# Fostering the Development of Master Adaptive Learners: A Conceptual Model to Guide Skill Acquisition in Medical Education

William B. Cutrer, MD, MEd, Bonnie Miller, MD, Martin V. Pusic, MD, PhD, George Mejicano, MD, MS, Rajesh S. Mangrulkar, MD, Larry D. Gruppen, PhD, Richard E. Hawkins, MD, Susan E. Skochelak, MD, MPH, and Donald E. Moore Jr, PhD

## Abstract

Change is ubiquitous in health care, making continuous adaptation necessary for clinicians to provide the best possible care to their patients. The authors propose that developing the capabilities of a Master Adaptive Learner will provide future physicians with strategies for learning in the health care environment and for managing change more effectively. The concept of a Master Adaptive Learner describes a metacognitive approach to learning based on self-regulation that can foster the development and use of adaptive expertise in practice. The authors describe a conceptual literature-based model for a Master Adaptive Learner that provides a shared language to facilitate exploration and conversation about both successes and struggles during the learning process.



The rapidly changing context of health care delivery is creating what some call an ongoing "knowledge and skills gap" between what people know at one moment and what they will need to know at the next moment in order to be successful in their everyday lives and the workplace.[1] These circumstances require clinicians to develop the expertise to function efficiently on everyday tasks, but also to create solutions for novel workplace challenges.[2]

### Adaptive Expertise for the Health Professions

The predominant work of clinicians in their daily practice is problem solving.[3–5] In most cases, clinicians will possess the necessary knowledge and skills to address problems directly. There will be times, however, when clinical decision making will require new learning and innovative solutions to deal with problems. In an effort to explain these circumstances, scholars have drawn on the difference between routine and adaptive expertise.[6,7] Routine expertise involves mastering performance to the extent that it becomes highly efficient and accurate, drawing on the specific knowledge and skills that an expert has learned over time. With repetition (ideally with feedback[8]), performance becomes increasingly automatic and is characterized by speed and accuracy reflecting the traits of an expert at the mastery stage in the Dreyfus brothers' conceptualization of expertise.[9] Adaptive expertise is different. It seeks to balance the efficiency of routine expertise with more effortful learning and innovative problem solving.[2,7] A clinician is using the skills of adaptive expertise when she recognizes that a "routine" approach is not working optimally and reframes the problem in a way that allows her to explore new concepts (learn) and invent new solutions (innovate). Clinicians able to demonstrate both types of expertise have developed the capability to work within an "optimal adaptability corridor," where they balance the efficiency and innovative dimensions of problem solving[10] (see Figure 1).

Adaptive expertise is based on the ideal that individuals will learn and innovate in response to practice challenges. Reports have suggested that many clinicians may not be learning effectively in practice, making it difficult to employ adaptive expertise.[11,12] These clinicians may not be learning effectively in practice because they have not been "prepared for future learning."[11,12] Preparation for future learning (PFL) is described as the capacity to learn new information, make effective use of resources, and invent new procedures to support learning and problem solving in practice.[10] Adaptive expertise requires (1) an openness to reflecting on practice, (2) meta-reasoning skills to recognize that routine expertise schema stored in long-term memory will not work, (3) critical thinking to challenge current assumptions and beliefs, and (4) the ability to reconstruct the problem space.[6] PFL enables clinicians to access encapsulated knowledge that contains basic science and clinical principles that help them develop innovative solutions to challenging novel problems.[13–15] In this way, they can function effectively within the "optimal adaptability corridor," balancing the efficiency (routine expertise) and innovative (adaptive expertise) dimensions of clinical problem solving.

To provide the best possible care to their patients in a highly complex, continuously changing health care environment, clinicians need to be prepared for future learning (i.e., PFL) so that they can balance routine and adaptive expertise in the optimal adaptability corridor. Training must begin during undergraduate medical education to ensure readiness for learning (i.e., PFL) and that individuals develop the skills and processes necessary to learn effectively in the workplace. Building on previously described PFL-related behaviors[12] such as asking pertinent questions, using resources that lead to practice change, and strategically seeking feedback, as well as other critical skills identified from the literature, we propose a conceptual model for a Master Adaptive

Please see the end of this article for information about the authors.

Correspondence should be addressed to William B. Cutrer, 5121 Doctors' Office Tower, 2200 Children's Way, Nashville, TN 37232; telephone: (615) 936-3968; e-mail: Bill.Cutrer@Vanderbilt.edu; Twitter: @BillCutrerMD.

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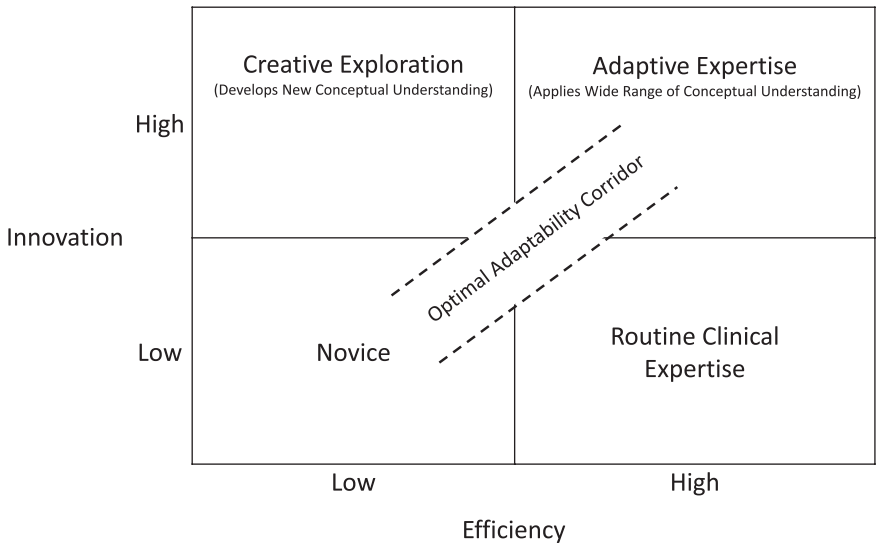


**Figure 1** Balancing routine and adaptive expertise in the optimal adaptability corridor. Adapted with permission from Bransford J, Barron B, Pea RD, et al. Foundations and opportunities for an interdisciplinary science of learning. In: Sawyer RK, ed. The Cambridge Handbook of the Learning Sciences. New York: Cambridge University Press; 2006:27.

Learner who will function effectively in the optimal adaptability corridor.

## The Master Adaptive Learner—A Conceptual Model

The authors, associated with the Accelerating Change in Education project of the American Medical Association, developed a conceptual model to guide efforts in fostering medical student development of the skills and process necessary for learning and working effectively within the optimal adaptability corridor. Drawing on the research and conceptual literature in medical education and the learning sciences, we created a model of the Master Adaptive Learner.[16–27] In addition, the model was also informed by the Practice-Based Learning and Improvement competency domain of the Accreditation Council for Graduate Medical Education and the American Board of Medical Specialties, and by the plan–do–study–act cycle used for continuous quality improvement.[28,29]

We propose an integrated process that a Master Adaptive Learner would use to learn in practice which has four general phases: *Planning*, *Learning*, *Assessing*, and *Adjusting*.[17] The major components of the Master Adaptive Learner process (*Planning*, *Learning*, *Assessing*, *Adjusting*) are represented by four phase gears in the center of Figure 2. We present these components at two different levels of detail in Figure 2 and in Figure 3, which depicts the skills necessary to perform the stages of learning within each phase. While the diagram suggests that the process follows a lockstep, sequential progression, the process is much more iterative, moving among the four phases as issues are resolved and new questions emerge. In the sections that follow, we break down each of the four main phases and highlight the relevant research evidence.

### Planning phase

The Planning phase incorporates three stages (identifying a gap; selecting an opportunity for learning; and searching for resources for learning). In the initial stage, identifying a gap between what is and what should/could be, the learner becomes aware that something in her practice is "not right," requiring an innovative solution. This awareness could be the result of what Schön called a "surprise," a sudden intuitive realization.[30] External feedback and formal performance review can also highlight gaps for learners at multiple levels. Recognition and thinking about the gap produces a feeling of cognitive dissonance that causes the learner to search for a solution to reduce the feeling of discomfort.[31] When an individual determines that the dissonance is related to her knowledge deficits, she is likely to search for learning activities that will reduce the discomfort.[31–33] Another way to describe what happens during this stage is to say that a "teachable moment" is recognized. A teachable moment is defined as the time when a learner's psychological readiness for learning is highest.[34]

The strength and persistence of the teachable moment will determine whether an individual will consider learning as a way to address it and move to the next stage: searching for resources for learning.[35] Furthermore, if the individual perceives learning and the results of learning to be straightforward, easy to achieve, and in the best interest of her patients, she would be more likely to pursue learning.[36]

The ability to ask thoughtful questions, prioritize the answers, and set goals is essential for entering the learning cycle and moving to the next phase. Skillful *questioning* includes both the ability to critically question observations as well as focus on specific issues. A Master Adaptive Learner makes a habit of inquisitively examining a situation from multiple perspectives seeking to understand the "what," "how," and "why" of the given situation.

*Prioritization* is a crucial skill for helping individuals select and plan an opportunity for learning. Addressing all gaps related to patient care is a worthy goal, but not feasible. Fox and colleagues[36] created a taxonomy of change based on the size and complexity of change that can be used in priority setting. A Master Adaptive Learner could consider this taxonomy as a way of prioritizing identified gaps during the Planning phase to help make decisions about matching benefit with effort. *Accommodations* are small, simple changes such as changing the dosing regimen for a given antibiotic. *Adjustments* are small- to moderate-size changes that require more time and effort to make, such as adopting a new ventilator mode for a select patient population. *Redirections* require significantly larger alterations to a practice, such as restructuring the way clinic staff screen diabetic patients for appropriate vaccinations. *Transformations* are large, complex changes that often require restructuring and redefinition of many elements of a practice, such as changing from an open operative approach to a laparoscopic approach for cholecystectomy.

*Goal setting* is an important part of planning and self-regulating learning.[17] Setting goals provides individuals with an explicit and intentional focus for learning. Having a specific goal will allow the individual to learn without becoming overwhelmed with all of the

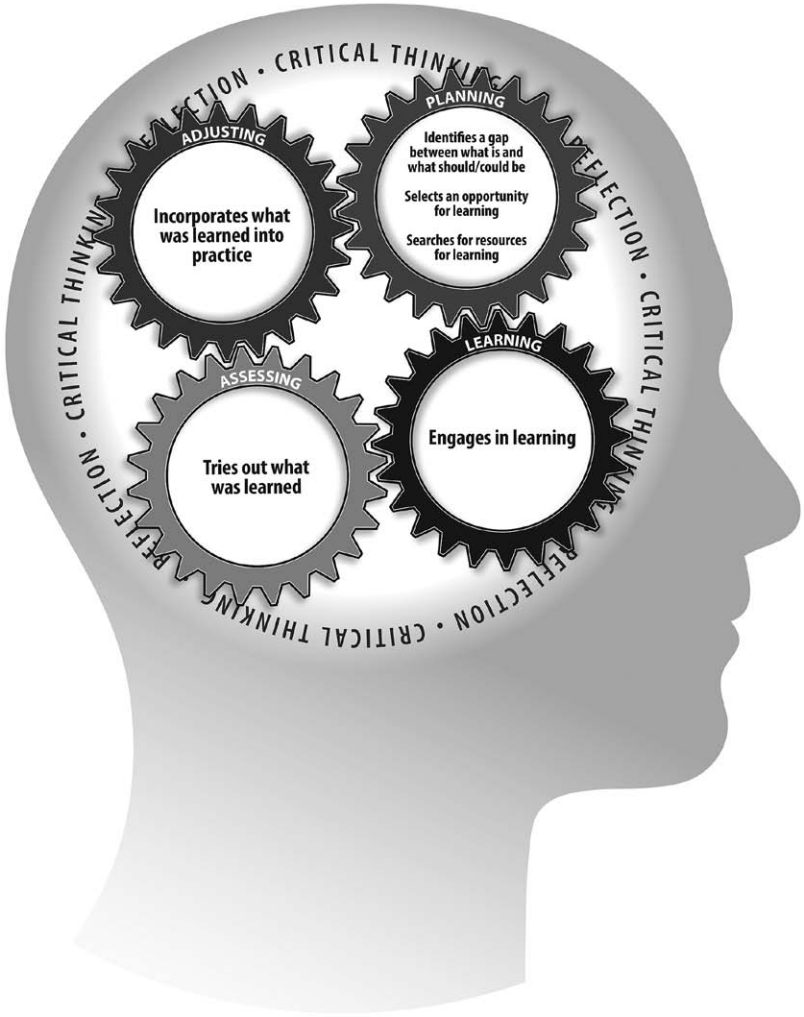


**Figure 2** Inside the mind of the Master Adaptive Learner.

different directions and content that might be available. The best goals move past focus on task accomplishment and simple instructional aims of a given situation, to knowledge-building goals which are progressive and aim at deeper understanding.[22]

Once a goal or set of learning goals has been created, the next stage is identification of learning resources. Learning resources include human and material resources that provide clinicians with the facts, principles, and experiences necessary to achieve these goals.[37] Physicians prefer learning resources that are familiar, accessible, clinically relevant, and time-efficient.[38] A successful search for learning resources should be framed by the learning goals. *Searching* includes more than the ability to search the literature. It also includes the broader consideration and discovery of formal, informal, and incidental learning opportunities. Again, the strength and persistence of the feelings of cognitive dissonance will determine how strongly an individual will search for learning resources as well as pursue and persist in learning.[35] Individuals may use any one or several of these learning resources at any time, but it is during the Learning phase that their use is more focused and structured.

**Learning phase**

After the Planning phase, the individual will begin to engage in the Learning phase. This is a period of intense focus in which she wrestles with internalizing her new understandings that address her identified gap in knowledge, skill, or attitude. During the entire process, she manages the combination of resources that she finds most effective to reduce the dissonance that started the process.[39]

One of the questions a learner would ask during this phase focuses on the degree to which evidence supports what she is learning. It is important that the selected learning resources addressing the knowledge gap are based on evidence. Being able to *critically appraise* different sources is an essential skill at this stage of learning.[40]

In addition, during the Learning phase, the individual will have to guard against using ineffective learning strategies. *Learning strategies* such as re-reading, highlighting and underlining, or cramming have been shown to be ineffective, but often follow medical students through residency training to practice. Master Adaptive Learners should employ more effective strategies, such as knowledge retrieval practice, spaced repetitious learning, calibration, elaboration, and concept interleaving.[41–44] These strategies take more effort but lead to learning that is deeper and more durable.[45]

**Assessing phase**

During the Assessing phase, the individual will try out what she is learning. She begins to use the new knowledge, skills, or attitudes to address the initial challenge and, in doing so, begins to form an opinion about its effectiveness. She then decides to accept or reject it. She experiments in the practice setting while confirming the benefits of what she has learned with external perspectives. This phase begins with the individual being uncomfortable with her new capabilities, but as she progresses through the phase, she becomes more confident and skillful.[46,47] The stage ends when she is sufficiently comfortable with the newly learned skills and knowledge and they start to become second nature.

*Self-assessment* is a critical skill during the Assessing phase. The evidence suggests that unguided self-assessment by medical trainees and clinicians is not accurate.[48–51] It has been described as the "process of interpreting data about our own performance and comparing it to an explicit or implicit standard."[52] *Informed self-assessment* has been described and suggested as an alternative.[53,54] One of the keys to informed self-assessment is *external feedback* which is described as "clear, timely, specific, constructive feedback, preferably offered by trusted, credible supervisors in a safe environment, to inform a clinician's self-

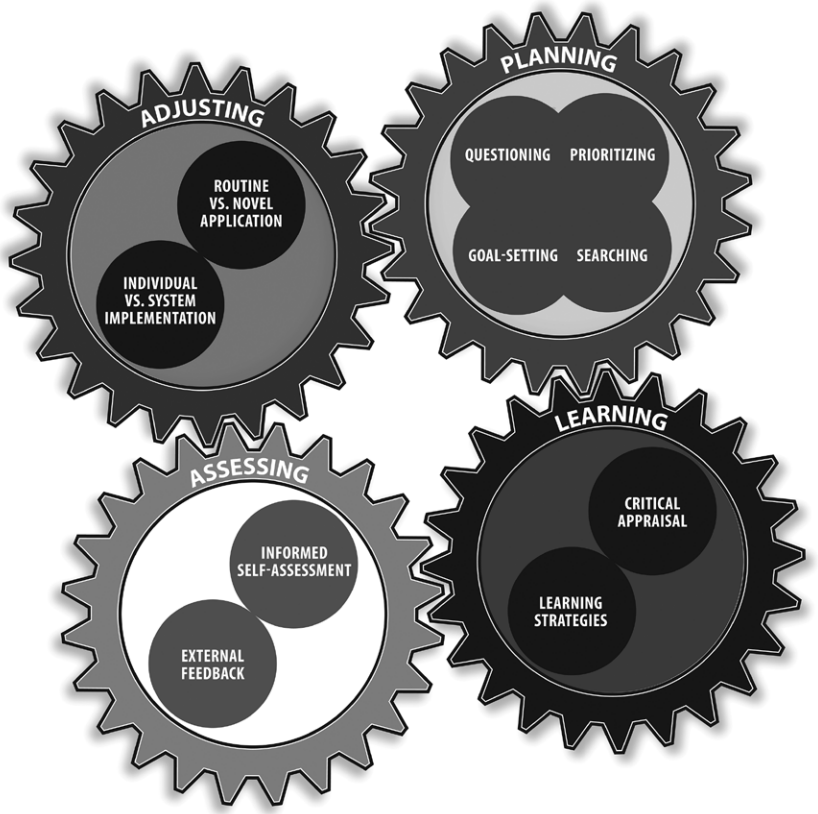


**Figure 3** Skills of the Master Adaptive Learner.

assessment."[53] Informed self-assessment and external feedback go hand in hand as a clinician tries out what she learned and makes the determination to accept or reject the new learning. If she accepts the new learning as effective, she moves on to the final phase of making adjustments in practice.

### Adjusting phase

During the final Adjusting phase, an individual will incorporate what she has learned into her daily routines; it will become a part of the routine that she uses to manage her patients. At this point, she must consider how new knowledge and skills will impact the day-to-day operations of her practice. She must consider the types of problems where the new learning is relevant. Will the individual use her new learning to solve routine problems, such as the new antibiotic regimen for a known infection? On the other hand, if the new learning were to be applied to a novel problem facing the clinician, deeper understanding of that novel problem and potential impacts of applying the new learning would need to be considered. Reexamining new learning through the lens of the type of problem to be addressed, *routine vs. novel*, necessitates a broad consideration of opportunities and barriers to adjusting her practice.

The implications of applying her new learning in the clinical workspace are considerable. The learner must consider whether the change needed is at the individual or system level. Determining *individual vs. system implementation* reconnects with her earlier assessment of scope of change needed during the Planning phase: accommodations, adjustments, redirections, or transformations. When system-level changes are needed, failure to consider the opportunities and barriers of a larger system implementation will make adjustments based on the individual's new learning less likely to succeed.

The Adjusting phase is more difficult for early learners given that they do not control office functioning or systems of care. Learners at these levels can still consider the impact of sharing their new learning with other members of the health care team.

## Cognitive Skills Needed Throughout the Master Adaptive Learner Process

Surrounding the gears of the individual learner's mind in Figure 2 are two cognitive skills that are essential to learning in practice and span every phase of the learning process: critical thinking and reflection.

*Critical thinking* is defined as the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.[55,56]

The second cognitive skill needed throughout the Master Adaptive Learning process is *reflection*. Reflective skill can be defined as

> a metacognitive process that occurs before, during and after situations with the purpose of developing greater understanding of both the self and the situation so that future encounters with the situation are informed from previous encounters.[57]

This skill, more than any other, allows clinicians to maximize the learning benefit from various experiences and workplace encounters. Combining critical thinking and reflection allows a learner to be intentional about their own learning and to understand whether the learning is effective.

## Conclusion

Because health care is changing rapidly, training students and residents has to change as well to provide them with the skills necessary to learn, adapt, and thrive in the new environment. We provide this conceptual model to help medical students and residents develop the skills to become Master Adaptive Learners. We hope that this shared conceptual model will facilitate conversation between teachers and learners that allows for the analysis and diagnosis of learning struggles, as well as motivate individuals to be more effective and impactful in learning that improves the delivery of high-quality health care. Additionally, we believe that working from a shared conceptual model will also allow for a robust and unified research agenda to guide deeper understanding of the

interaction between the clinician, her skill as a learner, and the clinical working–learning environment.

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**W.B. Cutrer** is assistant professor, Department of Pediatrics, Vanderbilt University School of Medicine, Nashville, Tennessee.

**B. Miller** is senior associate dean for health sciences education and executive vice president for educational affairs, Vanderbilt University School of Medicine, Nashville, Tennessee.

**M.V. Pusic** is assistant professor of emergency medicine and director, Division of Learning Analytics, NYU School of Medicine, New York, New York.

**G. Mejicano** is senior associate dean for education, Oregon Health & Science University, School of Medicine, Portland, Oregon.

**R.S. Mangrulkar** is associate dean for medical student education, University of Michigan Medical School, Ann Arbor, Michigan.

**L.D. Gruppen** is professor, Department of Learning Health Sciences, University of Michigan Medical School, Ann Arbor, Michigan.

**R.E. Hawkins** is vice president, medical education outcomes, American Medical Association, Chicago, Illinois.

**S.E. Skochelak** is group vice president, medical education, American Medical Association, Chicago, Illinois.

**D.E. Moore Jr** is professor of medical education and administration and director, Office for Continuous Professional Development, Vanderbilt University School of Medicine, Nashville, Tennessee.

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