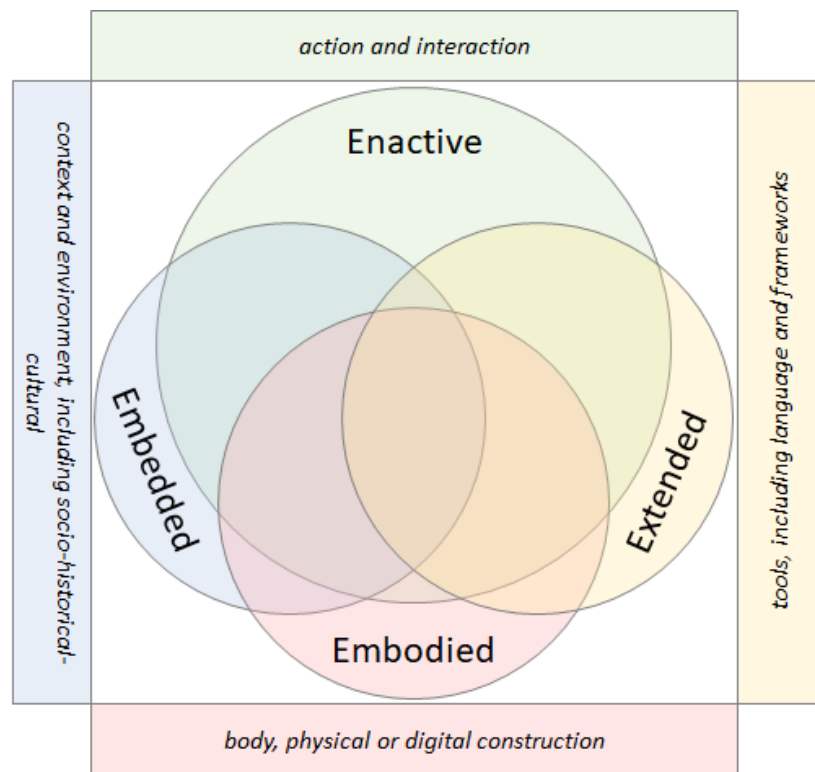
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4E Cognition is one of the dominant learning sciences perspectives, which states cognition (and therefore learning) is enactive, embodied, embedded, and extended (Steier et al., 2019). The prevalent model of cognition posits that cognition is located in the brain and that it can be explained comprehensively in terms of brain processes. 4E Cognition extends cognition beyond the brain, involving the body as well as the situation and interactions of the person within the environment. The brain, body and environment are a gestalt, and the dynamic relations among the elements allows us to develop a better understanding of cognition. The purpose of the 4E cognition schema is to provide a tool for describing the complicated action of cognition more clearly.

**Enactive:** The traditional conception is that cognition is a process that occurs within the brain through symbolic representations. However, the enactive perspective of cognition posits that the process is not located exclusively in the brain, but rather in action.

Thinking is distributed in interaction with others, the immediate context, and numerous other elements such as language, culture, and so on; therefore, it is impossible to isolate cognition. Furthermore, the enactive perspective problematizes the traditional focus on symbolic mental representations by locating cognition in actions and interactions. Cognition is emergent through the interactions and interdependencies of multiple elements in a complex dynamical system including neural activity, sensory-motor activity, multiple human beings, contextual features, tools, stories, language, and so on.



**Embodied:** Embodied theory argues that cognition extends beyond the mind and occurs in our actions, many of which involve our bodies. Vygotsky (1962) stated, “The word was not the beginning—action was there first.” Actions influence cognition in the same way that cognition influences the body. Embodied cognition researchers point out that it is not insignificant that the brain co-evolved with the body. For example, infants tend to participate in an exploratory practice known as mouthing—putting anything and everything in their mouths—which allows them to discover and learn through their senses. If humans had developed and evolved without particular body features (e.g., our hands), how we perceive



and interact with the world would be quite different. Treating the mind as embodied allows us to think of our actions as more than pre-planned processes insofar as how one acts may not be so opaque to others as we might think. For example, when you observe a friend reaching for their cup to take a drink, it is not a meaningless action. Conceptual metaphor theory (Lakoff & Johnson, 1999) argues that all human thoughts (including concepts) are grounded in analogy (“this current situation reminds me of prior experiences”) and that they can all be traced to bodily experiences. For instance, if you think about “making progress” and then monitor your own thinking, you might find yourself experiencing something like momentum or a forward (or upward) movement in space.

**Embedded:** The embodied mind cannot function in isolation from the physical, social, and cultural environment because the environment in which the mind exists is part of the mind. The mind is situated within a particular context that is defined by physical capacities and influenced by current concerns and goals. Furthermore, the environment in which the mind is embedded allows us to define affordances. According to James Gibson (1977), affordances are different possibilities for action. For example, the open bag of chips on my desk is perceived as being there for shoveling chips into my mouth. Both affordances and capacities should be understood in a relational manner. The water bottle that I pick up to drink from and quench my thirst would not afford picking up for the ants that would scurry across the desk (had I forgotten to clean up the crumbs); however, the water bottle could present other affordances such as a platform to walk on. The unique features of an environment provide unique affordances for cognition. These features include physical elements, cultural-historical structures, and social characteristics such as interpersonal relationships and interactions. Being afforded and constrained by these features, cognition has an intimate relationship with external artifacts. In order to achieve effective learning, learners need to coordinate their cognitive processes in concert with environmental resources (Pouw et al., 2014).

**Extended:** When dealing with a task, if an instrument outside of the mind functions as a process in which if it were done mentally would be recognized as cognition, then it should be considered part of the cognitive process (Clark & Chalmers, 1998). Extended theory researchers maintain that if certain artifacts aid an individual in the cognition process, whether a simple pen and paper or a complex computer, then these tools should be considered part of cognition. Many of our tools enable this kind of augmented cognition. The extended theory of cognition provides an approach to understanding learning, specifically scaffolding, through incremental adaptations. As an individual person figures out how to utilize the artifact in various circumstances according to their needs, the tool becomes a mediator by which to perform meaningful actions and interpret the world. Polanyi (1958) presents an example of a blind person to demonstrate that artifacts mediate cognition through incremental adaptation to different experiences. When a blind person holds a walking stick for the first time, their cognition is focused on the simple sensation of the handle; however, as they learn to negotiate through the landscape, using the stick to feel their way, their focus shifts from the feeling of the stick in their hand to using the walking stick to discern the obstacles in their path (Polanyi, 1958). In its simplest form, extended cognition theory suggests that there are some thoughts that are impossible for humans to think without the use of particular tools. Leveraging the affordances (different possibilities for action; Gibson, 1977) of particular technologies enables, facilitates, mediates, structures, and expands possibilities for cognition.

#### 4E Cognition - Learning Activity Design Principles

- Ensure that the majority of the time learners spend in the learning activity is spent in action and interaction.



- Help learners develop skills in identifying tools (including disciplinary tools, theoretical or conceptual frameworks, and language) through which to extend their thinking.
- Engage learners in physical (or digital) construction of things - the things they construct and/or the processes through which they construct them should embody their thinking and learning.
- Help learners develop skills in analyzing the relationships between the learning at hand and contextual features including relationships, physical environment, and socio-historical cultural elements.

## References

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