It's Not All in Your Head: Viewing Graduate Medical Education Through the Lens of Situated Cognition

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Consider the last time you sat down to begin a complex activity, such as writing a scientific article or crafting a persuasive letter to a colleague. When you started did you have, in your head, an exact outline of what you wanted to say and then transferred those ideas, verbatim, to your word-processing software? Or did you have a general idea of the topics you wanted to cover and, as you began writing, saw your text *emerge* as you typed and interacted with the software? In other words, did your final written document go directly from your brain to the virtual paper or did that text materialize as you wrote, revised what you wrote, and copied and pasted different sections of your text? If you are like me, the latter is a more accurate description of how complex activities, such as writing, occur in practice.

Now think about your last patient encounter, and ask yourself this same question: did you know ahead of time exactly what you wanted to say and do in the encounter, or did those details emerge in the context of the doctor-patient interaction? Although there is limited empirical evidence, I would argue that similar to writing and other complex human activities, most clinical encounters are dynamic events that emerge as doctors and patients interact in a clinical environment.

The processes described above can be explained by different theories of human learning. The fairly straightforward notion of taking a fully formed idea in one's head and transferring it to the virtual paper is closely related to an *information processing* description of how humans think and learn. In contrast, the description of a dynamic interaction between a whole person and his environment is closely linked to a quite different theory of how humans think and learn: *situated cognition*. The purpose of this editorial is to (1) describe situated cognition and contrast it to more traditional information processing theories, and (2) consider how situated cognition theory can be applied to teaching, learning, and research in graduate medical education (GME).

Situated Cognition Versus Information Processing Theory (TABLE)

Situated cognition (often referred to as "sitcog") is a contemporary theory of cognition that contends that all thinking, and thus all learning, must be viewed as *situated* within the larger context of the physical and social environment. From the sitcog perspective, cognition is not an internal process, knowledge is not an object, and memory is not a location; instead, cognition, knowing, and learning all take place as interactions between people and their environment.[1] Whereas a traditional information processing theorist might talk about "the world inside the head," a sitcog theorist would prefer to discuss "the head inside the world." While an information processing theorist might focus on mental representations of the world and the nature of input/output transformations, a sitcog theorist would prefer to focus on situations and the parts that people play. In particular, these theorists think of knowledge as resulting from human interactions with the world, and thus are concerned about the mutual accommodation between people and the environment.

In addition to these basic assumptions, sitcog theory emphasizes perception rather than memory as the primary means by which people learn. For sitcog theorists the process of understanding the world around us is not about storing and retrieving information from memory, but rather about perceiving and acting on the spot when necessary. From this perspective "remembering arises through interactions with the environment, and the concept of memory becomes nonexistent or irrelevant to an explanation of knowledge and learning, replaced by an emphasis on the tuning of attention and perception; that is, perceptual learning."[2(p44)] This understanding of perception is closely linked to the *ecological psychology* approach, which says that perception is a direct process and that information is detected, not constructed.[3] In accordance with this ecological approach, the collection of information provided by our sensory receptors is all we need to perceive anything.[4] Over time people learn to

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TABLE **Information Processing Theory Versus Situated Cognition Theory**

	Information Processing Theory	Situated Cognition Theory
How does learning occur?	- Learning is an individual process of acquiring and storing information in LTM	- Learning is a shared process of perceiving and acting - Thinking and learning make sense only within particular situations
What factors influence learning?	- Existing "mental models" in LTM - Previous experiences - How information is organized in the environment	- Authenticity of the learning environment - Multiple exposures to realistic situations
What is the role of memory?	- Information is stored in and retrieved from LTM - Humans are storage-retrieval systems (computer analogy)	- Memory, in the traditional sense, is deemphasized; perceiving and acting "on the spot" is underscored - Humans are perceiving-acting systems
Where does knowledge reside?	- Knowledge resides within individuals	- Knowledge resides in the actions of individuals and groups - Knowledge is distributed throughout the environment
What are the instructional implications?	- Help learners activate prior knowledge from their LTM - Provide structured and organized learning experiences that build from simple to more complex - Design learning materials that facilitate encoding into LTM	- Anchor all learning activities in authentic contexts - Present information in a variety of different ways - Do not oversimplify (or decontextualize) content - Engage learners in communities of practice with other, more experienced learners
What are the research implications?	- Study individuals, including their knowledge structures, prior experiences, and cognitive approaches to learning - Study characteristics of the learning environment that facilitate storage/retrieval of information to/from LTM	- Study the interactions (or "dynamic interplay") between individuals and their environment - Consider nonlinear and multilevel approaches to data collection and analysis - Use a variety of assessment tools to assess thinking, learning, and performance

Abbreviation: LTM, long-term memory.

"tune" their attention and perception such that they more efficiently interact with their environment. Thus, through this lens, humans are viewed as perceiving-acting systems, as opposed to storage-retrieval systems.[5]

Learning From a Situated Perspective

To understand learning, sitcog theorists always consider 2 components: the person and the context. From this perspective, knowledge and intelligence are conceptualized as the *interaction* between the person and the context, and consequently, sitcog theorists place equal emphasis on the person and environment.[2] Knowledge is conceptualized as being located in the actions of individuals or groups of individuals and evolves as we work our way through new situations. In real-world situations knowledge is not solely contained within a single individual or group of individuals. Instead, knowledge is distributed throughout the environment in people, computers, books, and other tools or instruments.[2] Additionally, "each individual's goals, values, and beliefs interact with these distributed sources of information, so that each person's experience in the situation is unique."[2(p46)]

Implications for Teaching and Research in GME

The primary instructional implication of a sitcog perspective is that *all learning should be situated in authentic contexts*. Contexts are truly "authentic" if they share some of the important aspects of real-world problems, including being ill structured, having complex goals, and containing collaborative activities among learners and practitioners in society.[2] Problem-based learning environments, such as those used in some medical schools, are examples of sitcog theory in practice. Moreover, almost all clinical teaching takes place in an authentic environment, within clinics, hospitals, and medical centers. In these settings an apprenticeship model of teaching and learning is an instructional exemplar of a sitcog perspective.[6] Problem-based learning activities and apprenticeships give trainees the opportunity to learn, in context, while solving ill-structured problems that possess multiple solutions or solution paths.[7] In so doing these learning situations give individuals the opportunity to construct extensive, flexible knowledge by integrating information across multiple domains, instead of learning decontextualized facts. Trainees who learn by solving complex problems develop extensive, flexible knowledge that is more easily retrieved and applied under varying conditions: they are able to transfer their learning to novel situations.[8]

In medical education research, a sitcog perspective means that research investigations must consider more than just individuals and what they think, feel, and do. Instead, research paradigms should be more inclusive, by taking into account educators, trainees, and patients, and the interactions (or "dynamic interplay")[1] between them.

Mennin[9] has described this type of inquiry as the study of *relationship-center learning* whereby "The quality of the exchange between things [teachers and learners] becomes more important than the things themselves. Teaching and learning are seen as relational…"[p164] Moreover, research paradigms must attend to the specifics of the clinical learning environment and the influences this environment might have on thinking and learning. It is important to recognize that understanding the complexity of dynamic clinical environments is challenging: using simple research designs, such as cross-sectional questionnaires or survey designs, is unlikely to elucidate if and how learning occurs in such environments. Qualitative methods and mixed-method designs (designs that include both qualitative and quantitative methods) can be particularly illuminating when trying to understand thinking and learning as it occurs in actual practice.[10]

Durning et al[11] provide an instructive example of a research project grounded in sitcog theory. In this mixed-method study the researchers explored the influences of selected contextual factors on clinical reasoning performance in internal medicine experts (board-certified internists). They did so by constructing and collecting validity evidence for a series of videotapes portraying different chief complaints for 3 common diagnoses seen in internal medicine. The researchers then modified selected contextual factors—patient, encounter, and/or physician factors—in each videotape and examined how these factors influenced clinician performance. Consistent with the sitcog perspective, this work focused on more than just the individuals in the study by examining the multilevel influences of the contextual factors. The study also used a variety of tools to assess performance, including a think-aloud protocol, survey instrument, time-stamped activity data, and objective assessment of diagnostic performance. Using a variety of assessment tools aligns well with the sitcog assumption that knowledge is not solely contained within a single individual but instead emerges as people interact with their environment. Capturing this type of complexity necessitates the use of multiple assessments focused on different factors and levels of analysis.

Concluding Thoughts

To truly comprehend complex human activities—such as writing a scientific paper or interacting with a patient during a clinical encounter—a broader perspective on how humans think and learn is required. Traditional information processing theories are incomplete and fail to capture the dynamics of human endeavors, particularly social endeavors. Situated cognition is an expansive theoretic model that can inform us about how real people, including physicians in training, think and learn in authentic contexts. Therefore, the editors of *JGME* join with other scholars[6,9] in encouraging GME educators to explore sitcog theory and consider how this theoretic framework might be used to enhance education and research in GME settings.

Recommended Readings

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