Adaptive Learning for Change and Uncertainty: Preparing Tomorrow's Medical Professionals

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Abstract: Today's physicians must be equipped to address the changes and complexities in healthcare. This study focused on medical educators' experiences and understanding of the Master Adaptive Learner (MAL) model, which uses a metacognitive approach to teach physicians to develop adaptive expertise to manage change and uncertainty effectively. Findings included five major themes that describe how medical educators prepare future-ready physicians with guidance from the model. Using a Futures Literacy (FL) framework, the research supports the need for adaptive and futures learning in medical education to develop physicians equipped with adaptive expertise and skills to anticipate the future.

Keywords: adaptive learning, futures literacy, medical education, master adaptive learner (MAL)

The medical education curriculum currently focuses on teaching and assessing isolated knowledge and often the information medical students learn early in medical education changes upon entrance to residency and even more upon entrance into practice, thus creating a gap between what society needs from physicians and what medical education provides (Mylopoulos, 2020; Papanagnou et al., 2021). As the curriculum is developed and updated, it is necessary to envision what the healthcare system will look like 10, 20, or 30 years from now, what the future generation of medical providers will look like, and how educators can address these issues today (Chen, 2017).

Shifting from an educational model that fosters the traditional physician's role to a role that meets the current and future needs of patients, the healthcare system, and society is essential to 21st-century medical education (Borkan et al., 2021; Schiavone & Ferretti, 2021; Skochelak et al., 2021). Cutrer et al. (2017) developed the Master Adaptive Learner (MAL) model in response to the need for adaptive expertise in medical education. The MAL model teaches future physicians metacognitive and adaptive skills to address uncertainty and novel challenges within the clinical practice (Cutrer et al., 2019; Skochelak et al., 2020). The MAL model approaches lifelong learning through self-regulated learning to create a shared mental model for learners and educators to foster deeper understanding and knowledge (Cutrer et al., 2018).

Despite the knowledge of the importance of adaptive expertise and adaptability, there is limited research on adaptive expertise in medical education. Research is even more limited regarding medical educators' personal experiences teaching and learning adaptive expertise through the MAL model (Kua et al., 2021). Additionally, there are few standards for preparing educators to teach the phases of the MAL model (Wolff et al., 2021). The findings from this study identify teaching strategies and educator experiences for teaching aspects of the MAL model, including

barriers and facilitators to teaching MAL, and contribute to the literature on the growing use of adaptive learning in medical education.

Literature Review

Based on self-regulated learning, the MAL (Figure 1) model trains learners to develop skills of adaptive expertise that include flexibility, openness to change, and learning new concepts and solutions. Adaptive expertise is developed through curiosity, motivation, a growth mindset, and resilience, all essential to the MAL model. Adaptive experts balance treating a patient through routine treatment, which emphasizes efficiency, and novel treatments, which emphasizes innovation. Although adaptive expertise requires efficiency and innovation, they work together to develop adaptiveness (Mylopoulos & Woods, 2017).

Figure 4
The Master Adaptive Learner Process
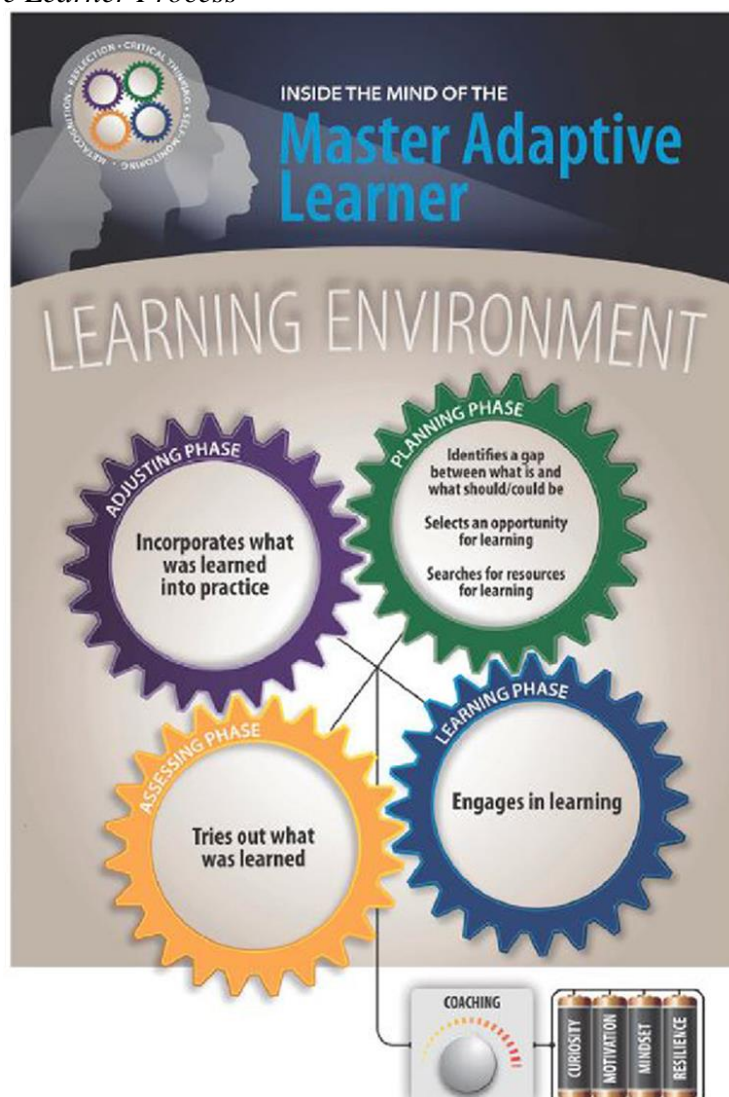
Note: The phases and characteristics of the Master Adaptive Learner model are shown. The characteristics are depicted as batteries driven by coaching, which power the 4 phases of the

model. From "Exploring the Characteristics and Context that allow Master Adaptive Learners to thrive," by W.B. Cutrer, H. G. Atkinson, E. Friedman, N. Deiorio, L. D. Gruppen, M. Dekhtyar, and M. Pusic, 2018, *Medical Teacher, 40*(8), p. 2

As the healthcare system changes rapidly, routine approaches to problems will soon be replaced by new and innovative approaches (Pusic et al., 2018; Pusic, 2020; Schiavone & Ferretti, 2021). To prepare future physicians to develop adaptive skills, medical educators must shift from an educational model that favors routine expertise to a model that promotes adaptive expertise. Guided by the notions of efficiency and innovation, adaptive experts must become comfortable with learning through experimentation, uncertainty, randomness, and challenging the status quo. Adaptive expertise is not simply increasing one's expertise; instead, it is a developed capability that fosters an adaptive mindset to learn for the unknown future (Pusic et al., 2018).

Futures literacy is a capacity to view change as a resource to question predisposed actions and seek a new and innovative present that allows people to envision the future based on present action (Miller, 2018). Describing futures literacy as one's ability to imagine, Miller (2015) argues that futures literacy as a capacity includes awareness, discovery, and choices (Häggström & Schmidt, 2021). Futures literacy creates a vision of how something will happen, guiding action in the present. Futures literacy specifically addresses the issue of developing individuals' relationships with the future beyond the predictable or known futures to being able to anticipate and use the future to create better futures (Fleener, 2022). Thus, futures literacy focuses on "using the future" in the present to anticipate uncertainty and guide a response to novelty (Facer & Sriprakash, 2021).

Methodology

This qualitative study aimed to better understand adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the MAL model at medical education institutions. The overall research question asks: *How do medical educators prepare future-ready MAL physicians for the future of healthcare?* This research question was supported by two sub-research questions: (1) *What are medical educators' experiences with and ideas about the MAL model?* and (2) *How can the MAL model be combined with futures literacy to prepare future-ready physicians?*

Purposeful sampling (Creswell & Poth, 2018; Merriam & Tisdell, 2015) was used to select 15 participants who had experience teaching the MAL model. Participants came from 15 different medical schools across the U.S. and taught at both undergraduate and graduate levels. Participants represented 10 specialty areas including family medicine, emergency medicine, pediatrics, internal medicine, obstetrics and gynecology, educational policy, psychology, higher education, adult education, and evaluation. Responsive interviewing was used to gather in-depth information from participants through semi-structured interviews with open-ended questions (Rubin & Rubin, 2012). Data were analyzed using first and second cycle coding to develop themes to address the research questions (Saldaña, 2016).

Findings

The findings from this study include five emergent themes: (1) lifelong self-improvement, (2) creating a culture of learning, (3) assessment through self-reflection and coaching, (4) overcoming a punitive culture, (5) future adaptive expert, and four sub-themes: (1) coaching framework, (2) teaching how to learn, (3) system barriers, and (4) facilitating a shared vision. The first four themes and subsequent subthemes emerged in response to sub-research question one. The fifth theme emerged in response to sub-research question two.

All 15 participants provided insight into their experiences with the model in the classroom and/or clinical setting. Findings from the study answered the overall research question and are supported by existing literature on adaptive expertise and the MAL model. Findings suggested that medical educators' experiences vary, and a specific curriculum is not followed when implementing the model. Instead, medical educators have taken concepts of the model and adapted them to the needs of their programs and students. Findings suggest that the MAL model can be applied to medical education as a meta-curriculum. A meta-curriculum defines the boundaries within which learned, planned, and taught curriculum is delivered. The meta-curriculum defines how medical education should be developed, structured, and delivered (Smith, 2004). The themes that guide the use of this meta-curriculum emerged as participants described their thinking about and use of the MAL model.

Discussion

Findings revealed new insights into how the model has been implemented and how it can be expanded better to prepare future physicians for the future of healthcare. Each phase of the model addresses using metacognitive processes to support a deeper understanding and transfer of knowledge in medical education (Cutrer et al., 2017). Participants noted the model's importance as a learning model for preparing physicians for the future of healthcare. For example, some participants indicated that their teaching efforts often focused on one aspect of the model, such as the planning phase or developing a growth mindset, and often depended on how it fits into the existing curriculum. Findings highlight the need for educators to convey the value of the MAL model by explicitly explaining to learners how the MAL model is not only a tool to help them through medical school but a tool to support them in lifelong learning and throughout their career as a provider. Faculty development is needed to support the preparation of future-ready physicians through the MAL model and should focus on educating medical educators about the MAL model and creating a learning environment conducive to fostering adaptive learning. Participants noted that medical educators have a responsibility to be more intentional in educating future physicians on how to independently find gaps in their knowledge and function in times of uncertainty. However, this must be supported by a shared vision for adaptive learning in the educational environment.

While the MAL model fosters the skills to work through periods of uncertainty, findings indicate that a key component of preparing future-ready physicians for the future of healthcare is missing. This key component is the anticipation of uncertainty. Futures literacy cultivates mindsets to prepare for the emergence of uncertainty, take control of it, and use it as a resource to respond to change (Miller, 2015) and shape the future. Beyond adapting to change, futures literacy supports

developing strategies for creating possible, plausible, and desirable futures (Miller, 2018) that move beyond adaptation to creativity and novelty. Futures literacy is valuable for providing physicians the skills to not only adapt to uncertainty and change but embrace it. This will involve becoming familiar with the unfamiliar and understanding that you will encounter change. However, how you use change to rethink and question present assumptions will enable you to embrace complexity and uncertainty (Miller, 2018).

Recommendations for Future Research

The study adds to the MAL model literature and introduces future studies to medical education literature. Faculty development is needed to support the preparation of future-ready physicians through the MAL model. Faculty development should focus on educating medical educators about the MAL model and creating a learning environment conducive to fostering adaptive learning. Future research should include a longitudinal study of how teaching efforts related to the MAL model are translated into physician practice and how a practicing physician incorporates the MAL model into patient care. Future research should also explore the MAL model and futures literacy to respond to uncertainty and facilitate anticipatory practices in medicine.

Futures literacy combined with MAL will better prepare future-ready physicians as faculty develop understandings of how to address possible, plausible, and desirable futures. Futures literacy prepares individuals to embrace uncertainty and see it as a resource rather than a threat (Miller, 2018). While the MAL model prepares physicians to work through uncertainty, focusing on understanding anticipation through the lens of futures literacy prepares physicians to anticipate innately unknowable phenomena (Miller, 2015). Future research should explore the relationship between the MAL model and futures literacy and how it can be implemented in the MAL model such as using an active pedagogical approach (Häggström & Schmidt, 2021) or anticipatory activities (Facer & Sriprakash, 2021; Häggström & Schmidt, 2021; Miller, 2018). As a framework for learning, futures literacy encourages the practice of anticipation (Facer & Sriprakash, 2021). This recommendation is foundational to incorporating future studies in medical education literature.

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