

ABSTRACT

LOCKLEAR, ELIZABETH ASHLYN. Educating for Uncertainty: A Qualitative Study on Preparing Future-Ready Physicians through Master Adaptive Learning. (Under the direction of Dr. Jayne Fleener).

Advances in technology, changing population demographics, and policy and regulatory developments are contributing to increasing complexity, continuous change, and uncertainty in healthcare. Physicians in today's healthcare system must be ready and willing to address the rapid changes and increasing complexity within healthcare. Medical educators are integrating systems-thinking and adaptive learning into the medical education curriculum to prepare future physicians with the skills needed to foster this readiness and willingness to address rapid change and prepare physicians to manage uncertainty and ambiguity in an unknown future. Without these skills, physicians will struggle to learn new and emerging treatments for patient care and implement transformative health policies.

This basic qualitative study focused on medical educators' experiences and understanding of the Master Adaptive Learner model developed by Cutrer et al. (2019) at medical education institutions. The model uses a metacognitive approach to teach future physicians to develop and demonstrate adaptive expertise to manage change and uncertainty effectively. Further, this study aimed to combine the characteristics of the Master Adaptive Learner model with the Futures Literacy framework to develop the construct of a future-ready physician equipped with adaptive expertise and skills to anticipate the future.

Semi-structured interviews were the primary data collection method, and data analysis consisted of first cycle and second cycle coding to develop themes to address research questions. 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, and (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. This study adds new insights into how the model has been implemented and how it can be expanded to better prepare future physicians for the future of healthcare, including a discussion of barriers and facilitators of implementation. Findings also indicated the need to incorporate futures literacy to prepare physicians to anticipate uncertainty and be comfortable with addressing uncertainty. Recommendations for future research include creating faculty development for MAL implementation, a longitudinal evaluation of MAL practices from medical education through patient practice, an exploration of MAL implementation in UME versus GME and research into how the MAL strategies can be combined with futures literacy to work through uncertainty and change.

© Copyright 2022 by Elizabeth Ashlyn Locklear

All Rights Reserved

Educating for Uncertainty: A Qualitative Study on Preparing Future-Ready Physicians through
Master Adaptive Learning

by
Elizabeth Ashlyn Locklear

A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Educational Leadership, Policy, and Human Development

Raleigh, North Carolina

2022

APPROVED BY:

Dr. Jayne Fleener
Committee Chair

Dr. Susan Barcinas

Dr. Peter Hessling

Dr. Chad Hoggan

DEDICATION

This dissertation is dedicated to my parents, Thomas and Dr. Zoe Locklear, who instilled in me the value of education, dedication, and hard work. Without your encouragement, guidance, and love, I would not be where I am today.

BIOGRAPHY

Elizabeth Locklear was born and raised in Robeson County, North Carolina, and is a proud member of the Lumbee Tribe. Growing up in the small town of Pembroke, she was surrounded by a support system of loving family and friends. Elizabeth graduated Summa Cum Laude from the University of North Carolina at Pembroke (UNCP) with a Bachelor of Science in Mass Communication with a concentration in Public Relations in 2014. She earned a Master of Arts in Communication with an emphasis on Health Communication from East Carolina University (ECU) in 2015.

Currently, Elizabeth works as an Academic Advisor at ECU. Before joining ECU, Elizabeth worked as an instructor at Pitt Community College in the English and Humanities department. She began working in the Pre-Professional Advising Center in May of 2016 as a Student Services Specialist and, in 2017, was promoted to Academic Advisor for the College of Allied Health Sciences and Pre-Professional Advising. In April 2019, Elizabeth was recognized by the Advising Collaborative as an “Outstanding New Advisor.” In her free time, Elizabeth enjoys spending time with family and friends, traveling to the beach, and playing with her two Yorkies, Mila and Trixie.

ACKNOWLEDGMENTS

- To my mom, Dr. Zoe Locklear, I wholeheartedly owe so much of my success to you. Words cannot describe how thankful I am to have you as my mom. Since I was a little girl, you have shown me the value of education and dedication. You are my biggest role model and the hardest working person I know. Thank you for your continuous love and support and for always being there with whatever I needed. Thank you for being the best mom.
- To my dad, Thomas Locklear. How great does it feel to have two kids who are NCSU alumni? Thank you for always encouraging me to work hard, do my best, and always rely on God. I look forward to spending more time with you landscaping and gardening. I love you.
- Brittany O'Donnell: Words cannot express my appreciation for your love and support throughout this journey. I could not have done this without you. I love you.
- To my brother, Matthew Locklear. Thank you for your support and check-ins throughout this journey. I am grateful and honored to be your sister.
- To my nephew, Jackson Locklear. Thank you for always giving me a reason to smile over the past two years. I cannot wait to have the opportunity to spend more time with you and see you grow. I am honored to be your aunt. Maybe within a few years, we will have a three-generation wolfpack family!
- To my dissertation chair and committee, I express my sincerest gratitude for the knowledge you have taught me in the classroom and throughout my dissertation process. The work you do truly has a lasting impact on students.

- To my wonderful chair, Dr. Jayne Fleener. Thank you for your guidance, encouragement, and patience. Thank you for introducing me to futures research and opening my eyes to a new field of study.
- To my sweet, adorable Yorkies, Mila and Trixie. Thank you for always being by my side while I read, wrote papers, and participated in Zoom class sessions. Thank you for insisting I take breaks to go on adventures outside, play fetch, or cuddle.
- To Kelly Reddick. Thank you for always being there to support and encourage me throughout this process and in life. You are a true friend, and I will always treasure our friendship.
- To Brittany Wood. Thank you for being the absolute best cheerleader and life coach. Your support and encouraging words throughout this process have been invaluable. Your friendship is an honor.
- To Elizabeth McAllister. Thank you for working with me throughout this journey and being so flexible. I feel blessed to have the opportunity to work with you.
- To my ECU family and coworkers. Thank you for your continuous encouragement, support, and friendship. You are much more than coworkers; you are lifelong friends.
- To all my AWCPE friends, you all have been the best support system. Thank you for the encouragement and support words throughout this journey. To Beth Kornegay, I am so grateful to have met you on that first day of class. I could not have done this without you.
- To all of my participants. My sincerest gratitude to you for sharing your experiences and stories with me and opening my eyes to new insights into medical education. I could not have done this without you.

TABLE OF CONTENTS

LIST OF TABLES	X
LIST OF FIGURES	XI
CHAPTER 1: INTRODUCTION & BACKGROUND.....	1
Introduction.....	1
Changing Medical Education	1
Systems-Thinking	3
Response to Change: Master Adaptive Learners.....	4
Statement of the Problem.....	5
Purpose of the Study and Research Questions	6
Significance of the Study	6
Conceptual and Theoretical Frameworks	8
Self-Directed Learning	9
Lifelong Learning	9
Reflective Practice	10
Futures Literacy	10
Research Methodology Perspective.....	11
Definition of Key Terms.....	12
Organization of Study	13
Chapter Summary	14
CHAPTER 2: LITERATURE REVIEW	16
Introduction.....	16
Current State of Healthcare System and Medical Education.....	16
Healthcare as a Complex Adaptive System.....	17
Current State of Medical Education	18
AMA Response to Need for Change	20
Health Systems Science.....	21
HSS Curricular Domains	23
Adaptive Expertise in Healthcare and Medical Education	25
Adaptive Expertise in Healthcare	25
Adaptive Expertise in Medical Education	26
The Master Adaptive Learner Model	28

Development of MAL Model	29
Routine Expertise vs. Adaptive Expertise	32
Four Phases of MAL.....	32
Cognitive Skills in MAL	37
Internal Characteristics of MAL	38
Medical Educators and the MAL Model	40
Coaching	41
Medical Curriculum.....	43
Learning Environment	44
Conceptual and Theoretical Frameworks	46
Self-Directed Learning	47
Lifelong Learning	49
Reflective Practice	49
Futures Literacy	51
Defining a Future-Ready Physician.....	54
Conclusion	55
Chapter Summary	56
CHAPTER 3: METHODOLOGY	58
Introduction.....	58
Qualitative Research Paradigm.....	59
Research Design: Basic Qualitative Study	59
Researcher Positionality	60
Ethics	62
Data Collection	63
Semi-Structured Interviews	63
Research Participants.....	65
Documents	66
Memos	66
Data Analysis.....	67
Coding.....	67
Establishing Rigor and Trustworthiness.....	69
Worthy Topic.....	70
Rich Rigor.....	70

Sincerity	70
Credibility	71
Resonance	71
Significant Contribution	72
Ethics	72
Meaningful Coherence.....	73
Limitations, and Delimitations of Study.....	73
Limitations	73
Delimitations.....	74
Chapter Summary	74
CHAPTER 4: FINDINGS	75
Introduction.....	75
Participants	75
Presentation of Themes.....	77
Theme 1: Lifelong Self-Improvement.....	78
Theme 2: Creating a Culture of Learning.....	81
Theme 3: Assessment through Self-reflection and Coaching.....	86
Theme 4: Overcoming a Punitive Culture	89
Theme 5: Future Adaptive Expert	93
Chapter Summary	96
CHAPTER 5: DISCUSSION	97
Summary and Discussion of Findings	98
Lifelong Self-Improvement	99
Theme 2: Creating a Culture of Learning.....	100
Theme 3: Assessment Through Self-Reflection and Coaching.....	102
Theme 4: Overcoming a Punitive Culture	103
Theme 5: Future Adaptive Expert	105
Interpretation of Findings	106
Discussion of Findings and Conceptual Frameworks	107
Adult Learning Theories.....	107
Futures Studies.....	108
Limitations.....	109
Recommendations and Implications for Practice	110

Recommendations for Future Research.....	112
Chapter Summary	114
Researcher Reflections	116
REFERENCES.....	118
APPENDICES.....	139
Appendix A: Consent Form.....	140
Appendix B: Interview Protocol.....	145
Appendix C: Sub-Research Questions and Interview Questions Alignment	149
Appendix D: Recruitment Letter	150
Appendix E: Figure Copyright Permissions	151

LIST OF TABLES

Table 1.	Coaching Competencies Throughout the MAL Phases	43
Table 2.	Summary of Participant Profiles.....	76
Table 3.	Themes by Sub-Research Question	78

LIST OF FIGURES

Figure 1.	Health Systems Science Curricular Domains	24
Figure 2.	Dreyfus Model of Expertise	30
Figure 3.	Adaptive Expertise Dreyfus Model.....	31
Figure 4.	The Master Adaptive Learner Process	33
Figure 5.	Theoretical and Conceptual Frameworks of Study	46
Figure 6.	Construct of Future-Ready Physician.....	55
Figure 7.	Color-Coded Structural Codes	68
Figure 8.	Illustration of Coding Methods	69
Figure 9.	Perceived Stages of MAL Adoption.....	77
Figure 10.	Participants' Application of the MAL Model	84

CHAPTER 1: INTRODUCTION & BACKGROUND

Introduction

“The physicians of tomorrow are taught by the teachers of today using the curriculum of the past” (Sethuraman, 1995). This quote captures the motivation for and essence of this study.

The current medical education curriculum remains the same as it was in the 20th century.

Influenced by Flexner’s two-pillar educational model of medical education, the first two years of medical school focus on a basic science curriculum, followed by two years of clinical science curriculum (Cutrer et al., 2021). Researchers have discussed the increasing complexity and change within the healthcare system (Borkan et al., 2021; Mylopoulos, 2020; Steinert et al., 2021) and have called for a change to address the century-old curriculum and incorporate a three-pillar model of undergraduate medical education called Health Systems Science (HSS).

HSS integrates systems thinking into medical education and practice to address the increasing complexity and change in healthcare (Bhopal, 2015; Skochelak et al., 2020). Key factors influencing change in the healthcare system include an aging population, changes in population needs, patient consumerism, an increase in chronic disorders, technological advances, and policy and regulatory developments (Schiavone & Ferretti, 2021; Stanford Medicine, 2020). As seen in the wake of the COVID-19 pandemic, identifying and adapting to healthcare’s changing and sometimes abrupt dynamics is vital for maintaining effective and quality patient care (Perrin et al., 2020). Physicians in today’s healthcare system must address rapid changes, manage uncertainty, and be adaptive.

Changing Medical Education

The medical education curriculum currently focuses on teaching and assessing isolated knowledge. Students are focused on memorization and grade achievements as markers for

success, and little has changed to align medical education with the shifting dynamics in the healthcare system. This focus on isolated learning has resulted in a gap between what society needs physicians to accomplish and the received medical training (Mylopoulos, 2020; Papanagnou et al., 2021). 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). The information medical students learn early in medical education often 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). 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).

In 2013, the American Medical Association (AMA) acknowledged this gap between training and practice and created an opportunity for medical schools across the United States to transform medical education and push century-old boundaries to develop medical schools of the future. Thus, the AMA Accelerating Change in Medical Education consortium was created to develop the tools needed to support future physicians to practice in modern healthcare (Lomis et al., 2021; Skochelak et al., 2020, 2021). Today, the 37-member Accelerating Change consortium is working on updating medical education to reflect a changing healthcare system through the field of Health Systems Science (HSS).

The goal of the AMA Accelerating Change consortium is to create transformative change within medical education, and adaptive expertise is a crucial component of achieving this goal

(Cutrer et al., 2019, 2021; Mylopoulos, 2020). Adaptive expertise is “an emerging model of expertise in health professions education that directly addresses the challenge of preparing learners for an unknown future” (Mylopoulos, 2020, p. S11). Drawing on the pedagogical model of Preparation for Future Learning (PFL), adaptive expertise focuses on the capability to balance between established effective treatments (efficiency) and to use resources to learn new strategies for problem-solving when treating patients (innovation).

Systems-Thinking

Medical education should focus on preparing future physicians using systems thinking (Borkan et al., 2021; Skochelak et al., 2020). Physicians who are systems-thinkers holistically treat patients while constantly innovating to identify, respond to, and act on trends in healthcare (Otaki et al., 2020). Adopting a systems-thinking approach to healthcare prepares future physicians to take a broad approach to holistically understanding the healthcare system’s interacting and interdependent parts (Cutrer et al., 2019; Skochelak et al., 2020). Health Systems Science emphasizes that healthcare is a complex adaptive system, and systems thinking is key to understanding, operating, and improving healthcare (Skochelak et al., 2020).

HSS is defined as the “study of how healthcare is delivered, how healthcare professionals work together to deliver that care, and how the health system can improve patient care and healthcare delivery” (Borkan et al., 2021, p. S26). While the Lancet Commission called for a re-examination to address outdated medical curricula more than a decade ago, no action has been proposed on a scale as large as HSS. The consortium’s actions and development of HSS have been the most impactful initiative for reshaping health education for the future in the recent decade (Skochelak et al., 2020).

Response to Change: Master Adaptive Learners

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

The MAL model consists of a four-phase process that a master adaptive learner follows when routine treatments for patient care cannot or will not work. The four phases include planning, learning, assessing, and adjusting. In the planning phase, learners recognize a gap in practice, which includes knowledge, skills, or attitudes. Once this gap is identified, the learner begins to search for new solutions to address gaps. In the learning phase, learners focus intensely on their new knowledge and learning strategies. In the assessing phase, learners seek feedback and conduct self-assessments on what they have learned. In the final adjusting phase, learners decide whether to incorporate their new knowledge into the clinical setting and potentially into the overall healthcare system (Cutrer et al., 2019).

This dissertation focused on medical educators' use of the MAL model to prepare future physicians to become adaptive experts. As discussed below, adaptive expertise is critical for equipping physicians with the skills to manage and respond to uncertainty and rapid change within the complex healthcare system. Additionally, this study sought to build on the MAL model through futures literacy as a strategy to prepare future physicians to be adaptive and have the capacity to think about what is to come and what information is needed to anticipate the future of healthcare (Poli, 2019). The United Nations Education Scientific and Cultural Organization (UNESCO) supports futures literacy by developing individuals' and groups' abilities to use anticipatory systems to create possible futures as proactive strategies during rapid change. The capacity for futures literacy requires embracing complexity and change, which opens the door for innovation and openness to take advantage of novelty and embrace a new sense of agency (Kazemier et al., 2021).

Statement of the Problem

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).

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. Findings contribute to the growing use of adaptive learning in medical education.

Purpose of the Study and Research Questions

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 following overall research question guided this study: **How do medical educators prepare future-ready MAL physicians for the future of healthcare?** The sub-research questions below aimed to understand the specific actions taken by medical educators to prepare future-ready physicians.

- What are medical educators' experiences with and ideas about the MAL model?
- How can the MAL model be combined with futures literacy to prepare future-ready physicians?

Significance of the Study

The healthcare system continues to change rapidly as technological advances and social and economic factors have changed the delivery of care (Combes & Arespachoga, 2012; Han et al., 2019), prompting physicians to rethink how to treat patients and provide care. For example, telemedicine or telehealth has grown exponentially since the onset of the COVID-19

pandemic. This research will inform medical educators of strategies for preparing future physicians for technological advances and system challenges requiring physicians to think outside the box when treating patients. Findings can also inform curriculum policies and standards imposed by accrediting bodies. For example, when medical educators first used Interprofessional Education (IPE), it was not widely practiced, and there was no mention of IPE in course competencies. However, IPE is essential to many medical schools' curricula today. There is now an accrediting agency specifically for IPE referred to as Joint Accreditation (Regnier et al., 2019).

This research adds to the growing literature on adaptive expertise in health education (Cutrer et al., 2017; Mylopoulos, 2020). The study's focus on medical educators' specific actions could potentially guide the implementation of the MAL model and curriculum development to train future-ready physicians at medical schools across the country. Additionally, this study sought to combine the MAL framework with futures literacy to further develop future-ready physicians' capacity to anticipate uncertainty.

In addition to expanding the literature, this research was timely for several reasons. First, as we navigate the COVID-19 pandemic and a future post-pandemic society, the healthcare system will continue to experience rapid change (Kim et al., 2020). Throughout the COVID-19 pandemic, the word *pivot* was used to convey sudden changes. This pandemic buzzword applied to changes in all facets of life, from education to business to healthcare. In today's post-pandemic world, the word *pivot* often elicits an "adapt or die" response to change. The sudden need to and expectation to adapt is commonplace in our society (Baker, 2020; McGinn, 2021). Therefore, it is no surprise that as physicians continue to provide care, they will be expected to pivot and adapt to changing dynamics and uncertainty.

Second, HSS and the MAL model are still in their infancy. This study's discussion of HSS as the third pillar of medical education added to the literature, ensuring that the concept of systems-based practice is not lost within medical education literature (Gonzalo et al., 2017). The discussion and focus on the MAL model also expand the literature and how the model is applied in medical education. Third, the analysis of the MAL model with the combination of futures literacy and anticipatory systems connected medical education and futures studies. This concept has received little attention in the literature, and this analysis introduced futures literacy to medical education as an educational strategy.

Finally, the overarching goal of medical education is to provide care to improve patient outcomes and address population health (Skochelak et al., 2020). Findings from this study can inform medical educators on the MAL model and adaptive expertise, so more medical schools may consider adopting these concepts when preparing future physicians. Training future-ready physicians not only improves physician efficiency and patient care, but through systems-thinking, future-ready physicians will significantly impact addressing social determinants of health and society's well-being.

Conceptual and Theoretical Frameworks

No specific conceptual or theoretical framework guides the MAL model; instead, the model integrates several conceptual and theoretical frameworks to create a shared language and attitude toward learning in medical education (Cutrer et al., 2019). Pusic (2020) described the MAL model as one in which a series of theories and methods can be used, varying in utility and applicability depending on the environment. Given the purpose of this study, the following conceptual and theoretical frameworks are discussed concerning the MAL model. Each conceptual and theoretical framework is associated with adult learning theory.

Self-Directed Learning

Self-Directed Learning (SDL) focuses on the learner's ability to pursue learning and self-awareness during their learning process. Openness, critical thinking, and reflective practice are essential drivers of SDL (Garrison, 1997; van Woezik et al., 2021). Creating specific, measurable, attainable, relevant, and timely (SMART) goals to meet learning objectives is an example of SDL (Mai & Clark, 2016). For example, in a study by Sawatsky et al. (2017), a participant noted that the motivation for SDL occurred when a patient asked a question. However, the provider could not provide an answer, which prompted the provider to search for an answer to the patient's question. However, it was noted in the study that when situations become uninteresting and questions have been answered, the probing for answers stops.

While Cutrer et al. (2021) refer to MAL as a process of self-regulated learning (SRL), SDL and SRL are closely related. In Cutrer's most recent work, SDL is used to define adaptive learners (Cutrer et al., 2021). SDL and SRL focus on developing awareness and critical thinking. However, self-directed learners develop a longitudinal attitude towards learning by setting goals and self-awareness, which is better suited for lifelong learning (van Woezik et al., 2021); therefore, SDL was best suited for this study.

Lifelong Learning

Lifelong learning is essential to complex professions (van Woezik et al., 2021). Encouraging lifelong learning as a skill to respond to uncertainty and adaptation has been adopted within policy development, particularly educational policy (Edwards et al., 2002). Lifelong learning supports future-ready physicians by focusing on mastery learning which is needed given the constant and rapid changes in the healthcare system and best treatment practices (Richardson et al., 2021). The premise of lifelong learning is that learning does not stop

when one finishes formal educational training. Dewey describes education as a supplier of growth (Cross-Durrant, 1984). Although Dewey (1916) does not specifically use the term lifelong learning, he does describe the continuity of the learning process. He argues that education is part of a growing process that has no end. Dewey (1916) underlines the importance of adaptiveness when discussing continuity of life and life as a self-renewing process that promotes learning through interactions with one's environment. Narang et al. (2018) note personalized learning, adaptive learning, and flipped classrooms as educational tools for teaching lifelong learning.

Reflective Practice

Reflective practice is a critical skill in the MAL model that aids problem-solving by encouraging learners to consider alternative paths to solve problems (Roessger, 2014). Through mindful consideration, learners are aware of their knowledge and actions, particularly in a professional setting (Osterman, 1990). Reflective practice is vital in the MAL model as learners reflect their knowledge throughout each phase of the model (reflection-in-action) (Farrell, 2012). Through reflective practice, learners are prepared to recognize uncertainty and practice within complex systems. Medical education incorporating reflective practice draws on practicing within uncertainty, similar to adaptive expertise. Learners can engage in reflective practice through reflective journaling or case studies that present patient scenarios that disrupt assumptions and ask students to reflect on this disruption (Orsino & Ng, 2019).

Futures Literacy

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 (Hägström & Schmidt, 2021). Futures literacy creates a vision of how something will happen, guiding action in the present. Thus, futures literacy focuses on “using the future” in the present to anticipate uncertainty and guide a response to novelty (Facer & Sriprakash, 2021).

Research Methodology Perspective

This study used qualitative methodology and was grounded in interpretivism. From an interpretivist perspective, meaning is socially constructed; therefore, individuals’ constructions and interpretations of purpose can change over time (Merriam & Grenier, 2019). Informed by constructivism’s ontological and epistemological beliefs, this study focused on medical educators’ understanding and teaching of the MAL model. Given the focus on the importance of future-ready physicians, a basic qualitative research design was appropriate for this study (Merriam & Grenier, 2019). This approach was appropriate for this study because the aim was to understand medical educators’ experiences using and teaching the MAL model and future directions for the MAL model.

A basic qualitative study (Merriam & Tisdell, 2015) is used by researchers to seek or understand how people make meaning of situations, experiences, processes, and world views. Using constructivism as the foundation, the researcher is the research instrument in which inductive methods are utilized to understand how people make sense of phenomena and provide a detailed description (Merriam & Tisdell, 2015). Basic qualitative studies are the most common type of qualitative research in education (Merriam, 2002).

Often used in qualitative research, purposeful sampling (Creswell & Poth, 2018; Merriam & Tisdell, 2015) was used in this study to select participants who had experience with teaching the MAL model. Purposeful sampling allowed for a selection of medical educators who best

informed the research. 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).

Definition of Key Terms

Adaptive Expertise. “The combination of routine and innovative problem-solving. An individual demonstrating adaptive expertise recognizes when a “routine” approach will not work and subsequently reframes the problem in a way that allows her to explore new concepts (learning) and to invent new solutions (innovation)” (Cutrer et al., 2019, p. 193).

Complex Adaptive System. “Complex adaptive systems are characterized by continuing self-organization, requiring the system to be open at a state far from equilibrium, with ill-defined boundaries, being sensitive to initial conditions and involve a large number of non-linear interactions and multiple feedback loops” (Sturmberg et al., 2012, pp. 203-204).

Futures Literacy. “Futures literacy is a capability. It is the skill that allows people to better understand the role of the future in what they see and do. Being futures literate empowers the imagination, enhances our ability to prepare, recover and invent as changes occur” (UNESCO, 2020).

Graduate Medical Education (GME). Formal education and training that occurs after receiving M.D. or D.O. degree. Most often thought of as residency or fellowship.

Growth Mindset. “One of the four internal characteristics that drive the Master Adaptive Learning process. It is a positive belief pattern held about one’s intelligence and capacity for learning being open to ongoing improvement. The other three characteristics are motivation, curiosity, and resilience” (Cutrer et al., 2019, p. 193).

Healthcare Delivery System. “An organization of people, institutions, and resources that delivers healthcare services to meet the health needs of target populations” (Skochelak et al., 2020, p. 316).

Health Systems Science. “The principles, methods, and practice of improving quality and patient experience, outcomes, and costs of healthcare delivery for patient and populations within systems of medical care” (Skochelak et al., 2020, p. 316).

Metacognition. “Awareness and understanding of one’s own thought processes” (Cutrer et al., 2019, p. 194)

Routine Expertise. “Mastering a process to such an extent that a learner becomes highly efficient and accurate, even appearing to perform the process automatically. Contrast with innovation expertise and adaptive expertise” (Cutrer et al., 2019, p. 194).

Systems Thinking. “Recognizing and understanding the complex interdependencies and relationships within a functional system such as healthcare. Allows the formation of linkages among disparate areas of activity in healthcare to improve outcomes, patient experience, and value in healthcare” (Skochelak et al., 2020, p. 318)

Undergraduate Medical Education (UME). Formal four-year curriculum and training that leads to a medical degree and license.

Organization of Study

This dissertation includes five chapters: introduction, literature review, methodology, findings, and discussion. Chapter one introduces the problem that medical education fails to prepare future physicians with the skills to address change, ambiguity, and uncertainty in healthcare. The chapter includes a brief background, statement of the problem, purpose,

significance of the study, research questions, an overview of conceptual and theoretical frameworks, and definitions of terms used throughout the study.

Chapter two includes a review of the literature and arguments concerning the study. Chapter two begins with a discussion of the healthcare and medical education systems, with a primary focus on the MAL model and how to implement the model to elicit change in medical education and prepare future-ready physicians. An overview of the conceptual and theoretical frameworks that guided the study is presented.

Chapter three provides the rationale for the research methodology and design and explains the qualitative research data collection and analysis used in the study. The researcher's positionality also discusses ethical considerations, credibility, and trustworthiness. It concludes with a discussion of the limitations, delimitations, and assumptions.

Chapter four includes the findings' overall emergent themes and subthemes that address the research questions. The themes and subthemes emerged from participants' experiences with the MAL model. Chapter five examines and interprets the research findings by discussing themes and subthemes. It also discusses the limitations of the study, implications for practice, research, and future directions. The chapter concludes with my thoughts on the meaning of this study and my reflections as the researcher.

Chapter Summary

Increasing societal change is leading to change and uncertainty within the complex healthcare system. Researchers have called on medical educators to reexamine the medical education curriculum to better prepare future physicians. Adaptive expertise is one approach medical educators use to address the gap between medical education training and clinical practice. Some medical schools have implemented the MAL model to develop metacognitive and

adaptive skills in future physicians. This basic qualitative study sought to understand adaptive expertise and the MAL model in medical education and medical educators' experiences in making meaning of the MAL model, conveying the value of the MAL model, and developing future-ready physicians. The results of this study contribute to medical education and futures studies literature and provide insight into adaptive expertise as a necessary skill in the 21st-century complex healthcare system to address the gap between medical education and the realities of healthcare.

CHAPTER 2: LITERATURE REVIEW

Introduction

This study aimed to understand medical educators' experiences teaching the Master Adaptive Learner (MAL) model, learning to use the MAL model, and adaptive expertise to prepare future-ready physicians to identify and adapt to uncertainty and changes within the healthcare system. Further, this study explored the construct of future-ready physicians through futures literacy and anticipatory systems. This chapter begins with a discussion of the healthcare context and the need for change in medical education. Next, I discuss what has been proposed as the third pillar of medical education, Health Systems Science (HSS), including an overview of HSS research and a discussion of curriculum domains. Following, I discuss adaptive expertise within the MAL model and how it relates to HSS. Then, I discuss the combination of the MAL model and futures literacy and anticipatory systems to develop the construct of a future-ready physician.

Current State of Healthcare System and Medical Education

Within the last 30 years, the health care system has faced changes in population, urbanization, chronic diseases, behavioral and mental health, infectious diseases, regionally specific conflicts, politics, and concerns of digital healthcare and security (Combes & Arespachoga, 2012; Han et al., 2019; Schiavone & Ferretti, 2021). Not only has the healthcare system changed over the past 30 years, but patients are more empowered in their care, where and how they receive care, and the tools they use to navigate their care and the healthcare system (Wakefield et al., 2018). Researchers foresee these changes increasing rapidly over the coming years, requiring changes to all areas of the healthcare system's culture and practices (Bhopal, 2015; Kim et al., 2020; Schiavone & Ferretti, 2021; Skochelak et al., 2021). These changes are

moving healthcare away from the traditional care model and redesigning roles in the delivery of care (Schiavone & Ferretti, 2021).

Healthcare as a Complex Adaptive System

The American healthcare system consists of interacting and interdependent parts growing in complexity at a rapid rate. As a complex adaptive system, these interacting and interdependent groups within healthcare form multiple micro-systems at differing levels or hierarchies (Cordon, 2013). These interrelated micro-systems include various people, processes, and structures constantly changing from technological innovations, changing patient demographics, and advances in financial systems (Combes & Arespacochaga, 2012; Han et al., 2019). Change occurring in these interacting and interdependent components can potentially impact one another, resulting in a domino effect on the system (Cordon, 2013).

Recent research has urged an examination of healthcare as a Complex Adaptive System (CAS) (Ratnapalan & Lang, 2019). In response, medical educators are using adaptive expertise to teach future physicians the complexity of the healthcare system (Martin, 2018; Skochelak et al., 2020, 2021). Rather than a static system, healthcare as a CAS comprises independent and dependent parts that influence each other and the system altogether (Cordon, 2013; Skochelak et al., 2021). CAS generates emergence, and the adaptability and change associated with complex systems add to the complexity of healthcare delivery (Cordon, 2013). A CAS is non-linear, self-organizing, interconnected, constantly evolving, and challenging to predict or control (Martin, 2018; Munro et al., 2020). Complex Adaptive Systems have four elements, interconnectedness, interdependence, diversity, and adaptability. To truly interact within a CAS, one must understand all aspects of the system (Smyre & Richardson, 2016). Skochelak et al. (2020) discuss that complexity defines healthcare. With many moving parts, social challenges, and rapid changes,

medical education researchers have begun to address the complexities of educating the next generation of medical professionals.

Current State of Medical Education

There are two degrees of medical school training in medical education: allopathic medicine and osteopathic medicine. Those who attend an allopathic medical school earn an MD, Doctor of Medicine, while those who attend an osteopathic medical school earn a DO, Doctor of Osteopathic Medicine (Murphy, 2021). Both degrees prepare individuals to be physicians, requiring the same level of schooling, training, and residency. However, the foundational beliefs and origins of the two schools of thought differ. For allopathic medicine, theoretically, treatment is focused on treating disease, while osteopathic medicine is focused on treating the patient, thus a holistic, mind-body focus (Kowarski, 2020).

Nearly ten years ago, medical educators reflected and re-examined the current state of health professions education in a report published in *The Lancet Commission on Education of Health Professionals for the 21st Century* (Frenk et al., 2010). The Lancet Commission report described the trajectory of medical education over the past century. Before disseminating the Flexner Report, standard approaches to medical education were not developed (Borkan et al., 2021). The Flexner report provided standard medical education approaches grounded in biological sciences and scientific theory. Flexner's report established a 2+2 model of education. The first two years of medical school are devoted to learning basic and clinical science, followed by two years of immersive clinical education and apprenticeship. The principles of Flexner's report are still prevalent in medical education 100 years later, which is scientific-based and focused on the doctor-patient relationship. While needed at the time, Flexner's report is no

longer sufficient for preparing future physicians to address the complexities of the healthcare system (Skochelak et al., 2020).

Since the 1990s, researchers have discussed an increasing need to address system issues such as social determinants of health, healthcare inequities, chronic healthcare needs, and the increasing and often unstable healthcare costs. While other models of medical education have been proposed, such as problem-based learning and integrated curriculum, a model of medical education that promotes a comprehensive and systemic approach to healthcare is needed (Borkan et al., 2021; Skochelak et al., 2021). Other medical education leaders and stakeholders agree and argue for a need to focus on medical education innovation.

The Lancet report focused on several issues within the current state of health professions. Frenk et al. (2010) wrote, “problems are systemic: mismatch of competencies to patient and population needs; poor teamwork; persistent gender stratification of professional status; narrow technical focus without broader contextual understanding; episodic encounters rather than continuous care; predominant hospital orientation at the expense of primary care; quantitative and qualitative imbalances in the professional labor market; and weak leadership to improve health-system performance” (p. 1, 923). The goal of the Lancet Commission was to encourage medical education reform from a systems perspective that was interprofessional and included all health professionals. Health professionals should learn to engage in critical reasoning to support a healthcare system that is patient and population focused. Such a change would lead to institutional and instructional design reform, creating transformative change and interdependence in medical education (Skochelak et al., 2021; Van Eck et al., 2021; Frenk et al., 2010).

Researchers within healthcare and medical education have called attention to the growing divide between the healthcare system and the medical education system (Cutrer et al., 2017;

Gonzalo et al., 2017; Mylopoulos, 2020; Skochelak et al., 2021). This division is causing concern as physicians entering practice are ill-equipped to provide quality and efficient patient treatment. Furthermore, current challenges in healthcare indicate that physicians are not trained for the current healthcare system (Cutrer et al., 2021). These challenges include high incidences of medical error, rising healthcare costs, and increasing rates of physician burnout (Lomis et al., 2021). Given the rapid advances in technology and medicine, this gap will likely continue throughout their career trajectory (Skochelak et al., 2021). As the healthcare system rapidly changes, the concepts that physicians learn could be outdated by the time they enter practice (Lajoie & Gube, 2018). Therefore, medical education is seen as a continuum of lifelong learning from undergraduate medical education (UME) to graduate medical education (GME) and then continuing medical education (CME) or continuing professional education (CPE) (Murray et al., 2021).

The rapid changes within the healthcare system have changed how health educators educate. To prepare future-ready physicians, medical educators need to create deliberate training that teaches adaptive skills for the future. This training will require a shift in the strategies used by medical educators. The curriculum needs to move away from memorization, which has discouraged physicians from utilizing critical thinking skills, to strategies that address critical thinking and coping with uncertainty through fostering self-directed, lifelong learning skills in an ongoing process of co-learning (Skochelak et al., 2021).

AMA Response to Need for Change

In response to the growing need for change to medical education curricula, the American Medical Association (AMA) implemented the Accelerating Change in Medical Education initiative in 2013 to address the changing climate of the healthcare system. This initiative was an

unprecedented opportunity for medical schools across the country to collaborate to develop innovative teaching strategies to support new learning pathways in medical education (Lomis et al., 2021). Beginning with 11 medical schools across the country, the Accelerating Change in Medical Education consortium developed a curriculum that supported systems thinking and innovation as the foundation of the transformative innovations proposed by the consortium (Van Eck et al., 2021). By 2016, the consortium had expanded to 32 medical schools. Since the start of the Accelerating Change consortium, schools have collaborated on teaching approaches, improving patient safety, performance, and patient-centered care, and educating future doctors on the complexities of the healthcare system and financing. In the process of collaboration and a focus on addressing the changing healthcare system, the consortium developed the construct of Health Systems Science (HSS) (Borkan et al., 2021).

Rogers' (2003) Diffusion of Innovations theory provides a lens to consider how the Accelerating Change in Medical Education Consortium has grown in membership. The initial consortium of medical schools and the AMA served as innovators, introducing the Accelerating Change in Medical Education initiative. As these innovators began sharing information about the Accelerating Change consortium, other schools became aware and joined the efforts to change medical education through systems thinking, thus becoming early adopters. As more schools learned about the consortium and the support from the AMA, the early majority schools became open to the idea of systems thinking and being to implement it in the curriculum.

Health Systems Science

The AMA Accelerating Change in Medical Education Consortium focuses on moving medical education into the future. As an emerging discipline, Health Systems Science (HSS) aims to educate physicians to improve health at the individual, community, and population

levels. Without HSS, a physician cannot fully understand what factors influence patients' health or the population's health (Skochelak et al., 2020). The current medical education curriculum focuses on memorization and acquiring a particular grade, which has inhibited a growth mindset in learners. Freire (1998) describes this learning as the "banking model" of education. The learner is viewed as an empty account in which educators deposit knowledge. A growth mindset fosters a holistic view of medicine, which focuses not only on the acute symptoms or illness of a patient but on the environmental and economic factors that will play a role in treating a patient (Skochelak et al., 2021). A growth mindset encourages learners to question the status quo, share ideas and challenges, and not be afraid to fail (Dweck, 2006; Dweck & Molden, 2017; Yeager & Dweck, 2020). When given the freedom to truly immerse in the learning experience, learners become skilled at critical thinking and develop a deeper understanding of providing solutions for addressing problems and adapting to new solutions. As stated previously, the Lancet Commission encouraged medical education reform from a systems perspective in which interdependence is key (Frenk et al., 2010). The AMA Accelerating Change consortium has incorporated interdependence as an educational outcome through a growth mindset (Skochelak et al., 2021). Since 2020, the AMA Accelerating Change consortium has addressed all recommendations of the Lancet Commission in some aspect (Richardson et al., 2021; Skochelak et al., 2021).

The key to learning Health Systems Science is to be a systems thinker. Systems thinking addresses problems and complex systems such as healthcare (Kramer & Smit, 1977). Systems thinking approaches a system to understand the interconnectedness and interdependence of the system's parts. Systems thinking in education aims to prepare students to understand the context and identify connections in the knowledge that emerges (Smyre & Richardson, 2016). This

concept is essential to patient treatment because it provides patient-centered care. Physicians must have a holistic approach to understanding the systems surrounding patients and how the parts of a system interact (Skochelak et al., 2021).

From a systems perspective, physicians must approach patient needs and treatment from the patient's point of view, considering the patient's community and what patients may encounter outside the physician's office in their day-to-day lives. Physicians who adopt this approach use systems thinking to understand the complex factors and context that impact a patient's health (Borkan et al., 2021; Skochelak et al., 2021). A physician's professional identity is expanded through HSS as physicians are prepared to be an expert in patient care and innovate and transform the healthcare system to improve overall health outcomes and health equity. Extending beyond the individual physician-provider relationship, HSS uses systems thinking to address the gaps in knowledge and understand the systems that impact social determinants of health (Skochelak et al., 2020).

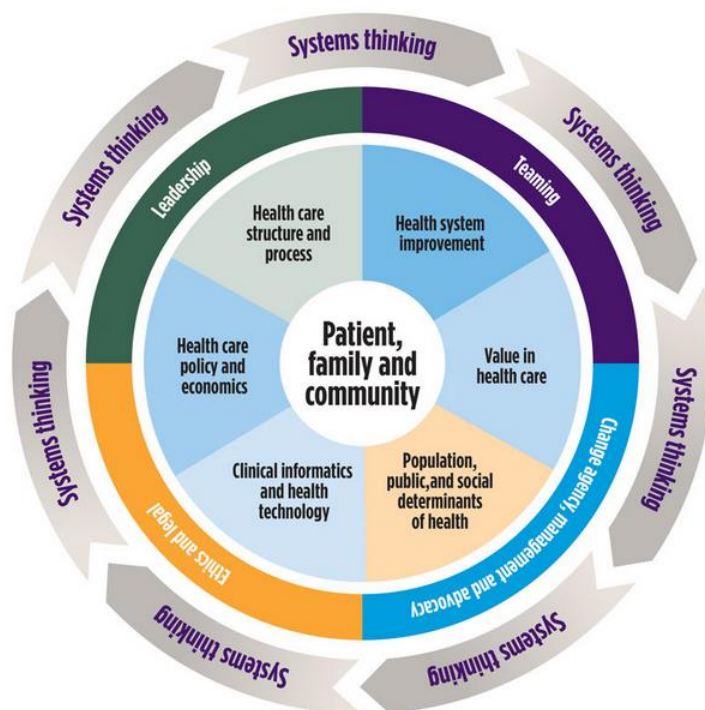
HSS Curricular Domains

Health Systems Science is divided into three curricular domains: core functional, foundational, and linking domains (Figure 1). Each domain contains subcategories that expand the three curricular domains. The core functional domain is comprised of the following seven subcategories: (1) patient, family, and community, (2) health care structure and process, (3) health care policy and economics, (4) clinical informatics and health technology, (5) population, public, and social determinants of health, (6) value in health care, and (7) health system improvement (Skochelak et al., 2020). The core functional domain is the inner circle of the HSS model, with the patient, family, and community at the very center.

The foundational domain is comprised of 4 subcategories: (1) change agency, management, and advocacy, (2) ethics and legal, (3) leadership, and (4) teaming. The foundational domain highlights the importance of patient relationships from a systems approach and the competencies needed to provide direct patient care. Many subcategories are already incorporated into medical education but not within a health systems science context. The linking domain is represented by systems thinking which links the domains and subcategories to the overall medical curricula.

Figure 1

Health Systems Science Curricular Domains



Note: Reprinted from *Health Systems Science* (2nd ed. p. 9) by J. Gonzalo, S. Skochelak, J. Borkan, and D. Wolpaw, 2020, Elsevier. Copyright 2021 by Elsevier Inc. Reprinted with permission.

Adaptive Expertise in Healthcare and Medical Education

Adaptive Expertise in Healthcare

Adaptive expertise is becoming a new goal for clinical training. An adaptive expert is flexible in using knowledge and innovation to create novel solutions and learn from daily problem-solving (Mylopoulos et al., 2018; Steinert et al., 2021). Adaptive expertise consists of two types of expertise, routine and adaptive. Routine expertise uses procedural knowledge to know “how” things work. Problems are approached with a fixed script of solutions; however, these solutions may not address novel and unfamiliar challenges. Individuals using adaptive expertise know how to solve common problems and use conceptual knowledge to understand “why” things work (Kua et al., 2021; Mylopoulos et al., 2018). Adaptive experts are analytical when solving problems and innovative when dealing with novel challenges.

Adapting to complexity and uncertainty is essential for physicians to provide quality patient care (Kua et al., 2021; Mylopoulos et al., 2018). High intrinsic motivation and passion for learning are critical personal attributes for developing adaptive expertise. An individual’s reason for learning something can impact how well the information is understood and applied to practice (Grant et al., 2017). Four characteristics of adaptive expertise include curiosity, motivation, growth mindset, and resilience (Cutrer et al., 2018; Steinert et al., 2021). Additionally, lifelong and self-regulated learning in which knowledge is flexible is essential to developing adaptive expertise (Lajoie & Gube, 2018).

Adaptive expertise emphasizes two approaches to problems: efficiency and innovation (Mylopoulos & Woods, 2017). Adaptive experts balance the decision to treat a patient through a routine, efficient treatment or use innovative solutions for patient treatment. Donald Schön’s (1983) reflective practice and reflexivity closely align with adaptive expertise, as daily problems

are opportunities for learners to expand their knowledge through training (Mylopoulos & Regehr, 2009). Through reflective practice, adaptive experts distinguish between expertise that is efficient and expertise that is innovative. Mylopoulos et al. (2016) describe adaptive physicians as being able to see the “old in the new” through past knowledge and the “new in the old” by reflecting and rethinking their current approaches to practice. Adaptive expertise does not just emerge; it is an attitude towards learning taught and practiced throughout one’s career (Mylopoulos & Regehr, 2009).

Adaptive Expertise in Medical Education

Mylopoulos et al. (2018) argue that health educators should implement a curriculum that supports procedural and conceptual knowledge within adaptive expertise. Teaching adaptive expertise involves taking learners out of their comfort zone and challenging their ability to develop in new situations (Merritt et al., 2022). Individuals who use adaptive expertise respond to novelty and complexity by balancing their procedural and conceptual knowledge to foster innovation (Mylopoulos, 2020; Steinert et al., 2021). Procedural knowledge aids in developing efficient problem-solving, while conceptual knowledge aids in developing learning and innovation. Training that includes procedural efficiency to solve problems never encountered before and conceptual knowledge supports preparation for future learning (PFL).

PFL is “a learner’s ability to select and learn from new resources and to use that learning to facilitate solving novel problems” (Manzone et al., 2021, p. 2). Mylopoulos et al. (2016) define PFL as “the capacity to learn new information, to use resources effectively and innovatively, and to invent new strategies for learning and problem-solving in practice” (p. 116). According to Mylopoulos et al. (2018), PFL involves learning new information, utilizing resources, and creating new approaches to learning and problem-solving. Improving learners’

ability to transfer knowledge from one situation to an unfamiliar situation is crucial (Beck et al., 2020; Kua et al., 2021; Pusic et al., 2018; Sears, 2017). PFL teaches learners to use prior knowledge and adapt to a changing situation to support future learning (Kua et al., 2021). Support for future learning and knowing how to transfer and apply prior knowledge is essential to problem-solving, as students are unlikely to encounter a problem precisely as taught in the classroom, and it is impossible to constantly develop a curriculum that encompasses the rapid changes in healthcare (Kua et al., 2021; Sears, 2017). Instead, medical education incorporating adaptive expertise teaches future physicians how to maneuver changing dynamics (Manzone et al., 2021).

As patient treatment becomes more diverse and complex, adaptive, future-ready physicians will need to assess a problem quickly, integrate previous knowledge and skill, use available resources, and implement new approaches to solving novel problems (Kua et al., 2021). One strategy of adaptive expertise is to allow students to struggle during problem-solving. Struggle and failure are crucial to developing adaptive expertise as they promote more profound conceptual knowledge and build a foundation that encourages students to generate new solutions to problems (Mylopoulos et al., 2018). Murray et al. (2021) argued that for transformation to occur in the medical education system, “a culture of learning must be developed based upon providing safe environments for learners to speak up, make mistakes (fail forward), and learn from their mistakes in an iterative process” (p. 6).

Patient care must be provided efficiently and effectively based on knowledge gained through formal training and adaptive to informal learning or new knowledge related to patient care. While physicians increase their knowledge as they progress in their careers, they must view themselves as lifelong learners and be open to novel approaches to solving complex patient

problems. Physicians must consider the patient's social context when dealing with complex patient problems. Physicians unable to adapt to complex patient problems still provide adequate care to the patient through routine expertise but are unlikely to adequately address situations of uncertainty and complexity (Mylopoulos et al., 2016).

Despite literature supporting adaptive expertise and the AMA's endorsement of adaptive expertise, some educators do not see a need for developing adaptive expertise as a new approach to learning. In contrast, others argue that the medical education curriculum does not have room to implement a new competency. However, teaching adaptive expertise should not be thought of as just another activity; it is an approach, a style, and an attitude (Kua et al., 2021), requiring a more dynamic curriculum (Fleener, 2002). Skills needed to develop adaptive expertise include reflection, collaboration, and flexibility. Adaptive experts will learn to innovate and respond to uncertainty and challenges (Cutrer et al., 2017).

The Master Adaptive Learner Model

The Master Adaptive Learner model (MAL) draws heavily on adaptive expertise. Although the development of adaptive expertise came from fields outside of health education, Cutrer et al. (2017) developed a conceptual model for medical education that is constructed on adaptive expertise and critical thinking (Kua et al., 2021). Based on self-regulation learning (SRL), the MAL model teaches learners to develop skills of adaptive expertise, which prepares future physicians to use metacognitive processes to support a deeper understanding and transfer of knowledge in medical education to create innovative solutions (Cutrer et al., 2017; Mylopoulos et al., 2016).

Cutrer et al. (2020) describe a master adaptive learner as an "individual who utilizes the metacognitive approach to self-regulated learning that leads to adaptive expertise development"

(p. 3). Within the MAL model, the master adaptive learner may be the medical student, the resident, or the physician. The focus of adaptive expertise and adaptive learning is different based on the type of learner. Effective master adaptive learners continuously work to improve their knowledge and skills through lifelong learning.

When self-regulating, learners engage in participation, performance, and reflection. They use meta-level processes to identify gaps in their knowledge and adapt when needed rather than utilize a one-size-fits-all approach to patient treatment (Lajoie & Gube, 2018). The model consists of four phases (planning, learning, assessing, and adjusting) and is driven by four internal characteristics (curiosity, motivation, growth mindset, and resilience). As learners navigate the MAL model, they learn to think metacognitively about why they do things the way they do them; not just to be efficient. Through metacognition, learners go beyond just trying to absorb knowledge; they actively engage in their learning and think critically about their thinking (Grant et al., 2017). The MAL model provides medical educators with a conceptual understanding of adaptive expertise to effectively train future providers for uncertainty (Cutrer et al., 2017; Kua et al., 2021). The model aims to help the learner adapt to the clinical practice environment.

Development of MAL Model

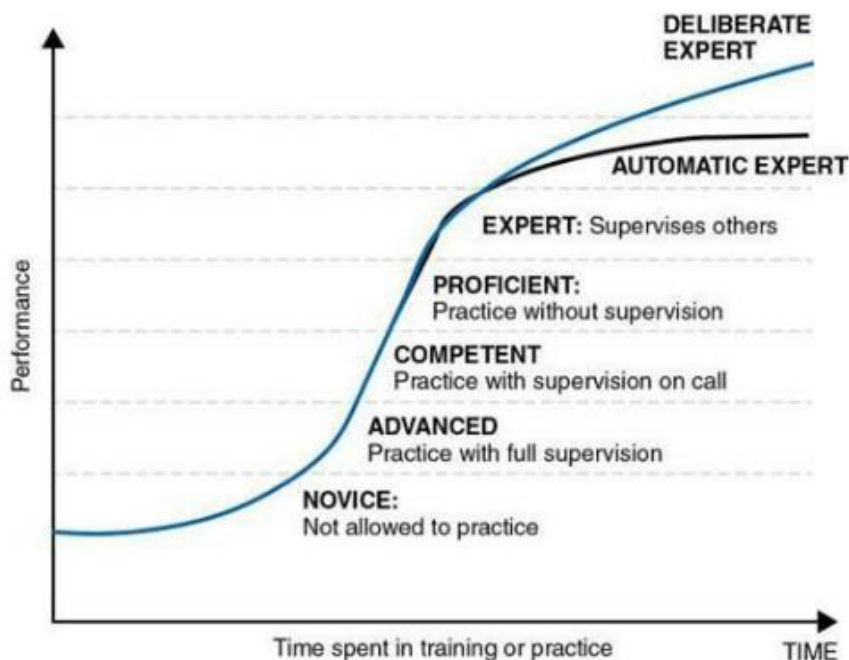
Developed from the work of the AMA Accelerating Change in Education consortium, the MAL model is crucial for supporting the consortium's efforts to accelerate change (Loomis, 2021). The model is based on the idea that lifelong learning is a part of the professional identity of healthcare providers and is a new way of challenging future physicians for lifelong learning in the complex healthcare system (Cutrer et al., 2019). The consortium and creators of the model used competencies within Health Systems Science, the Practice-Based Learning and

Improvement competency, and the Plan-Do-Study-Act cycle commonly used for quality improvement when forming the model (Cutrer et al., 2018; Pusic, 2020). MAL aims to optimize learning so that they are equipped with the skills to apply concepts they learn in medical school to situations they may encounter in future practice.

Cutrer et al. (2020) use a simplified version of the Dreyfus and Dreyfus brothers' model of expertise development to describe the need for the MAL model visually. The Dreyfus and Dreyfus model follows five stages of development from novice to expert (Edje & Price, 2021). Dreyfus and Dreyfus's model (Figure 2) of expertise describes becoming an expert through repetitive actions in which one becomes increasingly proficient (Cutrer et al., 2017). The model shows that the learning curve begins with novice practitioners, those at the beginning stages of medical school and not at the point in which they practice medicine.

Figure 2

Dreyfus Model of Expertise

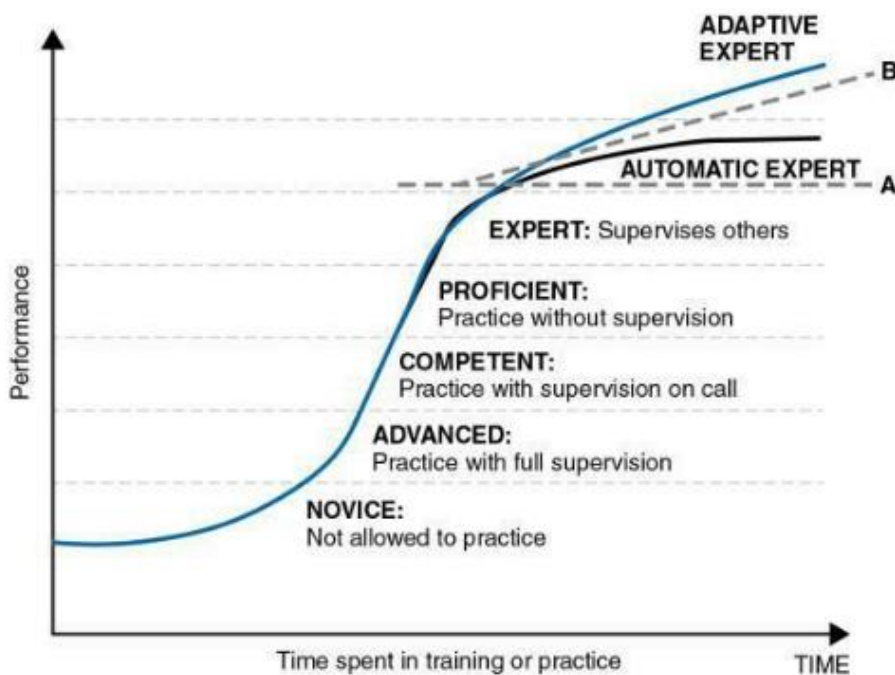


Note. Dreyfus and Dreyfus Model of Expertise. Reprinted from *The Master Adaptive Learner* (p. 11) by M. Pusic, W. Cutrer, and S. Santen, 2019, Elsevier. Copyright 2019 by Elsevier Inc. Reprinted with permission.

Over time, their performance advances, and their level of expertise gradually increases to expert. At this expert level, an individual does not need supervision for tasks and often supervises others (Beck et al., 2020; Pusic et al., 2018). However, Cutrer et al. (2017, 2018, 2020) argue that physicians' learning does not end once this level of expertise is reached, as depicted by the Dreyfus and Dreyfus model. Instead, physicians continue to learn and adapt their expertise to effectively address the complexities of health care (Figure 3).

Figure 3

Adaptive Expertise Dreyfus Model



Note. Adaptive Expertise Model of Dreyfus and Dreyfus Model of Expertise. Reprinted from The Master Adaptive Learner (p. 57) by K. Papp and P. Thomas, 2019, Elsevier. Copyright 2019 by Elsevier Inc. Reprinted with permission.

Routine Expertise vs. Adaptive Expertise

Routine expertise is achieved through learning using repetition and memorization and involves utilizing a skillset on commonly performed tasks (Branzetti et al., 2022). Adaptive expertise, on the other hand, is a balance between routine expertise and innovative problem-solving. Adaptive experts rely on innovation and knowledge discovery in response to new challenges. Physicians who can effectively balance these two types of expertise operate within an *optimal adaptability corridor* (Cutrer et al., 2020).

Operating within an optimal adaptability corridor enables physicians to provide the best possible care for patients. The MAL model is a guide for nurturing future physicians to develop the skills needed to function within the optimal adaptability corridor. Physicians not learning and adopting adaptive expertise may not have been trained. Teaching for adaptiveness is about finding the right balance between innovation and routine practice. When teaching master adaptive learners, medical educators aim for the optimal adaptability corridor in which physicians are trained to balance innovation and efficiency (Cutrer et al., 2019).

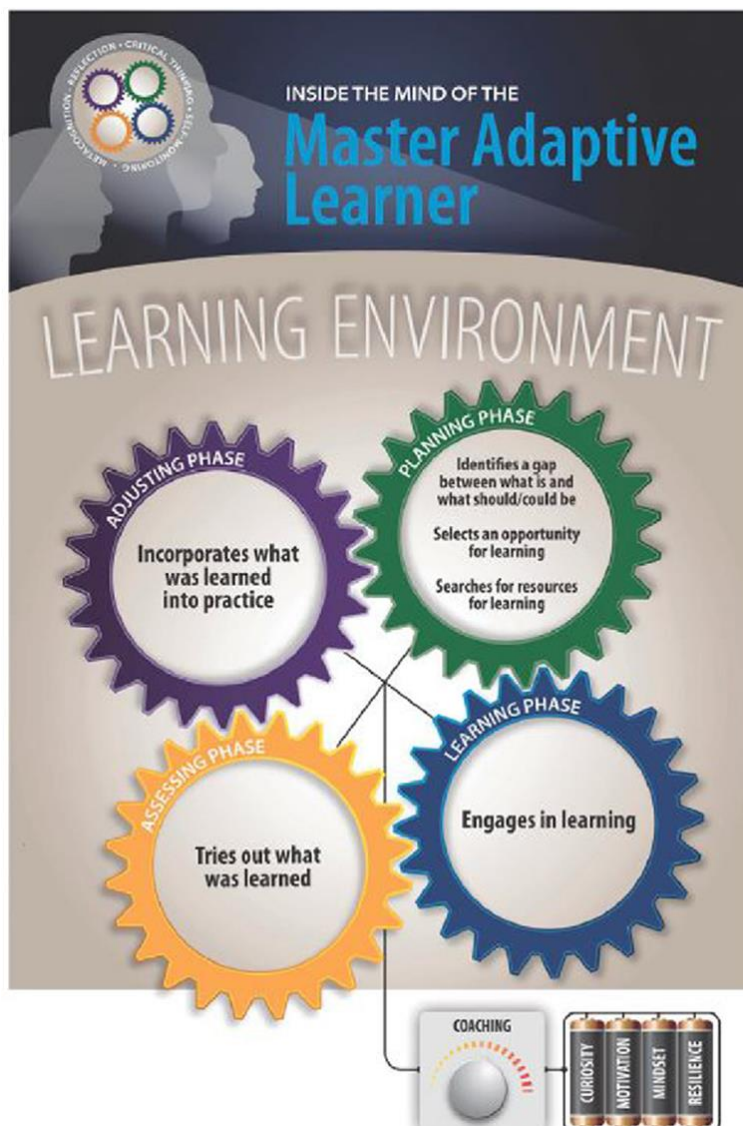
Four Phases of MAL

Drawing on medical education and SRL theory, MAL comprises four phases. The phases are fundamental to the MAL framework (Hauer et al., 2018) and parallel the Plan-Do-Study-Act model for quality improvement (Pusic, 2020). Each phase of the model is illustrated as a gear to depict the power and connectedness of each phase (Figure 4). The skills needed for each phase are listed within each gear. The gears are powered by four batteries representing the four

characteristics of a master adaptive learner. Connecting the batteries to the gears is coaching, most often from medical educators (Cutrer et al., 2018, 2019). This section discusses the four phases within the MAL model, followed by the four internal characteristics that drive the model.

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 (DOI: 10.1080/0142159X.2018.1484560)

Planning Phase

In phase one of the MAL model, learners identify gaps in their knowledge, select an opportunity to learn to address this gap and search for resources for learning. In determining a gap, the learner becomes aware that their current knowledge is insufficient for the problem. Drawing on Schön’s concept of “surprise” and Mezirow’s concept of disorienting dilemma, this awareness of a knowledge gap engenders cognitive dissonance (Edje & Price, 2021; Mann et al., 2009), which prompts the learner to begin searching for answers (Cutrer et al., 2017; Edje & Price, 2021). Goal setting is vital in searching for answers during the planning phase. Learners use self-regulating and self-directed learning to build knowledge and develop a deeper understanding. After selecting a plan to address the gap, learners search for resources fueled by the feeling of cognitive dissonance. Resources may be formal, nonformal, and unplanned learning, in addition to the learner’s persistence in finding answers (Cutrer et al., 2017).

Learning Phase

Following the planning phase, the learner analyzes their previous knowledge gap concerning the new knowledge learned in the learning phase. During this phase, the learner is focused on understanding new knowledge and how it will address their gap in knowledge. Learners are encouraged to focus their learning on a more profound and meaningful understanding of the evidence that supports their education. The learner uses critical appraisal to analyze which resources most effectively address cognitive dissonance feelings (Cutrer et al., 2017, 2020).

Assessing Phase

Next, in the assessing phase, the learner addresses the initial challenge by trying out their new knowledge and skills. Medical education aims to develop expert physicians who are knowledgeable in their practice but can also effectively self-assess and reflect on their thoughts and actions (Quirk & Chumley, 2018). As the learner implements or applies the new knowledge, they assess its effectiveness in addressing the knowledge gap. Self-assessment is crucial to this phase as the learner must evaluate whether they will accept the new knowledge and if it is accurate. Self-assessment is an essential component of being a master adaptive learner. Self-assessment is a “process of interpreting data about our own performance and comparing them to an explicit or implicit standard” (Epstein et al., 2008, p. 5). Effective self-assessment is needed to identify weaknesses independently and address weaknesses through self-development.

However, physicians struggle to self-assess, often identifying strengths as weaknesses (Peterson et al., 2014; Wolff & Santen, 2019). Therefore, informed self-assessment is needed throughout the MAL process to aid learning. Informed self-assessment involves seeking and integrating internal and external sources into the self-assessment process. This involves seeking feedback from external sources (people, processes) and internal sources (self), interpreting the feedback (reflect, assimilate), and responding to feedback (ignore, accept). Thus, informed self-assessment is a “phased, dynamic, interactive process of accessing, interpreting, and responding to external and internal data, influenced by multiple conditions and underlying tensions” (Sargent et al., 2010, p. 1,215).

Medical educators are likely to provide external input to the learner, and external feedback is essential to becoming an adaptive learner (Cutrer et al., 2017; Wolff & Santen, 2019). For educators, this means encouraging learners to adopt behaviors of seeking feedback

and providing structured activities to provide feedback on performance can foster feedback-seeking behaviors. Through modeling a growth mindset and MAL behaviors, educators can encourage learners to seek feedback to address learning gaps by providing detailed and timely feedback that is respectful, and observation of performance delivered verbally or written, rather than quantitatively with a grade (Wolff & Santen, 2019). While the literature supports the need for educators to foster self-assessment for MALs, there is little empirical evidence to support the claim.

Wolff et al. (2021) note assessment as a future direction for MAL research. While competencies for coaching in medical education have been identified, there is a lack of evidence in measuring the success of master adaptive learners (Stringer et al., 2019). In general, there is little evidence in the literature of the assessment of the MAL model. Stringer et al. (2019) present a discussion of an early attempt to assess the MAL model and acknowledge the need for future research. Stringer et al. (2022) conducted a study to examine an instrument for measuring the MAL process in medical students. While the instrument provided initial steps to measure the MAL model, more research is needed to understand the MAL learning process.

Assessment of the MAL model can be seen in three domains: individual characteristics, observable behaviors, and outcomes. Assessment of individual characteristics involves information on beliefs and attitudes, most accessed through self-assessment. Observable behaviors include assessing what learners do (Stringer et al., 2019)—for example, determining if they actively identify their learning gaps or set learning goals. Not only do observable behaviors indicate that learners know how but they show how to be a master adaptive learner. Outcomes, which overlap with observable behaviors, are indicated by the success of learners' actions, such as improving medical education test scores or patient care.

While there are a variety of assessments educators can use to assess the phases of the MAL model and given the complexity of the model, various assessments may be needed to ensure the learner is working through each phase of the model (Stringer et al., 2019). There is the prospect of a longitudinal assessment of learners' engagement with the MAL model through portfolio learning. Through tracking learning and performance with portfolios, educators can identify MAL behaviors over a period of time and assess whether students are growing to become master adaptive learners (Stringer et al., 2019).

Adjusting Phase

In the final adjusting phase, learners decide whether knowledge learned will be implemented into daily routine patient care or only applied to the isolated situation. This phase is more challenging for early learners as they navigate the complex healthcare system (Cutrer et al., 2017). This decision involves making changes and adapting practices that can have implications for the various systems within healthcare. Changes to practice can be within the clinical practice (microsystem), support for patient services (mesosystem), or the healthcare system (macrosystem) (Cutrer et al., 2019).

Cognitive Skills in MAL

Critical thinking and reflection are cognitive skills used as learners navigate the MAL model. In the MAL model, these skills surround the four-phase gears. Critical thinking involves “conceptualizing, applying, analyzing, synthesizing, and evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication as a guide to belief and action” (Cutrer et al., 2017, p. 73). Physicians can maximize their learning through reflection, which occurs before, during, and after, to gather information about a situation so that future cases will be informed by previous encounters (Cutrer et al., 2017).

Internal Characteristics of MAL

As mentioned, four internal characteristics provide the power to promote learner engagement in the MAL model, depicted as four batteries in the visual representation of the model. These internal characteristics include curiosity, motivation, a growth mindset, and resilience. Motivation drives curiosity to take action to fill the gap. An individual's belief that they can develop skills and their learning is based on a growth mindset. Overcoming obstacles and challenges involves resiliency to continue learning (Cutrer et al., 2019).

Curiosity

Crucial for the planning phase of the model, curiosity fuels a drive to fill a knowledge gap and is prompted by an internal desire to know and learn more. According to Cutrer et al. (2018), learners who demonstrate curiosity are likely to engage in problem-solving, self-assessment, and lifelong learning. Medical educators and the learning environment should promote curiosity by encouraging learners' abilities, feedback, engagement with challenging situations, opportunities for learners to ask questions, and enhancing learner self-sufficiency and knowledge. Medical educators can support learner curiosity through specific instructional approaches that promote students' responsibility for learning, multiple perspectives, and reflection. Using evidence-based instructional strategies, medical educators can foster curiosity within future physicians to deal with and address novel challenges (Cutrer et al., 2018; Dyche & Epstein, 2011). The focus on curiosity encourages the learner to fully understand a problem rather than simply completing a task or assessment to meet the minimum standards.

Motivation

Motivation is needed to propel learners through the MAL process, as a desire to address novel situations and challenges is driven by motivation. Several theories, such as the Self-

Determination Theory (SDT), support the correlation between motivation and effective learning. SDT is built on the foundation of intrinsic and extrinsic motivation. Intrinsic motivation is driven by personal interest, while extrinsic motivation is driven by reward. Motivation on a continuum may position someone as having shallow motivation (amotivation), high motivation based on their interest, or may fall somewhere between (Deci et al., 2017; Deci & Ryan, 1985).

Motivation can be fostered by addressing internal and external factors. Medical educators can stimulate intrinsic motivation by setting goals, concisely explaining how knowledge or skill will benefit the learners' needs, encouraging learner autonomy, and creating situations that maintain curiosity through various learning activities. Medical educators can foster extrinsic motivation by providing explicit instruction and feedback, acknowledging rewards, and engaging learners in social activities. Medical educators can use curricular design to increase learner motivation through group activities, mentorship, and positive role modeling. Intrinsic motivation should be of particular concern for medical educators as it is associated with deeper learning and persistence (Cutrer et al., 2018, 2020; Grant et al., 2017).

Growth Mindset

Mindsets are learners' beliefs about their traits and learning ability. Cutrer et al. (2018, 2020) discuss two mindsets concerning one's capacity for learning. Learners with a fixed mindset believe success is based on talent and intelligence. These learners are typically apprehensive about addressing challenges for fear of failure. A fixed mindset focused on performance within medical education may result in a learner genuinely lacking in areas of knowledge (Richardson et al., 2021). Learners with a growth mindset believe they can improve their intelligence and performance through hard work. Individuals with a growth mindset welcome challenges and opportunities to enhance their learning, enhancing overall academic

achievement (Dweck, 2006; Dweck & Molden, 2017; Yeager & Dweck, 2020). Physicians with a growth mindset learn new things, adapt, and work to improve practice skills.

According to Cutrer et al. (2020), one of the most successful methods of encouraging a growth mindset in learners is direct instruction on mindset and the types of mindsets. Medical educators must adopt a growth mindset before expecting learners to develop growth mindset competency. The focus should be on preparing future physicians who work to continuously grow and learn in the profession (Richardson et al., 2021). Additionally, the educational environment can support a growth mindset by establishing a culture that values the qualities of a growth mindset (Regan et al., 2022).

Resilience

Resilience is needed to function and thrive in complex systems such as healthcare. To be resilient, one must adapt and grow stronger in situations of change, uncertainty, adversity, or threats. Resilient learners are persistent through challenges and failures. Described as a central element of well-being for medical students and physicians, resilient learners use specific skills such as self-awareness and mindfulness to respond to stress (Cutrer et al., 2019). While more research on resiliency in medical education is still needed, the literature suggests that it plays an important role and can be enhanced through targeted actions (Cutrer et al., 2018, 2020).

Medical Educators and the MAL Model

As with the internal characteristics of MAL, external factors impact the development of master adaptive learners. Medical educators impact the development of master adaptive learners and promote MAL thinking in medical students. Medical educators' actions foster master adaptive learning by influencing contextual factors of the learning process. Medical educators' influence on the MAL process through coaching, curriculum development, and the learning

environment directly impacts the facilitation of MAL behaviors and adaptive expertise (Auerbach et al., 2020; Cutrer et al., 2018; Roberts et al., 2019).

Wolff et al. (2021) describe coaching in medical education as a learner-driven process “to facilitate the development of self-directed, fast-changing, adaptive expertise in healthcare provider training” (p. 1,210). The foundational strategies for teaching and learning MAL habits are introduced early on to newly matriculated medical students. Incorporating MAL into the medical curriculum establishes an adaptive learning culture (Roberts et al., 2019). While often overlooked, the learning environment has an important link to the MAL model and can be either beneficial or detrimental to the MAL process. The learning environment establishes the context of learning and impacts how learners interact with the MAL process (Gruppen et al., 2019; Regan et al., 2022).

Coaching

Each internal characteristic of the MAL model can be facilitated by coaching. Coaching from educators is a significant component of each phase of the model. Educators can control the model’s effectiveness through coaching and can directly influence each phase of the model by helping students explicitly understand adaptive expertise (Cutrer et al., 2018). According to Wolff, Ross, et al. (2020), coaching supports development through guiding reflection, helping to identify appropriate outcomes, and determining specific actions to achieve learning goals.

Coaching facilitates self-regulated learning and adaptive expertise, enabling future physicians to identify and address their knowledge gaps and adapt treatments as needed. Medical educators in a coaching role facilitate learners’ capacity for adaptiveness by evaluating their performance and providing feedback to learners on their performance. Coaches also work with learners on self-awareness and serve as models of adaptive expertise (Cutrer et al., 2018).

Coaching can support learner independence by encouraging identifying gaps in knowledge, supporting goal development, and self-responsibility for learning (Wolff, Ross, et al., 2020). Unfortunately, many health educators have not been trained in MAL; thus, educators must be prepared to demonstrate adaptive expertise and create an environment for MAL (Edje & Price, 2021).

Coaching Through the Model

As a coach, medical educators review personal goals with students by setting goals, reviewing their performance with a student concerning goal achievement, providing feedback, exploring barriers, and how to sustain goal achievement (Wolff, Ross, et al., 2020). According to Cutrer et al. (2020), coaching in the planning phase involves promoting reflection on identifying gaps, goal setting, and encouraging learners to keep identified goals in mind throughout the phase. Coaches can provide feedback in this phase by using goals and feedback on the quality and attainment of established goals.

In the learning phase, coaches model learning as a lifelong habit by discussing their experiences of realizing gaps in their knowledge and how they addressed them. Additionally, coaches can offer valuable resources and learning strategies during this stage. During the assessing phase, coaches assist with developing self-assessment skills by encouraging learners to reflect on the known information and independently analyze and interpret that information. In the adjusting phase, coaches serve as a resource for learners' ideas and how they will function within the healthcare system on an individual and organizational level (Cutrer et al., 2019). Wolff et al. (2021) identified coaching competencies and actions to assist learners in engaging in the MAL model (Table 1).

Table 1*Coaching Competencies Throughout MAL Phases*

MAL Phase	Coach's Actions
Planning	Use questioning to develop learner goals and elicit learner self-reflection
Learning	Active inquiry with learner to identify learning strategies
Assessing	Provides accountability and feedback for learner self-assessment
Adjusting	Identifies learner's abilities and further development of learner

Note: Wolff, M., Deiorio, N. M., Miller Juve, A., Richardson, J., Gazelle, G., Moore, M., Santen, S. A., & Hammoud, M. M. (2021). Beyond advising and mentoring: Competencies for coaching in medical education. *Medical Teacher*, 43(10), 1210-1213.

<https://doi.org/10.1080/0142159X.2021.1947479>

The coach's role in the MAL model is to offer positive feedback in developing a master adaptive learner (Cutrer et al., 2018). Key factors in adaptive learning are asking questions and incorporating feedback (Quirk & Chumley, 2018).

Medical Curriculum

Aside from coaching, the MAL process can be introduced by teaching the components of MAL through various educational concepts and principles throughout the medical curriculum. Roberts et al. (2019) discuss the early introduction of MAL to students through advertisement via the medical school's website, indicating that it could be a factor during the medical school admissions process for potential students interested in the prospect of lifelong learning. Educators should intentionally incorporate the MAL model in conversations to enhance understanding of MAL and develop a common language of adaptive learning among educators and learners. Beginning with the first week of school (orientation) and throughout the first year of medical school, educators can incorporate the MAL model in lectures, activities, and

formative feedback to demonstrate the MAL principles (Roberts et al., 2019). Introducing the MAL model early and throughout the curriculum enhances students' conceptual understanding of the model (Wilson-Delfosse & Fall, 2019).

Role modeling MAL behaviors facilitate learners to do the same. For example, if an educator identifies a learning gap and models for students how to address this gap, students will be more open to sharing their weaknesses. Encouraging students to step out of their comfort zone and speak up and recognize this as a growth process is critical to fostering master adaptive learners (Roberts et al., 2019). Thus, flexible, adaptive educators who can teach students how to learn are important (Auerbach et al., 2020).

Learning Environment

A driving force for implementing MAL into medical education is to create an environment in which MAL is a shared vision and mental model for educators and learners (Cutrer et al., 2018; Roberts et al., 2019). The learning environment plays a central role in the learning process and will differ among learning situations. A conceptual model of the learning environment can support educators by implementing the MAL model. Regan et al. (2022) argue that educators can support a more effective learning environment by: “highlighting patients as the focal point of learning, building a professional learner identity, teaching learning skills, and creating opportunities for collaborative learning” (p. 1).

The learning environment in medical education can be identified as classroom or clinical. The classroom environment is where learners learn foundational knowledge, while the clinical environment, also known as the work environment, is where students begin to apply their practice (Gruppen et al., 2019). In both environments, relationships between students and educators are important. Although, the transition between learning environments can be a

challenge for learners. Not only are they being exposed to new and uncertain situations in each environment, but their learning modalities have also changed. Whether the transition is from classroom to clinic or medical school to residency (UME to GME), medical educators can reduce this challenge by fostering master adaptive learner skills such as self-reflection and goal setting (Cutrer et al., 2018; Regan et al., 2022).

Much of the responsibility for creating a learning environment conducive to the MAL process will fall on medical educators. However, there are barriers to creating this type of environment. Barriers include the current medical education model, which favors a trainer-trainee mentality, and the time needed to devote to teaching competencies of lifelong learning, with little guidance on how to address them (Murray et al., 2021; Wolff, Stojan, et al., 2020). The trainer-trainee mentality negatively impacts the process of allowing students to pursue learning opportunities independently (Kercheval et al., 2021). It reinforces learners' reliance on correct grades and quantitative feedback, which can create a sense of perfectionism and linear thinking in students (Papanagnou et al., 2021).

Instead, a positive learning culture established by educators is conducive to the MAL model. In a study conducted on the future of lifelong learning in medical education, results indicated that for learning to be lifelong, changes in the educational environment need to be made for an environment that facilitates adaptive learning and curricula that develops adaptive learners. For this to be facilitated, faculty need to develop the skills and competencies to move from "a teacher role to a role as a facilitator of learning," a change supported through faculty development (Murray et al., 2021, p. 3). Additionally, in a study on educators' perspectives about the learning environment needed to promote master adaptive learners, Auerbach et al.

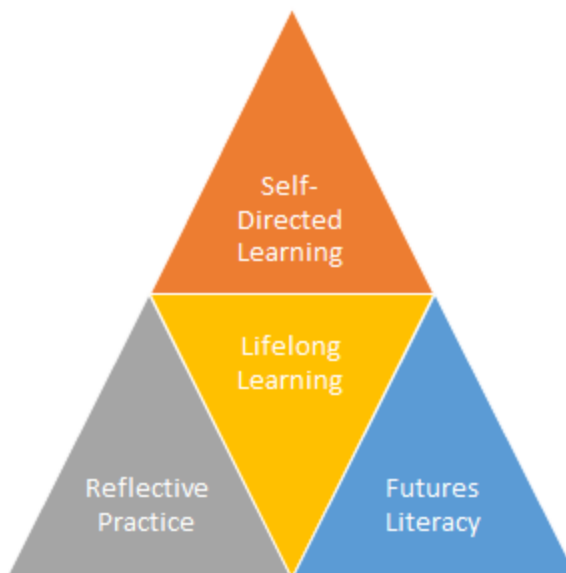
(2020) found that an institutional commitment to the MAL model is needed for creating a culture that supports learning and providing appropriate resources.

Conceptual and Theoretical Frameworks

The conceptual and theoretical frameworks that guide this study are rooted in adult learning theory and futures studies (Figure 5).

Figure 5

Conceptual and Theoretical Frameworks of Study



Note. Adult learning theories and future studies theory were used as a lens to which the study was conducted and analyzed

Self-directed learning, lifelong learning, and reflective practice are theories situated in adult learning theory. In the 1960s, adult educators and researchers began studying adult learners and how adults learn differently than children (Illeris, 2009). There are various adult learning theories within behaviorist, cognitive, and constructivist approaches to learning (Bélanger, 2011). According to Merriam (2008), adult learning is a multidimensional cognitive process

adults use to make meaning or generate knowledge. Adult learning occurs in various settings within the context of life experiences, promotes reflection, and uses creative modes of inquiry.

Futures Literacy is a conceptual framework within Futures Studies. Futures Studies have evolved since being used as a military strategy in the 1940s to predict future events and scenarios (Fergnani, 2020). Today, futures studies methods are used to map alternative futures through prospective thinking in planning and decision-making to navigate societal changes (Anthoni et al., 2020). Saleh et al. (2008) define the futures studies paradigm as a “multi-disciplinary research of change, trends, megatrends, driving forces, emerging counter forces, and uncertainties in all major areas of life to find the interacting dynamics that are creating the future” (p. 38). By approaching change systematically and anticipatively, future studies explore possible future alternatives, identify possible future scenarios, and make informed decisions about the capacity to adapt to future alternatives (Saleh et al., 2008). 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). To this end, futures literacy and anticipatory futures perspectives connect with adult learning theories to promote and support lifelong learning (UNESCO Institute for Lifelong Learning, 2020).

Self-Directed Learning

Often described as the goal of adult education, SDL emphasizes autonomy and individual freedom for adults to plan, conduct, and evaluate their learning (Taylor & Hamdy, 2013). As a self-initiated learning process, self-directed learners manage their learning, using critical thinking and defined goals to control how and what they learn. Self-directed learners curiously respond to surprise, uncertainty, and change which motivates them to generate learning to address gaps and

limitations within their knowledge (Caffarella, 1993; Mifflin, 2000; Taylor & Hamdy, 2013). Healthcare providers must provide care in a changing healthcare system, continuously reviewing and updating their knowledge and practice to address complex patient and healthcare problems (Mann et al., 2009). Competent healthcare professionals are expected to address complex healthcare problems (Mann et al., 2009).

The work of Tough (1971) and Knowles (1975) is foundational to the research on SDL (Merriam, 2001). However, Tough's research is often viewed as a pillar of SDL. Building off the work of Houle (1961), Tough provided a comprehensive description of SDL as a form or method of study (Candy, 1991; Merriam, 2001). SDL can be approached as an activity or an outcome of learning. Some researchers discuss SDL as a characteristic or personal quality that varies self-direction and can be measured. SDL as a method for learning is often defined by whether learning is initiated by oneself or directed by someone else, such as an educator (Candy, 1991). For example, Mezirow (1981) writes that an adult educator's role is to create opportunities for learners to enhance their abilities for self-direction.

SDL and lifelong learning discussed below have a shared purpose. Adults use SDL to learn throughout their lives, often outside formal education. Lifelong learning encourages adults to seek knowledge on their own beyond formal education. Therefore, SDL is a means and an end to lifelong learning (Candy, 1991). However, SDL is critiqued as it highlights individualistic learning while underrating the value of social and collaborative learning (Kotzee, 2012; Taylor & Hamdy, 2013). Candy (1991) also draws attention to the limitations of SDL in that while SDL is individualized, adult education takes place within a social context, which inherently impacts the learning process.

Lifelong Learning

One of the most challenging skills medical educators teach future physicians is to be lifelong learners (Gisoni et al., 2021). An essential goal of education, lifelong learning, is learning in any setting to improve an individual's growth and social well-being, culture, or society (Derrick, 2003). According to Dewey (1916), lifelong learning is situated in growth. Humans grow intellectually throughout their lives, in and outside formal educational settings (Cross-Durrant, 1984). Lifelong education is often discussed in relation to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), particularly with the Faure report (1972) and the Delors report (1996), which advocated for universal, lifelong learning (Bjursell, 2020; Jarvis, 2010).

Like SDL, lifelong learning can be approached from various angles, such as an individual's learning on a continuum of educational opportunities an institution offers (Bjursell, 2020). Humans rely on lifelong learning to adapt to a changing society. This learning process can occur in formal, informal, or nonformal settings. Physicians are expected to be lifelong learners to maintain the knowledge and skills needed to provide patient care (Tagawa, 2008). While in a formal educational setting, coaching and feedback from educators can support lifelong learning skills in students. Lifelong learning skills are essential to the continuous intake of learning, adapting, and innovating.

Reflective Practice

Reflective practice aids in problem-solving by providing practitioners with alternative paths to solutions (Roessger, 2014). Individuals and organizations look to reflective practice to improve effectiveness. Reflective practice occurs when one critically assesses and reflects on their actions and behaviors to develop professional effectiveness (Peters, 1991). According to

Grant et al. (2017), the work of John Dewey has contributed significantly to the theoretical underpinning of reflective learning and practice. Dewey argued that reflection as a deliberate action is central to reflective practice. Additionally, theorists such as Freire, Kolb, and Schön have influenced reflective practice's educational and philosophical perspective.

According to Schön (1983), reflective practice involves individuals using reflection-in-action to make quick judgments and decisions in novel or uncertain situations (Jordi, 2011). As Peters (1991) describes, the reflective practitioner systematically examines their actions. Schön (1983) contends that professionals participate in reflection intuitively during and after action. The overall theme of Schön's perspective is how practitioners can use reflection to think critically about their actions and improve professional practice and workplace learning (Cocodia, 2014). Thinking critically about their actions encourages asking "why" questions and challenging the status quo (Grant et al., 2017). Given the complex problems faced in today's workplace settings, reflective practice provides practitioners with a powerful strategy to help with problem-solving.

Schön's basis for using reflective practice in the workplace is supported by the argument that not all problems can be solved through knowledge taught in a formal learning context. Knowledge is often obtained through a more profound process involving an individual's reflective actions. Therefore, all knowledge cannot be taught; instead, it is gained through experience. Participation in reflection requires individuals to observe their actions externally and determine how they will affect their practice (Schön, 1983). By examining experiences and assumptions, practitioners can utilize reflection to solve many problems (Ferry & Ross-Gordon, 1998). Although, reflective practitioners must be open to constructive feedback and paradoxical beliefs and values (Peters, 1991).

Over recent years, reflective practice has gained momentum in physicians' continuing professional education settings and, subsequently, medical education (Grant et al., 2017; Mann et al., 2009). Professional identity is often developed through reflective practice. Reflective learning is vital in medical education (Taylor & Hamdy, 2013), and reflective practice can develop a physician's professional identity. As a reflective process, forming a professional identity can influence the transformation of the medical student into a physician (Grant et al., 2017). When medical students begin practicing, incorporating reflection into the medical curriculum, and using intrinsically motivating learning activities, they already possess the training and skill needed to promote and monitor their learning and knowledge throughout their careers (Grant et al., 2017).

Reflective practitioners know their prior and current knowledge and how this can be combined with new knowledge and skills (Grant et al., 2017). Reflective practitioners actively adjust and consider their practice for improvement and reflect upon problems as they occur (Tannebaum et al., 2013). For medical students, reflecting within a community of practice in which students observe physicians in practice assists them in gaining the medical knowledge and clinical skills needed because they can reflect on how they would respond to the situations they observe. Reflection can help future physicians in situations of uncertainty and help them deal with similar situations that may occur in the future.

Futures Literacy

Times of uncertainty and transition cultivate opportunities in technology and acceleration in disruption among systems. Organizations across all systems adopt dynamic capabilities such as futures literacy (Mortensen et al., 2021). The futures literacy framework developed by Riel Miller (2015) "is intended to cultivate mindsets that leave room for the emergence and suggests

leveraging novel occurrences in our external environment, which turns change into a resource rather than an enemy of planning” (p. 1). UNESCO’s conception of futures literacy as a capability and theoretical framework “aims to question norms, cognitive biases, and predisposed paradigms and hence introduces the potential to address several challenges in our age of dynamic business environments” (Mortensen et al., 2021, p. 1).

As a mindset, someone who is futures literate shifts their focus from the past to the future. This capacity orients one to think about what is to come and what information is needed to anticipate the future (Poli, 2019). People use awareness, discovery, and choice to envision the role of the future in their actions (Haggstrom & Schmidt, 2021). Understanding anticipatory systems and processes are central to becoming futures literate. Futures literacy consists of using anticipation for different ends, in different ways and contexts, thus making sense of and shaping emergent change (Miller, 2015). People become more futures literate as they understand the diversity of anticipatory assumptions better.

Futures literacy is defined as the capacity to encounter uncertainty and use the future for different reasons through the cognitive, emotional, and active levels (Haggstrom & Schmidt, 2021). An increasing body of knowledge has indicated the need for futures knowledge in decision-making processes. Futures knowledge posits “that uncertainty is always present, interdisciplinary perspectives and critical thinking are needed, and various possibilities and what-if thinking should be considered” (Heino, 2021, p.1). Futures knowledge and futures literacy are situated within constructivism as individuals aim to generate knowledge and assumptions when imagining futures to seek out the new and novel in the present.

Futures literacy improves the capability to acknowledge discontinuity and initiate learning processes to address uncertainty. Continuity refers to phenomena that repeat from one

moment to the next, while discontinuity refers to phenomena that display differences from one moment to the next. Using sensing and sense-making, humans identify continuity and discontinuity through the ability to anticipate phenomena that have occurred in the past or phenomena that are innately unknowable (Miller, 2015). Kazemier et al. (2021) argue for implementing futures literacy in higher education, arguing that higher education institutions are responsible for preparing future students and practitioners with the skills needed to work through complexity and uncertainty.

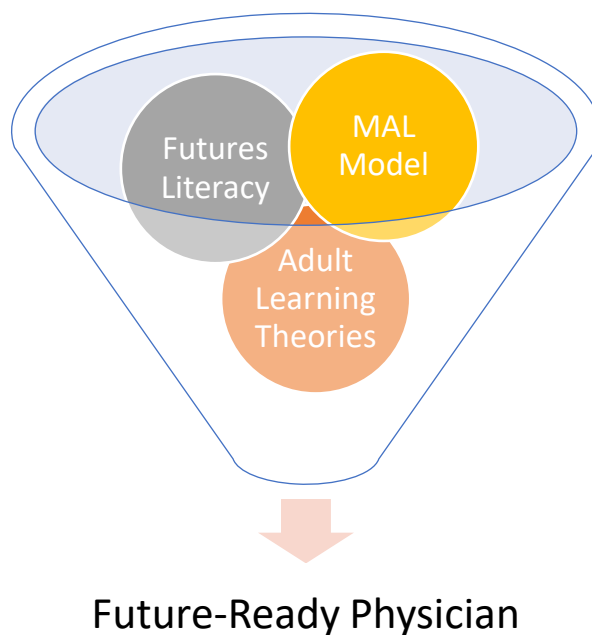
Anticipation is key for understanding futures literacy as the future exists in the present through anticipation (Facer & Sriprakash, 2021; Haggstrom & Schmidt, 2021; Miller, 2018). Future-literate people have a conscious understanding of their ability to anticipate the future. One can be trained in anticipation to foster familiarity with uncertainty. Haggstrom and Schmidt (2021) argue that anticipation and the ability to imagine the future go hand-in-hand, suggesting that the ability to fantasize is a driving force for futures literacy. Anticipatory activities engage individuals in a systematic process of imagining futures that are not constrained by the past, thus moving “beyond approaches that most humans acquire without effort or reflection” (Facer & Sriprakash, 2021, p. 3). Poli (2009) wrote that researchers’ understanding of anticipation is still developing, and there is a lack of conceptual language that describes the uniqueness of the concept, thus concealing the intricacies of anticipation.

The Discipline of Anticipation (DoA) expands the role of anticipation in how people conceptualize change and novelty (Mortensen et al., 2021). Miller discusses two categories for using anticipation and the future. Anticipation-for-the-future (AfF) focuses on planning and preparation for the future. Anticipation-for-emergence (AfE) anticipates novelty and newness in the future (Haggstrom & Schmidt, 2021; Miller, 2018). AfE aids in the sense-making of

invisible, uncertain change. Using AfE, people can make sense of novelty and ask new questions to detect new and emergent phenomena (Miller, 2018). Miller (2018) argues that one should work towards AfE because it takes “advantage of the unknowable as it starts to become knowable, enhancing the capacity to discover the present” (p. 59). AfE moves away from a focus on prediction and planning to a focus on diverse ways to approach situations of uncertainty and change. These conceptual and theoretical understandings of adult learning are foundational to developing a future-ready physician capable of anticipating and embracing change (Cutrer et al., 2021).

Defining a Future-Ready Physician

Based on the MAL model, theories of adult learning, and futures literacy, this section briefly discusses the construct of a future-ready physician (Figure 6). A future-ready physician (1) is an adaptive lifelong learner who (2) (per the MAL model) uses systems thinking when encountering uncertainty and anticipatory knowledge to analyze the future of quality patient care and (3) seeks out novel approaches that will propel the future of medicine. Applying futures literacy to the MAL model can further develop future physicians’ (4) abilities to adapt to change through growth and futures mindsets. Futures literacy and adaptive expertise prepare future-ready physicians with the skill set to respond to novelty and anticipate the future for the emergence of change or discontinuity.

Figure 6*Construct of Future-Ready Physician*

Note. This figure demonstrates the elements of a future-ready physician.

It is imperative that medical educators understand the value of future-ready physicians and how to support them in being future-ready. As Cutrer et al. (2021) discuss, despite the continuous updates to the medical education curriculum, the structure and process of learning are disconnected from real-world experiences. The rapid changes within healthcare will significantly impact the healthcare system, and medical educators have the power to take advantage of these changes. Approaching medical education curriculum with elements of adult learning theories, adaptive learning, and futures literacy addresses the learning and social needs to prepare the next generation of healthcare professionals.

Conclusion

Rapid change within the healthcare system is prompting action from medical educators to re-examine how future physicians are being prepared to handle uncertainty within medicine

(Cutrer et al., 2017; Skochelak et al., 2021). Medical educators are responsible for preparing future physicians to adapt to a changing healthcare system and implementing the Master Adaptive Learner model in medical education is one approach to meeting this responsibility. This research supports the ongoing responsibility of medical educators to prepare future physicians to address change and uncertainty in healthcare (Hunkins & Ornstein, 1989).

While the literature reviewed in this chapter presents a comprehensive overview of the need for change in medical education curriculum and the MAL model in medical education, including what it should consist of, there is little evidence on how medical educators have achieved this in practice. Conceptually the ideas have been presented in the literature, but there is little understanding of the experiences of medical educators who have implemented the MAL model. Medical educators' experiences provide insight into the practicality of the MAL model in medical education and how the model can prepare future-ready physicians. Furthermore, arguments have been made about the need for physicians who can adapt to new and novel situations (Kua et al., 2021; Manzone et al., 2021; Mylopoulos et al., 2018; Steinert et al., 2021), but the full scope of establishing these skills in future physicians has not been explored, particularly through the lens of futures literacy. Thus, this research examines medical educators' experiences with and ideas about the MAL model.

Chapter Summary

This chapter began by discussing healthcare and medical education conditions, which have necessitated the need to address changes within the healthcare system and medical education. As a complex adaptive system, the healthcare system is comprised of interconnected micro-systems that influence each other. The increasing complexity, continuous change, and uncertainty in healthcare warrant the need for medical educators to consider how the healthcare

system is being impacted and what this means for the education of future physicians (Bhopal, 2015). Acknowledging the rapid changes within healthcare and the outdated medical education curriculum, AMA Accelerating Change Consortium members came together to reimagine the curriculum that supports systems thinking, thus creating Health Systems Science.

Medical educators are implementing a new model of learning which focuses on adaptive expertise and systems thinking, which encourages learning from daily problem-solving. The MAL model has been discussed in medical education literature as a strategy for equipping future-ready physicians with the skills to address systematic issues within healthcare (Cutrer et al., 2019; Skochelak et al., 2020). Additional strategies such as coaching and internal characteristics of a future-ready physician were presented.

Four conceptual and theoretical frameworks that guide this study were discussed. Self-directed learning, reflective practice, and lifelong learning emphasize that addressing uncertainty, problem-solving, and adaptiveness are essential for adaptive learning within the MAL model. In addition, the futures literacy framework is discussed in combination with the MAL model to develop the construct of a future-ready physician. The futures literacy framework complements the MAL model as a metacognitive skill for thinking creatively, critically, and holistically about the future (Pouru-Mikkola & Wilenius, 2021).

CHAPTER 3: METHODOLOGY

Introduction

This study aimed to understand medical educators' experiences teaching and developing future-ready physicians through the Master Adaptive Learner (MAL) model. The experiences of medical educators' interactions with or implementing the model have received little attention in the literature as current literature focuses on model development and incorporating the model's components within medical education. Findings from this research study contribute to understanding how medical educators implemented the MAL model to prepare future-ready physicians and provide insight into adaptive expertise in the medical education system. The following overall research question guides this study: **How do medical educators prepare future-ready MAL physicians for the future of healthcare?** The sub-research questions below aim to understand the specific actions taken by medical educators to prepare future-ready physicians.

- What are medical educators' experiences with and ideas about the MAL model?
- How can the MAL model be combined with futures literacy to prepare future-ready physicians?

This chapter begins with an overview of the qualitative research paradigm, a description of the basic qualitative study used in this research, and the rationale for selecting this research design. Next, the chapter discusses the study's procedures, selection of research participants, data collection, and data analysis processes. The chapter concludes with a discussion of the study's trustworthiness and methodological integrity, followed by a chapter summary.

Qualitative Research Paradigm

Qualitative research seeks to understand, describe, and interpret the meaning people ascribe to their experiences and how these experiences impact their worldviews (Merriam & Tisdell, 2015). Findings are derived from data collected within the natural setting of people and places to establish categories and themes (Creswell & Poth, 2018).

The interpretivist paradigm that grounds qualitative research assumes that reality is socially constructed and that there can be multiple realities. Often used interchangeably with constructivism (Merriam & Tisdell, 2015), the interpretivist paradigm seeks to understand social phenomena from someone else's point of view and world experiences (Taylor et al., 2016). In qualitative research, the primary research instrument is the researcher. As the human instrument, the researcher uses inductive methods to understand people's socially constructed meanings as they interact with the world (Merriam, 2002).

There are various qualitative research designs. Qualitative researchers have written in-depth about the variety and diversity of qualitative research designs (Creswell & Poth, 2018, Denzin & Lincoln, 2011; Patton, 1990). Merriam and Tisdell (2015) discuss six common qualitative research designs: basic qualitative research, phenomenology, grounded theory, ethnography, narrative analysis, and qualitative case study.

Research Design: Basic Qualitative Study

Although there are a variety of qualitative research designs, researchers sometimes struggle to discern which method best fits their study. In such situations, researchers commonly use the basic qualitative approach (Merriam & Tisdell, 2015). Merriam and Tisdell (2015) explain that since all qualitative research is considered "interpretive," the labeling "basic qualitative study" is preferred. A basic qualitative study is the most common type of qualitative

design in education research (Merriam, 2002). With constructivism as the foundation, a basic qualitative study seeks to understand “how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences” (Merriam & Tisdell, 2015, p. 24).

The basic qualitative design is used in this study to understand medical educators’ experiences using the MAL model and future directions for the MAL model. Although other qualitative research designs encompass the same qualitative characteristics as this design, they have additional characteristics that do not fit the purpose of this study. For example, researchers identify ideas and beliefs in an ethnographic study but focus on culture-sharing and shared patterns of behaviors and interactions within cultural groups (Creswell, 2013; Creswell & Poth, 2018). Phenomenology explores the essence of lived experiences, but this research will focus on commonalities using the MAL model and individual experiences (Creswell & Poth, 2018). Case study research, like the other qualitative research designs, provides an in-depth understanding of individuals, places, or events; however, unlike a case study design, this research study is not bounded by specific parameters such as place or time (Creswell & Poth, 2018; Yin, 2018). While this is not a comprehensive review of all qualitative designs, this brief review justifies this study’s basic qualitative design.

Researcher Positionality

Researcher positionality refers to the position a researcher takes concerning the social context of the study (Coghlan & Brydon-Miller, 2014). As the primary instrument for data collection and interpretation, addressing my positionality and background is vital for establishing and maintaining the trustworthiness of the research. In qualitative research, one cannot avoid biases and subjectivities. Instead, qualitative researchers should identify them, monitor their

influences, and clearly state how they may impact data collection and analysis (Merriam & Tisdell, 2015).

COVID-19 has significantly impacted all aspects of society, particularly healthcare. It has also shown how quickly systems can change and how disruptive change can be. In an ever-changing society, it is becoming more critical to have the skills and qualities to adapt. Throughout my doctoral studies, I have studied the research area of Futures Studies. Saleh et al. (2008) define the futures studies paradigm as a “multi-disciplinary research of change, trends, megatrends, driving forces, emerging counter forces and uncertainties in all major areas of life to find the interacting dynamics that are creating the future” (p. 38). The anticipatory skills are emphasized in futures studies as a strategy for approaching change to teach tangible skills for handling uncertainty. Futures studies explore how we can support the development of anticipatory skills in adapting to and encouraging possible, plausible, and desirable changes in the future.

As someone who has experienced a lifetime of chronic pain, I have had countless interactions with various healthcare providers. The challenges of receiving appropriate diagnoses and treatment for my unique situation first awakened me to the problems of healthcare providers being able to address complex or unusual cases like mine and provide comprehensive care for their patients. Physicians equipped with skills to approach a complex patient or treatment may be more open to alternative diagnoses and willing to connect across a patient’s experiences rather than treating symptoms. This approach to patient care focuses on the patient from a “systems perspective” rather than a “symptoms perspective.” My own experiences have made the issue of physicians having these skills and dispositions very important to me and have made me wonder why some doctors have these skills while others do not. The Master Adaptive Learning skills

approach is designed to support the development of these skills. My own personal experiences influence my desire to understand how the MAL model may better prepare future medical practitioners to support patients such as me.

Furthermore, I am interested in the healthcare and higher education systems as my career and education focus on working with students who plan to enter the medical profession. As a healthcare educator, I recognize the importance of future healthcare providers needing to be aware of the changes in the healthcare system to adapt effectively and provide quality patient care. And as a healthcare education professional, I recognize how critical it is for healthcare educators to be aware of changes in the medical field to better prepare students. I became interested in futures research as I began to apply it to the education of future and current healthcare providers, as futures skills are necessary for adapting to the changing world. The points of view discussed here are my interpretation of the healthcare system and futures studies. I offer my position to readers as insight into how my experiences inform this study.

Ethics

Before the study began, I sought the North Carolina State University Institutional Review Board's (IRB) approval. Per the IRB, I provided participants with a detailed consent form (Appendix A), including the purpose of the study and a description of their involvement. Participants were asked to provide verbal consent before the data collection process. The study procedures were not considered risky as the interview questions asked about personal opinions and experiences. Further, an interview protocol was used to guide questions, so the interview remained on topic (Rubin & Rubin, 2012). I reminded the participants before the interview that we could stop the interview process at any time. Following the interview, I removed all direct

identifiers of the participants and third parties, such as the mention of medical schools or other medical educators by name.

Data Collection

In qualitative research, the researcher is the primary data collection instrument as they immerse themselves into the world they want to study (Flick, 2018). Qualitative data collection aims to gather rich data to analyze and understand phenomena, individual and collective experiences, and meaning-making processes. Researchers can use one or more methods to collect naturally occurring or elicited data (Flick, 2018).

The most common methods of data collection for qualitative studies are interviews, observations, and document analysis (Merriam & Tisdell, 2015). This study's primary data collection method was semi-structured interviews. In this study, semi-structured interviews gathered data on medical educators' experiences teaching adaptive learning and adaptive expertise. Data from document analysis supplied by the participants or from institutional websites supplemented the primary interview data. Memos or notes were also used in the collection process. Memos were generated by the researcher and used to reflect on the data gathered and keep track of my thoughts about data as they emerged.

Semi-Structured Interviews

deMarrais (2004) defines an interview as "a process in which a researcher and participant engage in a conversation focused on questions related to a research study" (p. 54). Interviews can take on many forms and be conducted in various formats, synchronously and asynchronously, such as face-to-face, telephone, video conference, and email (Roulston, 2010). Interviews are often used when phenomena cannot be observed, such as motivations, feelings, and individuals' interpretations of experiences (Merriam & Tisdell, 2015). Overall, qualitative researchers view

interviews as conversations between researchers and study participants on a focused research topic (deMarrais, 2004).

When using semi-structured interviews, researchers use an interview guide with prepared questions to assist during an interview. Questions are typically open-ended and are followed with a probe to gather further details and descriptions (Roulston, 2010; Rubin & Rubin, 2012). Semi-structured interviews guide the researcher but allow flexibility for the researcher to probe and encourage deeper conversation. As with all interviews, researchers must actively listen during semi-structured interviews, particularly when a probe may be needed to gather more data. While semi-structured interviews are asymmetrical in structure, the research participant has the flexibility to answer questions using their terms, guided by the researcher's questions (Roulston, 2010).

Since the purpose of this study is to understand medical educators' experiences with the MAL model, responsive interviewing was used to build a trusting relationship with the interview participants so they felt comfortable sharing their experiences. Responsive interviewing compliments semi-structured interviews because it stresses flexibility, and changes to interview questions by the researcher are expected (Rubin & Rubin, 2012). This style of qualitative interviewing enacts a give-and-take relationship between the research participants and the researcher.

An interview protocol was prepared and used during the interviews (Appendix B). A comparison table was used to organize research questions and align them with interview questions (Creswell & Poth, 2018) (Appendix C). Questions were open-ended to allow participants to provide as much detail as they wanted (Flick, 2018). My North Carolina State University Zoom account was used to conduct, record, and transcribe the interviews.

Transcriptions were verbatim using the Zoom transcription function immediately following each interview. I read through each transcript to make necessary edits, such as spelling and other transcription errors while listening to the audio recording to ensure accuracy and remove identifiers. Interviews ranged from 45 minutes to 60 minutes.

Research Participants

Purposeful sampling was used in this study to gain insight into specific master adaptive learning implementation efforts and explore the thoughts and experiences of leaders in the use of the MAL model to answer the research questions (Patton, 2015). The ideal participant was someone with an active role in medical education, such as a course director or program director specifically for MAL or who has had a role in teaching or developing MAL. I used two strategies to recruit participants for this study. First, I used the consortium directory listed on the American Medical Association (AMA) website and searched for medical schools that had experience with the MAL model. I then identified the appropriate contact based on the directory listing. Second, I utilized the references from the literature review to determine which medical educators had experience with the MAL model. To ensure a comprehensive sample of participants who met the criteria, I used snowball sampling, also called chain sampling (Patton, 1990), to ask participants for recommendations on other educators who have experience with the MAL model. Snowball sampling generated new information-rich cases (Patton, 1990).

Email communication was used to recruit participants (Appendix D). The email provided a written description of the study to explain the study's purpose, the participant's role, and the risks and benefits of participating in the study. After participants responded to the request to participate in the research study, participants were sent the consent form, and various interview days and times were proposed. Once the participant and I confirmed the date and time, I sent

another email invitation with a Zoom link for the interview. Participant profiles are discussed in chapter four.

Documents

Documents can refer to various “written, visual, digital, and physical materials” that exist before conducting research (Merriam & Tisdell, 2015, p. 62). Documents can be public or personal, prevalent cultural documents, or visual such as videos or pictures. Documents are often used for two distinct purposes. First, documents are used as objects where the focus is on the actual content within a text. Documents used this way are static and indisputable. Second, documents focus on the role and how documents are used in the appropriate setting concerning the research question(s). Using documents in this way seeks to understand how documents are used in everyday settings within the research (Rapley & Rees, 2018).

This study used curriculum documents, PowerPoint presentations, recorded interviews, and news articles as secondary data sources to support primary data gathered from interviews. The participants provided curriculum documents and PowerPoint presentations, while recorded interviews and news were gathered from the internet as public records. When analyzing the documents, I looked for evidence that supported the participants’ responses from the interviews or provided context for understanding their perspectives.

Memos

Throughout data collection, I wrote memos/notes to document my thoughts, reflections, tentative themes, and topics to follow up on in the beginning stages of data collection and analysis (Merriam & Tisdell, 2015). Additionally, I wrote memos during participant interviews. Memos were not only used to keep track of data and provide summaries, but memos played an essential role in synthesizing data for meaning (Creswell & Poth, 2018). Along with thoughts

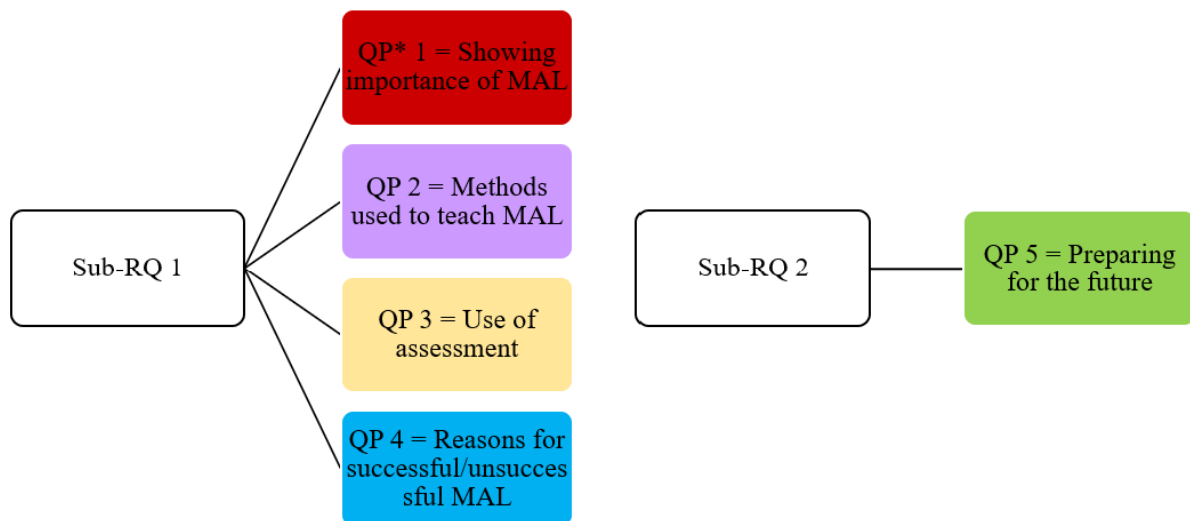
and reflections, memos combine different pieces of data to create a general construct and make sense of data (Miles et al., 2014).

Data Analysis

Data analysis begins with the first interactions of data collection. It is important to note that the analysis process does not wait for the collection process to end. Qualitative research is emergent, and as Merriam and Tisdell (2015) write, both the collection and analysis processes are recursive and dynamic. Thus, I conducted simultaneous data collection and analysis using analytic and focused interview questions, the constant comparative method, memos, and jottings during interviews (Miles et al., 2014).

Coding

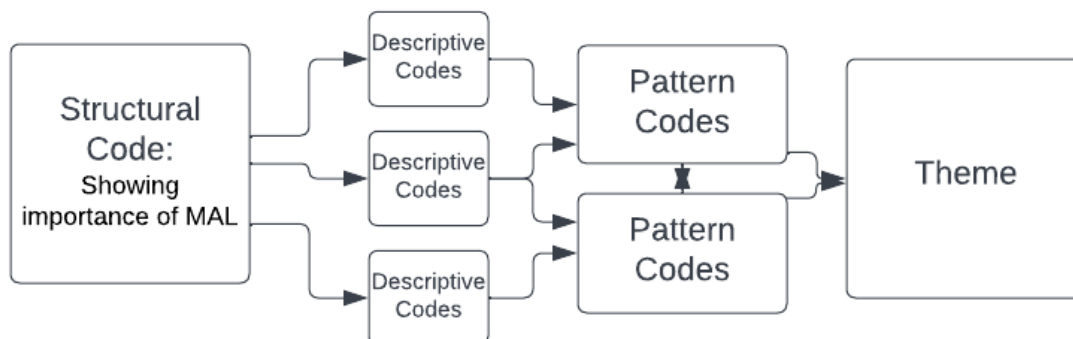
Coding was conducted following Saldaña's (2016) first and second cycle coding methods. Structural coding is a first cycle coding method directly related to addressing research questions. As shown in Appendix C, sub-research questions one and two were further supported by question prompts. Sub-research question one had four question prompts and sub-research question two had one question prompt. The question prompts facilitated the development of interview questions. During data analysis, question prompts were turned into a code and assigned a color. Since structural coding includes larger data segments, color coding each question prompt made it easier to analyze (Figure 7).

Figure 7*Color-Coded Structural Codes*

Note: Five color-coded structural codes based on question prompts and sub-research questions.

*QP = Question prompt

Structural coding was used as a categorization technique and as a foundation for more detailed coding (Saldaña, 2016); therefore, once data segments were categorized, first cycle coding was conducted again using descriptive coding. Once the first cycle descriptive codes were determined, second cycle coding was conducted. The goal of second cycle coding was to reorganize and reanalyze codes from first cycle coding to develop themes to address the research questions. Second cycle coding utilized pattern coding (Miles & Huberman, 1994). The pattern codes generated from second cycle coding were used to create emergent themes. Figure 8 illustrates the coding methods used in the study for each of the five question prompts. Additionally, throughout each cycle of coding, I conducted constant comparisons to compare codes for similarities and differences to create more robust themes and reach thematic saturation (Corbin & Strauss, 2008).

Figure 8*Illustration of Coding Methods*

Note: Illustration of coding methods used to create five themes.

Establishing Rigor and Trustworthiness

While the epistemological and ontological assumptions of qualitative research differ from quantitative research, researchers have established criteria for validation and markers for quality in qualitative research that parallel quantitative approaches to validation (Creswell & Poth, 2018; Merriam & Tisdell, 2015). Methodological rigor in qualitative research is often discussed in relation to positivistic terms such as validity and reliability. Much of the qualitative literature draws on Lincoln and Guba's (1985) alternative terms of qualitative approaches to rigor.

However, as Tracy (2010) points out, markers for qualitative quality change over time. Tracy's (2010) Big Tent criteria for qualitative quality acknowledges the complexity of qualitative research but also understands that the well-established markers for quality in quantitative research provide value in the research process. Therefore, Tracy (2010) presents the Big Tent criteria as a common language for qualitative researchers to use when assessing qualitative research. Tracy (2010) notes that the Big Tent criteria are a "conceptualization of qualitative quality...that delineates eight universal hallmarks for high-quality qualitative methods across paradigms" (p. 837). The eight hallmarks for quality qualitative research include the following

markers: “(1) worthy topic, (2) rich rigor, (3) sincerity, (4) credibility, (5) resonance, (6) significant contribution, (7) ethics, and (8) meaningful coherence” (Tracy, 2010, p. 839).

Researchers can approach these markers through various means and contexts (Tracy, 2017).

Worthy Topic

A worthy topic is “relevant, timely, significant, and compelling” (Tracy, 2017, p. 2). As Tracy (2010) discussed, societal events impact what is considered “worthy” and will significantly contribute to the topic. As society navigates the COVID-19 pandemic and a post-pandemic society, the healthcare system will continue to experience rapid change (Kim et al., 2020). Thus, the topic of this study directly relates to how future physicians will be prepared to handle the continued challenges of COVID-19 and how to respond to uncertainty and change within the healthcare setting.

Rich Rigor

Rich Rigor is achieved using “sufficient, abundant, appropriate, and complex theoretical constructs, data and time in the field, sample(s), context(s), and data collection and data analysis processes” (Tracy, 2010, p. 840). Unlike quantitative research, which favors precision, qualitative research values an abundance of rich descriptions and thoroughness (Tracy, 2017). As such, in this chapter, I describe the data collection and analysis processes used in the study.

Sincerity

Sincerity is achieved through “self-reflexivity about subjective values, biases, and inclinations of the researcher and transparency about the methods and challenges” (Tracy, 2017, p. 3). My positionality as the researcher is provided to address researcher bias, which addresses my assumptions, prejudices, and relationship to the topic of study. Additionally, the following section addresses transparency by discussing limitations and delimitations.

Credibility

Credibility is characterized by “thick description, triangulation or crystallization, multivocality, and member reflections” (Tracy, 2010, p. 842). A rich, thick description is an essential component of credibility. A thick description is achieved in chapter four through the presentation of findings presented in the participants’ own words. This thick description provides an extensive account of participants’ experiences and evidence of emergent themes.

Crystallization and triangulation rely on multiple sources of data to establish credibility. Denzin (1970) discussed four types of triangulation: data, investigator, theory, and methodological triangulation. Methodological and theory triangulation were used in this study. Methodological triangulation occurred through interviews, documents, memos, and triangulating and confirming emergent findings. As discussed in chapter two, this study used the conceptual and theoretical frameworks of self-directed learning, reflective practice, lifelong learning, and futures literacy. The study achieved theory triangulation by drawing on these frameworks to extend knowledge and various points of view (Flick, 2018).

Multivocality is characterized by the use of multiple voices within the context of the study. While all participants played a role in medical education, they varied in terms of years of experience, specialty, location, gender, age, and perspectives. Given the varying characteristics of participants, this attention to multivocality resulted in various participant opinions and perspectives throughout data collection (Tracy, 2010).

Resonance

Resonance refers to the impact of the study on the audience and whether a reader can draw connections between the findings and their own life or research (Tracy, 2017). Resonance can be achieved through “aesthetic merit, quality of description, and caliber of writing” (Tracy,

2017, p. 7), which can also be achieved through rich, thick description. Thus, rich, thick descriptive data about the research context provides insight into how the findings can apply to similar situations (Lincoln & Guba, 1985). Further, the discussion of future research and implications for practice discussed in chapter five adds to the resonance of this research.

Significant Contribution

Research significance is primarily based on the impact the findings have on the literature, theories, or practices and is related to the worthiness of the topic. Tracy (2017) presents four domains of significance: theoretical, heuristic, methodological, and practical. Regarding this study, the findings overlap and have heuristic and practical contributions (Tracy, 2017). Heuristic contributions encourage others to further explore or act on the research topic. Findings from this study and the discussion of future research in chapter five provide substantive suggestions for future directions and application of the MAL model. Practical contributions address whether the research findings are useful. As Tracy (2017) explains, practical contributions “empower participants to see the world in new ways, or help shed light on, transform, or valuably reframe a problem” (p. 8). This study offers practical contributions to addressing the need for a reexamination of the medical education curriculum based on the changing dynamics of healthcare.

Ethics

Tracy (2017) discusses four types of ethical qualitative research: procedural, situational, relational, and exiting. Procedural ethics involve standards established by an institutional review board (IRB). Procedural ethics were addressed through the approval of the North Carolina State University IRB. Situational ethics occur during data collection and are based on the context. To ensure situational ethics were upheld, an interview protocol was followed, and I repeatedly

reflected upon each participant interaction to ensure consistency among participants. This practice of repeated self-reflection also ensured that relational ethics were upheld, which focused on respecting participants and being aware of my influence as the researcher. Exiting ethics refers to how the researcher leaves the data collection site or makes a lasting impression on participants. Following each interview, I thanked each participant for their participation and took the necessary steps to ensure their interview transcript was kept safe and confidential.

Meaningful Coherence

Research that attains its purpose, uses appropriate research methods, and connects literature, research questions, findings, and interpretations in a meaningful way, achieves meaningful coherence (Tracy, 2010). As discussed in detail in chapter five, the findings of this study are discussed in relation to the literature reviewed, research questions and implications. The findings attend to the research questions of this study which were grounded in the literature and practical implications of the findings.

Limitations and Delimitations of Study

All research will inherently have associated limitations and delimitations. As Price and Murnan (2004) discuss, a limitation is a bias that the researcher cannot or does not control, affecting a study's results. On the other hand, a delimitation is a bias that the researcher does have control over. When a delimitation occurs in a study, it is intentional. Below are limitations and delimitations in regard to the design of this study.

Limitations

Limitations often occur outside of the researcher's control (Price & Murnan, 2004). One study limitation was the reliance on medical educators' agreement to participate in the research. Given that we are still dealing with challenges brought on by COVID-19, medical educators

have had to change their schedules or take on new responsibilities, thus leaving little time to participate in activities outside their everyday tasks. Additionally, since some medical educators were actively researching the MAL model, they were reluctant to share curriculum documents as these documents are being used to support their research intended for publication. Second, few medical schools across the country have implemented the MAL model. Consequently, this provided a small population from which to recruit participants.

Delimitations

The focus and purpose of this study is a delimitation. By focusing on medical educators' understanding and experiences, findings on other populations and factors that impact medical education are excluded.

Chapter Summary

This chapter provided a brief overview of the qualitative research paradigm and the basic qualitative method that guided this study. This study aimed to understand medical educators' experiences with the MAL model. Data collection included semi-structured interviews with medical educators who have experience with the MAL model and document analysis of documents that supported data from interviews. Data analysis consisted of first cycle and second cycle coding to develop themes to address research questions. This chapter also discussed research participant selection, research ethics, and my position as the researcher. The chapter ends with a discussion on criteria used to establish methodological rigor and trustworthiness. Chapter four presents the findings and addresses the research questions of this study.

CHAPTER 4: FINDINGS

Introduction

The Master Adaptive Learner (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). This qualitative study aimed to understand adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the MAL model. This study contributed to a better understanding of educators' experiences implementing adaptive expertise and the MAL model to better prepare future physicians to address healthcare's changing dynamics. The following overall research question guided this study: **How do medical educators prepare future-ready MAL physicians for the future of healthcare?** The sub-research questions below aimed to understand the specific actions taken by medical educators to prepare future-ready physicians.

- What are medical educators' experiences with and ideas about the MAL model?
- How can the MAL model be combined with futures literacy to prepare future-ready physicians?

Following a basic qualitative design, semi-structured interviews and document analysis were used as the primary and secondary data sources. This chapter begins with an overview of participant profiles, followed by the presentation of findings, including themes and subthemes related to the research questions. The chapter ends with a summary of the findings.

Participants

There were 15 participants in the study. Purposeful sampling was used to recruit participants via email based on their experience with the MAL model, evident through their work with the American Medical Association (AMA) or published research. Snowball sampling was

also used to ask participants for recommendations from other educators with experience with the MAL model. Of the 15 participants, 12 were recruited via purposeful sampling, and 3 were recruited via snowball sampling.

All participants were knowledgeable about the MAL model and were willing to share their experiences. Of the 15 participants, 11 were women, and 4 were men. Participants represented 10 specialty areas and medicine and academic disciplines. These included: family medicine, emergency medicine, pediatrics, internal medicine, obstetrics and gynecology, educational policy, psychology, higher education, adult education, and evaluation. Each participant was familiar with the MAL model, had experience as an educator in either the undergraduate medical education (UME) or graduate medical education (GME) setting, and had varying years of experience from under five years to greater than 15 years at the institution in which they were employed during the time of the interview (Table 2). Participants represented various allopathic institutions and professional educational titles such as Professor of Medicine, Associate Dean, and Program Director. Participants' roles and contributions to the model varied based on job duties. Additionally, 13 participants have conducted and published research on the MAL model.

Table 2

Summary of Participant Profiles

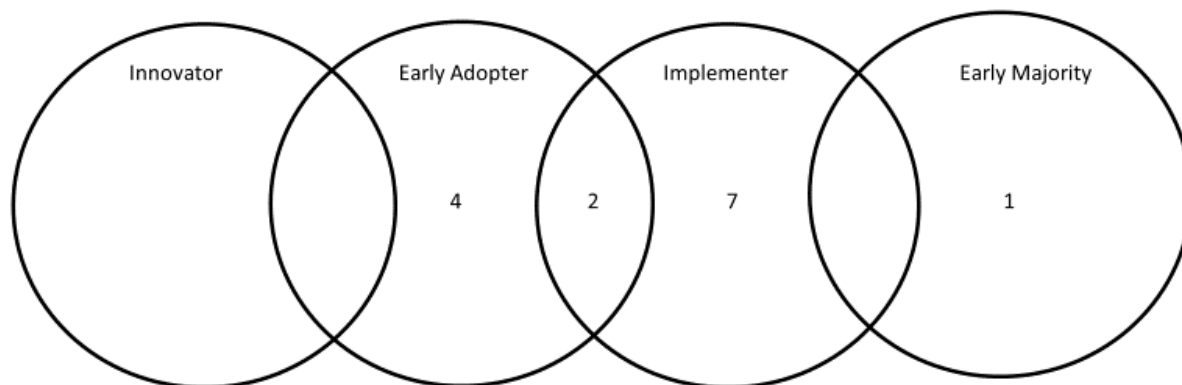
	Years of Experience			
	1-5	6-10	11-15	>15
UME	2	2	1	2
GME	2	2	1	3

Note. Participants' years of experience in undergraduate medical education (UME) and graduate medical education (GME).

All participants were asked if they considered themselves early adopters or implementers of the MAL model (see Figure 9). Seven participants considered themselves implementers, 4 early adopters, 2 considered themselves both, and 2 considered themselves neither. One participant who did not consider himself an early adopter or implementer indicated that he sees himself further along the diffusion of innovation scale as someone in the early majority. The second participant did not consider herself either an early adopter or implementer because her institution had not implemented the model even though she published research on the model.

Figure 9

Perceived Stages of MAL Adoption



Note. Stages of MAL adoption. Adapted from Rogers' (2003) Diffusion of Innovation theory.

Presentation of Themes

As discussed in chapter three, first and second cycle coding was used in data analysis. The coding process began with structural coding. Findings were categorized and organized by research question. Next, another round of first cycle coding was conducted, using descriptive coding to code the large data segments from structural coding. Once first cycle coding was

completed, second cycle coding was conducted using pattern coding to create themes and subthemes. Table 3 shows themes organized by research question.

Table 3

Themes by Sub-Research Question

Sub-Research Question:	Themes	Subtheme
What are medical educators' experiences with and ideas about the MAL model?	Lifelong Self-Improvement	
	Creating a Culture of Learning	Coaching Framework Teaching How to Learn
	Assessment Through Self-Reflection and Coaching	
How can the MAL model be combined with futures literacy to prepare future-ready physicians?	Overcoming a Punitive Culture	System Barriers Facilitating a Shared Vision
	Future Adaptive Expert	

Note. This table highlights the sub-research questions that guided this study and the themes and subthemes that address each question.

Theme 1: Lifelong Self-Improvement

A common practice of medical educators' experience with the MAL model was conveying the value and importance of the MAL model to students. Open coding generated 18 codes, and the overall theme, Lifelong Self-Improvement, emerged from the theoretical coding process. This theme emerged from participants' experiences describing MAL and its lifelong implications for students. The lifelong implications focused on learning to be a lifelong learner.

Throughout the interviews, the theme of lifelong self-improvement intersected with participants' experiences teaching MAL in the classroom and clinical settings. Participants explained that they aim to instill in medical students that as a physician, they will be inundated

with constant change. The first step to adapting to a changing environment is to develop an awareness of gaps in their knowledge and skills. Participant 6 explained,

It's really pretty straightforward that you know as a physician, you're going to find yourself constantly in a situation where you are going to have to learn something that's new, and you have to be able to recognize when you need to learn something new. You know, medicine is in a constant state of flux and constantly changing, and you have to be aware of your ability to adapt to that constant change.

This awareness, which occurs during the MAL model's planning phase, also consists of knowing how to find resources to address gaps. The planning phase is followed by the learning phase, which involves adapting learned resources and developing learning habits. For participants, this meant explaining to students that the MAL model is an approach to continuous quality improvement of oneself that you take part in as you go through an ongoing learning process.

And I say all of us need to continue to grow. And we need to continue to do continuous quality improvement on ourselves, and that just resonates with me; the way it's a continuous quality improvement on yourself, they [students] get it. It's a lifelong learner. Continuous quality improvement, where I ask myself, where do I need to improve, and it could be in any domain, and they need that, it really resonates with them. (P10)

Conveying the importance of being a lifelong learner was common in all participants' responses. Participants relied on the MAL model to explain to students that it can be used as a tool to adopt a mindset that you never stop learning. "You know how I describe it, is that it is an approach to

lifelong learning and kind of a way to keep your skills fresh and relevant to the patients in front of you” (P3).

Participants explained that the goal for students is to understand that as a physician, you are constantly learning new things, which can sometimes be overwhelming. However, the tools you learn from the MAL model teach you to be more intentional about continuous learning to adapt better to change. Participant 9 explained that the MAL model “gives you a roadmap for engaging in continuous learning.” Participant 4 adds,

We really try to set the foundation and set the expectation for them that they will become expert learners, and then they will continue to do that throughout their career.... and that is really what we’re trying to help them develop. We’re giving them tools; we’re giving them skills to hopefully learn in a way that allows them to ultimately develop and then practice in a way that demonstrates that adaptive expertise.

As the participants introduce the MAL model to students, they connect to continuous learning and its benefits to patient care. For example, Participant 4 explained that providing examples of physicians who do not address their need to learn and address uncertainty can have negative consequences. “There are some downstream implications for physicians who don’t deal with their uncertainty. They order more tests which drive up the cost of healthcare, and their patients are actually less satisfied with the physician.”

To help students understand the value of MAL, participants also had to be in tune with students’ responses and feedback to the MAL model. Participant 6 explained that once students enter their second year, they are so focused on trying to learn foundational information that it is hard for them to focus on learning something that is not going to be on a test in two weeks.

Participant 6 further explained that it is challenging to convey MAL's value because it is not as tangible as learning basic science or specific medical conditions.

Although it seems that students have overall responded positively to MAL, Participant 4 sums it up by reflecting,

In general, I think the students have responded fairly positively. There's a group that it resonates with right away, and they absolutely love it, and they're like, how can I learn more, I'm all about this. There's a group that is probably the biggest group, there's probably two-thirds in the middle, and it's like yeah, this is pretty helpful, this has some great ideas, and then there's a group that's really hesitant, and they're like yeah this is dumb. And my hope is that we at least plant some seeds, and they'll circle back to it at some point, but so, in general, the reception has been pretty good.

Theme 2: Creating a Culture of Learning

When discussing their experience, medical educators discussed how they use the MAL model to guide their teaching efforts to develop future-ready MAL physicians. Teaching efforts include educational strategies, tools, frameworks, and approaches to teaching the MAL model. Additionally, this question sought to explore participants' interactions with students. Open coding for the second research question generated over 30 open codes, and from the theoretical coding process, an overall theme and two subthemes emerged.

Throughout the interviews, participants indicated that the learning environment and culture played a role in their experiences teaching the MAL model, and the learning environment impacted teaching efforts. The theme of creating a Culture of Learning focuses on participants' actions as educators rather than environmental factors in the educational setting. The learning

environment and culture are also discussed later in this chapter in response to research question four.

Coaching Framework

As discussed in chapter two, coaching is an integral part of the MAL model and plays an integral role in participants' experiences when teaching the MAL model. While medical schools have integrated coaching and mentorship into their programs, MAL allows educators to incorporate coaching. Coaching adds support and structure to assist students as they work and grow through the phases of the MAL model and develop adaptive expertise.

Participant 4 explains that as a coach, an educator aims to guide students in their learning process through productive questioning, which promotes critical thinking. A coach's role is to be a mentor and provide rich, robust, and individualized feedback to students. "As a coach, one should not play a passive role, but rather an active role in providing detailed feedback both written and oral that is reinforcing and corrective" (P12). The goal of coaching is that as you work with students and ask questions, you begin to guide students in the practice of self-reflection (P11). As Participant 13 discussed, students struggle to set goals, and this needs to be a core focus for coaches as it hinders their ability to be lifelong learners. Often, this is where a coach will work one-on-one with a student to provide personalized feedback on their learning and performance.

Additionally, it is crucial that students feel comfortable approaching their coach. As Participant 12 explained, a coach should be impartial to having any influence on a student's performance assessment. A coach's focus should be to support the individual learner through guidance and recommendation of resources that support personal progress and success.

Participants discussed the need for educators to understand their role as a coach. Medical students have their own circumstances, so you need a coach who understands their challenges.

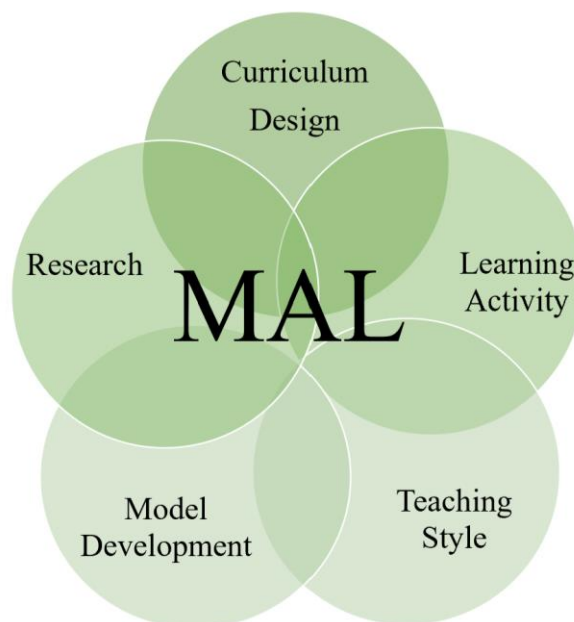
You got to be able to meet people where they are, and I think that's very, very challenging because these are primarily young adults; people between 25 and 35, and they're going through their own sort of growth processes and developmental processes, so it's definitely a challenge. (P7)

Participant 8 discussed plans at their institution to create a guide for faculty for coaching through thinking about their ideas and plans and providing strategies for achieving their goals. Coaches are there to encourage medical students to acknowledge their knowledge gaps. Participant 1 explains,

You [students] are encouraged to find your gap, and then somebody is meant to help you fill that gap or role model for you on how to fill that gap. It is okay to have a gap; it's expected to have a gap. And then we [coaches] show you how to fill it, how to continue to be curious to find that gap, and how to find tools to best fill that gap and move forward.

Teaching How to Learn

The MAL model centers around one's ability to optimize learning to address future knowledge gaps, meaning medical students need preparation for future learning (Cutrer et al., 2021). Participant 13 explained that the MAL model helps break down learning into essential phases. Findings show that participants have various applications for the model (Figure 10); whether it is used to design a curriculum, inform a specific learning activity, guide teaching style, or for model development and research, the model is used in a variety of modalities to foster master adaptive learners.

Figure 10*Participants' Application of the MAL Model*

Note. Various approaches used by medical educators for MAL implementation at their institutions.

Regarding curriculum design, two participants described how they used the model as a guide for curriculum development at their institution. Most participants used the model to guide specific discussions around the concepts of MAL and adaptive expertise but did not do a curriculum overhaul to reflect the model. Participants 1, 6, and 13 used new student orientation sessions as the first opportunity to introduce students to the MAL model and its components to students. Participant 6 described that when students are first introduced to the model, it is a “much more playful approach.” Participant 1 explained that introducing the model at orientation establishes the institution’s culture of learning. “We kind of set that goal and let them know that is what the culture is that we’re espousing here so that they have expectations coming in.”

Participants often chose specific concepts to teach students over time, such as the phases of the model or MAL characteristics like motivation, growth mindset, and reflection, when describing their approaches to teaching the MAL model. For example, Participants 4, 13, 14, and 15 discussed how the planning phase is taught by presenting a patient case and having each student identify and take note of everything about the case they felt unsure about or needed to revisit. Then as small groups, begin discussing resources that can be used to address knowledge gaps and categorize the resources—focusing on which resources will benefit the patient’s treatment, which resources are quick to achieve results, and which resources are accessible. Then as a group, have a conversation about resources and learning strategies for looking up resources. Participant 4 adds,

We tried to connect the dots of learning this skill set for them. For example, we do a session in year two of their clerkship year around asking good questions. We do a whole session with them on how to ask better questions, with the idea being that it helps them build on identifying their own gaps, and that helps them better identify what could be used as resources. We’re doing a session on asking questions, but here’s how it relates to and connects with what you are learning.

Participants also explained that incorporating practical and tangible activities into students’ experiences as a physician resonated with students. “We try really hard to make it relevant to our learners by using examples from their own practice” (P3). Participants 3, 4, and 5 explained that students respond better to some topics based on if they were in their preclinical or clinical years. Participant 4 explained that in year one, which is also the preclinical year, students are introduced to the concept of uncertainty, strategies for dealing with uncertainty, and the importance of self-regulation. In the following years, once students enter the clinical year,

uncertainty is discussed again, along with the concept of ambiguity, because now students have a different perspective as “they start to see things are a lot more uncertain when it comes to patient care” (P4). While students may not fully understand the MAL model until the clinical years, participants did agree that early introduction and discussion of MAL better prepare students for future learning.

Other curriculum activities discussed by participants focus on important concepts of the model, such as uncertainty, growth mindset, ambiguity, motivation, curiosity, and reflection. Participant 8 discussed a series of workshops on these concepts related to MAL development. One activity discussed focused on growth mindset and motivation in which the focus was for learners to have independence in their learning.

I really wanted to talk about how they can have autonomy in their Learning. Do they feel like they want to master being a doctor and what that is, what that looks like, what is a growth mindset, and what is the evidence we know about having a successful growth mindset... I had them think about something that's been challenging for them to learn and how they feel about failure. And then, I also ask them because I really want to tie it to their purpose of being a doctor, which is also around motivation. (P8)

Theme 3: Assessment through Self-reflection and Coaching

Medical educators also discussed their use of assessment to assess students' knowledge of the MAL model. Open coding generated 16 codes, and the overall theme, Assessment through Self-reflection and Coaching, emerged from the theoretical coding process. At the time of the interviews, none of the participants assessed knowledge of MAL in the undergraduate medical education (UME) or graduate medical education (GME) space. While specific indicators are not

currently being used to assess specific knowledge of the model, participants have thought about assessing MAL knowledge. Participant 5 explained that you could assess more artificially in the preclinical setting. For example, suppose students are presented with a patient problem and must develop a treatment plan. In that case, the educator could assess whether students accurately go through each phase of the model, such as did they identify their learning gaps and whether they found the appropriate resources to address their gaps. However, things happen more organically in the clinical setting based on the problems presented.

Further, as Participant 4 discussed, a master adaptive learner is always learning; therefore, there may not be one tool to assess someone who is MAL.

There's not one tool that will say, yep, you're a master adaptive learner or not. It really is about how we use multiple different tools to inform growth towards this type of learning or this approach to learning but assessment, I think, is really still important and critical to being able to do this well. (P4)

While indicators for assessment of MAL knowledge have not been implemented, participants did discuss the importance of self-assessment for master adaptive learners and the need to develop self-assessing behaviors in future physicians.

And the learners that I see who are effective and successful are learners who can assess their learning gaps and who can figure out how to address them. If they figure out how to use resources to address their learning needs and they really follow the master adaptive learner process, where they're constantly hungry for what I need to learn now and what's my next step, and they seek the advice of the experts to help them...it describes the behavior of successful learners across the continuum. (P6)

Participant 4 discussed that educators could help students develop self-assessment skills through coaching and explained that at their institution, a portfolio system is used to assess students' medical knowledge and other skills such as professionalism and communication. Students are asked to assess themselves on meeting goals and then have conversations with their coach on meeting their goals, which provides self-assessment with external feedback. Through this process, students become more informed about their self-assessment abilities and learn how to work through the phases of the MAL model.

A coach meets with them multiple times throughout the year to look at their data with the core goal of really helping them calibrate their self-assessment. So really pairing that informed self-assessment with external feedback. And so I think they get a lot better at that over the four years here. They come in, probably thinking they're very good self-assessors. Most of us as humans think we are, and we're not. And so, really trying to help them partner with that self-assessment. (P4)

Participant 12 also described a similar portfolio system that promotes students' ability to self-assess and develop as reflective practitioners.

There is a process of creating a portfolio, where they review their assessment feedback, identify strengths and targeted areas for improvement, and reflect on that. And then develop a learning plan that they create of the three or four things that are priorities for them... each student is assigned a physician advisor at matriculation, and the physician advisor serves as a coach to help the students interpret feedback, identify themes in feedback, and they will review students' formative portfolios. (P12)

Theme 4: Overcoming a Punitive Culture

Given that the MAL model was a new concept introduced to the curriculum, participants discussed barriers and facilitators they faced when implementing the MAL model. Barriers and facilitators include external factors that impacted the implementation of MAL. Open coding for the fourth theme generated over 50 open codes. Therefore, it was decided to analyze findings by creating two categories, barriers, and facilitators, to analyze the data better when creating focused codes. The emergent theme, Overcoming a Punitive Culture, and two subthemes, Systems Barriers and Facilitating a Shared Vision emerged.

While briefly mentioned in the discussion of theme two, below is an in-depth discussion on the impact of the learning environment and culture in terms of barriers and facilitators on implementing the MAL model. Barriers refer to any obstacles participants faced concerning implementing or attempting to implement the MAL model at their institution. Facilitators refer to any events or situations that encouraged the implementation of MAL at the participants' institution.

When creating the fourth theme, I drew on the phrase “punitive culture,” which is an *in vivo* code from Participant 3, who explained that the current learning environment and culture in medical education are not conducive to the goals and objectives of the MAL model. “So much of the culture in medicine feels punitive, even if it is not” (P3). This perspective of a “punitive culture” is a barrier, and overcoming this punitive culture facilitates the development and implementation of the MAL model.

System Barriers

When discussing barriers, participants focused on those related to environmental factors as well as those related to fixed mindsets. Regarding environmental factors, participants

explained that the current educational system presents challenges for teaching medical students and residents how to develop adaptive expertise, a critical component of the MAL model.

Participants 4, 6, and 12 explain that time constraints make it challenging to devote curriculum time to in-depth teaching of the model. Participant 7 goes on to explain that not only is it challenging to find time, but the model itself and the goals of the model take time to explain. Adding that routine expertise is easier to teach rather than adaptive expertise and that the innovative learning involved in adaptive expertise is time-consuming, and that a “culture of safety (one that values order and certainty), does not tolerate innovation (uncertainty)” (P7).

Additional environmental factors that act as barriers include systems and processes that students and educators must navigate within the medical and educational system during the classroom and clinical stages. In addition to the time constraints mentioned above, when students begin entering the clinical phase, they must begin learning the ins and outs of the clinical environment, such as electronic medical records systems, patient interactions, clinical safety procedures, and interactions with other medical professionals in team-based care. Participant 15 pointed out that students “spend a lot of time not necessarily on learning but learning how to navigate the clinical space.” Participant 13 adds that “there [are] a lot of barriers to the process of learning in the hospital and training systems based on how education is set up in medicine.”

A fixed mindset about education and learning also proved to be a barrier to implementing MAL. Participants discussed that certain mindsets, both educators and students, have inhibited a MAL’s growth. With the structure of the current medical education system, students “feel they are trying to compete for a grade” (P4), view “having questions as a sign of weakness” (P2) and feel “having a knowledge gap is humiliation” (P1). Coming into medical school from undergraduate studies, students focus on achievement and assessment. Participant 14 noted that

the environment is based on “external assessment.” Participant 12 adds, “throughout their formal education, they’ve been taught to memorize content and do well on high stakes exams,” encouraging students to focus on getting correct answers and high grades.

Within the first phase of the MAL model, one begins to identify gaps. However, participants noted that students’ willingness to acknowledge and discuss knowledge gaps is not commonplace in medical education.

We’re basically building an educational conceptual framework around Learning that requires people who are willing to disclose they don’t know something, which is not the environment that they’re roaming around in, right? There are all sorts of shame and fear and embarrassment, etc. (P13)

Participant 8 explained that students learn new skills but “need a safe place to apply it.” For Participant 1, creating a “psychologically safe” space for students to ask questions and not be afraid to fail is an ideal learning environment.

Facilitating a Shared Vision

While participants discussed various barriers to MAL implementation, facilitators were also discussed. Facilitating a shared vision of MAL implementation mainly focused on educators taking the reins and implementing policies and procedures that create a better learning environment and culture for adaptive learning. All participants discussed the need for faculty development to create an environment more conducive to adaptive learning. Participant 1 noted that faculty need to create an environment where students can speak up if they think there is an error or need to ask a question.

I think creating that environment is critically important. The clinical learning environment is also something where the tone is set by those who are leading in

that space. So, the faculty have to have some faculty development as well. And the master adaptive learning model is something that a lot of them just don't know about. It's just not something that they trained under. A lot of them may have been exposed to the Socratic method of teaching where you know they go ahead and ask you questions until you don't know the answer, and then they think they've done their job and, in the meanwhile, you are wounded for life. You've been embarrassed in front of all your colleagues and your peers, and then so forth, and so on. You know that there needs to be enough safety around an individual to fail. (P1)

Participant 9 explained that an environment that fosters adaptive learning is set as an expectation as part of their institution's culture.

When we talk to people, we talk about the master adaptive learning model. We shared this with every single faculty member, we shared it with every prospective student during the interview process, and we shared it with the clinical faculty... We just talked about it all the time and had common vocabulary words. I think the biggest facilitator for implementation for us was culture. We all had to buy into this understanding that this is our culture and agree as a group that we were going to do it. (P9)

In terms of creating a culture that facilitates adaptive learning, Participant 2 explained,

To me, the best way to do that is not to make a new curriculum that follows master adaptive learning; to me, it's the need to see that in our faculty. You know, to see it being modeled. Where a person that you trust or respect because they're an expert acknowledges that they don't know what's going on, they're confused,

and they're uncertain, they're doubtful, you know some measure or some indication of weakness in that you know in their expertise has some gap. So knowing that even the Gods have gaps that they need to deal with makes it much more feasible for mere human students to be willing to do the same. And if the faculty can not only acknowledge those gaps but demonstrate what they do in response, I think that demonstrates what the good practices are in that area. But I think, more importantly, it's just conveying the values of acknowledging uncertainty, acknowledging it's uncomfortable but still picking the difficult step of confronting and dealing with that uncertainty.

Participant 4 echoes this by stating,

I think you need to be in an environment with clinicians and faculty that are role modeling the right type of behavior. There's so much importance in role modeling and seeing faculty and other TEAM members admitting what they don't know and being willing to try to address that through learning.

In terms of faculty development, Participant 6 described,

We've done several trainings, we have a weekly faculty development session, and we've devoted several sessions using the MAL model and what it means for students... it's really just first walking them through the model, through the activity, and then talking explicitly about each of the phases and what's it going to look like.

Theme 5: Future Adaptive Expert

The second sub-research question sought to answer how the MAL model can be combined with futures literacy to prepare future-ready physicians. Open coding generated 26

codes, and the overall theme, Future Adaptive Expert, emerged from the theoretical coding process. Futures literacy is a capacity to view change as a resource to question predisposed ways of action and seek a new and innovative present that allows people to envision the future based on present action (Miller, 2018). Participant 1 described a future-ready MAL physician as,

Somebody who is curious. Someone who is open to new ideas. Somebody who is willing to step outside their comfort zone. I think that is so important; in fact, I honestly think that growth only happens at the edges of your comfort zone.

Participant 15 stated that a future-ready MAL physician is “in control of their own learning” and has the “ability to master systems.” Participant 6 explained that a future-ready MAL physician has a sense of awareness describing someone who is,

Constantly aware of their situation and able to see when they have a learning gap or a learning need to be able to access resources or know whom to ask for resources, able to use those resources, and you know, a future-ready physician may and then be able to reflect on practices. (P6)

Participants 2, 4, 5, 10, 12, and 13 noted that adaptive expertise is needed to be a future-ready MAL physician. When discussing what is needed to be future-ready, Participant 4 added,

My mind goes to the adaptive expertise that really is the target of this type of Learning, and that is needed to be future-ready. The future is going to be full of novel challenges, things we have not faced before and do not have known solutions, and so it really is that adaptive expertise that will allow individuals to thrive.

Participant 4 explained,

Adaptive expertise, that is the goal of Learning, is also the foundation for leading, which is one of the things we also talked about a lot with the students. Being future-ready is also being, I think, prepared to lead, and the adaptive expertise really is the foundation that allows that, and it's the learning that leads to the adaptive expertise that allows the leading into the future, regardless of what that context looks like known solutions, and so it really is that adaptive expertise that will allow individuals.

Participant 5 discussed that the MAL model alone does not convey adaptive expertise but rather a "learning cycle." Participant 13 also stated that while adaptive expertise addresses uncertainty, there is no clear connection between the model and adaptive expertise. "I don't feel like it is naturally explained in the model about how it would help build or facilitate people functioning in moments of uncertainty" (P 13).

Participant 2 discussed that the MAL model implies that it "asks you to embrace uncertainty," which is "an unnatural act" for many.

And I'm not sure how you train people to be more comfortable with uncertainty. Or the extent to which they are risk intolerant, but as an intervention, I think definitely to make people recognize that what you think is so, isn't necessarily so...and there are lots of ways that you will have to adapt and change, and the sooner, you get used to it the better. (P2)

When discussing the model and its purpose, Participant 13 stated, "what the model was built to do is develop people to help build adaptive expertise, and adaptive expertise is the ability to take previous knowledge and apply it to new and novel situations."

Chapter Summary

This chapter presented the findings of this basic qualitative study which examined adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the MAL model to prepare future-ready physicians for the future of healthcare. Fifteen participants shared their experiences teaching adaptive expertise and the MAL model. Findings were organized by research question and discussed in sections based on emergent themes and subthemes. The themes and subthemes described how medical educators prepare future-ready physicians with guidance from the MAL model. Chapter five discusses the findings and themes and how findings connect to the conceptual and theoretical frameworks and literature discussed in chapter two. Furthermore, recommendations and implications for future practice and research are discussed.

CHAPTER 5: DISCUSSION

The need for adaptive expertise in medical education is increasing as the healthcare system rapidly evolves amid technological advances and changes in the delivery of care, as social and economic factors change how society functions (Combes & Arespachoga, 2012; Han et al., 2019). As the healthcare system rapidly changes, the concepts and knowledge that physicians learn could be outdated by the time they enter practice (Lajoie & Gube, 2018). Future physicians must adapt to rapid changes and uncertainty within the healthcare system to maintain effective patient care practices. The Master Adaptive Learner (MAL) model has been presented as a tool for developing adaptive expertise in future physicians, giving them the proficiency to adapt to uncertainty in healthcare (Cutrer et al., 2019; Skochelak et al., 2020). The model aims to develop adaptive experts who can balance efficiency and innovation in patient care (Pusic, 2020).

While the literature has informed the development of the MAL model, the phases of the model, and the model's connection to adaptive expertise, how the model is applied in medical education by medical educators and the impact of the model in practice have yet to be examined. Understanding the model's use by educators will shed light on how other medical schools and health professions programs can educate master adaptive learners. This study seeks to understand adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the MAL model at medical education institutions. Findings from the study provide insight into medical educators' experiences and ideas about the MAL model. The findings also identify how the MAL model can be combined with futures literacy to prepare future-ready physicians.

The following overall research question guided this study: **How do medical educators prepare future-ready MAL physicians for the future of healthcare?** The sub-research questions below aimed to understand the specific actions taken by medical educators to prepare future-ready physicians.

- What are medical educators' experiences with and ideas about the MAL model?
- How can the MAL model be combined with futures literacy to prepare future-ready physicians?

The research question and sub-research questions were addressed through a basic qualitative study, using semi-structured interviews with medical educators who were familiar with and had experience with the MAL model. This chapter includes a summary and discussion of the findings, including a discussion of the findings based on the conceptual and theoretical frameworks discussed in the literature review. The study's limitations, implications for practice, and future research are examined. The chapter closes with a summary and researcher reflections.

Summary and Discussion of 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.

The overall research question that guided this study was, how do medical educators prepare future-ready MAL physicians for the future of healthcare? 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.

Lifelong Self-Improvement

Lifelong self-improvement was a theme that emerged as participants described their use of the MAL model. They explored the importance of the MAL model to medical students and its usefulness in medical school and throughout their careers as a physician. This theme drew mainly on discussions of lifelong learning and self-improvement. As reiterated in the literature, effective master adaptive learners continuously work to improve their knowledge and skills through lifelong learning (Cutrer et al., 2020), and lifelong learning is part of the professional identity of healthcare providers (Cutrer et al., 2019). Participant 9 explained that the model is a road map for growth and continuous learning. The MAL model is often compared to the Plan, Do, Study, Act (PDSA) cycle based on quality improvement. However, for medical educators, the model is seen as a quality improvement of oneself through continuous learning (Cutrer et al., 2018; Pusic, 2020; Richardson et al., 2021).

Educators strive to deliver information that is easy for students to understand and value. Effectively conveying the model's value ensures future physicians understand the importance of

master adaptive learner skills. To convey the model's value, participants presented it as a tool that can be used for self-improvement. Healthcare is a complex adaptive system comprised of continuous moving parts (Cordon, 2013; Skochelak et al., 2021). Knowledge and skills learned today may not apply to patient care 1, 5, or 10 years later. As Participant 4 explained, not being able to adapt to the future of healthcare can have downstream implications for patients.

When using the MAL model, medical educators developed strategies for conveying the value of the model tied to lifelong learning strategies. One strategy discussed by participants was the need to be responsive to students' reactions to the model. Just because the MAL model is a topic of discussion or presented in the classroom or clinical setting does not mean the student will automatically value or recognize its importance. Participant 6 explained that medical students are introduced to a great deal of information throughout medical school, and often they have their ideas and perceptions of what they should be learning. For example, if presented with information on heart disease versus information on a metacognitive learning model such as MAL, students will likely be more interested in discussing heart disease over the learning model. The discussion of heart disease is more directly related to their career as physicians, and for them meets their expectations of what a physician should know. Therefore, medical educators should explain why the learning model is just as crucial to their careers.

Theme 2: Creating a Culture of Learning

The second theme, creating a culture of learning, is supported by two sub-themes, coaching framework and teaching how to learn. This theme explored the experiences of medical educators with the MAL model within the learning environment. To teach the phases of the MAL model, medical educators take on a coaching role. Coaching is an important teaching tool for developing future-ready MAL physicians (Cutrer et al., 2018; Wolff et al., 2020). Coaching

assists in developing MALs by providing individualized feedback to learners as they work through the phases of the MAL model.

All participants discussed the importance of providing feedback to students, a finding supported by the literature (Wolff & Santen, 2019; Wolff et al., 2021). Participant 4 described that feedback with productive questioning facilitates critical thinking for students. This individualized feedback should be detailed, robust, and supportive of learning. The use of these strategies shows students the importance of and strategies for a culture of inquiry and problem solving important for developing a culture of learning. Specific competencies for providing feedback were consistent with those discussed in the literature (Wolff et al., 2021), which include guiding students through the practice of self-reflection and reviewing performance in relation to goal achievement and sustaining set goals. Findings suggest that a coach is more than an educator. A coach is a mentor who understands what challenges learners face and pushes them to challenge themselves to become better learners.

The MAL model is a learning model that prepares future physicians to use metacognitive processes to support a deeper understanding and transfer of knowledge in medical education to create innovative solutions (Cutrer et al., 2017). Thus, understanding how to learn and preparing for how to learn are needed for future-ready physicians (Cutrer et al., 2021). Medical educators directly influence how learners perceive the MAL model. Findings indicate that medical educators use a variety of teaching strategies when teaching the MAL model and that there is not a one size fits all approach to how the model is implemented. Model delivery or implementation varies depending on the discussion topic or the student's stage in their medical education.

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. Participants 1, 6, and 13 described using new student orientation as an opportunity to introduce the MAL model to students. This early introduction of the MAL model is consistent with Roberts et al.'s (2019) discussion on MAL implementation. Participant 4 explained that the goal of introducing the MAL model during these fundamental segments of the medical students' journey is to connect the dots of learning the MAL skills so that students can build on each phase of the model.

Theme 3: Assessment Through Self-Reflection and Coaching

The third theme, assessment through self-reflection and coaching, provided insight into how medical educators assess students' knowledge of the MAL model. Findings indicate that specific indicators for the assessment of MAL have not been developed. Consistent with the literature (Wolff et al., 2021), participants noted that more research is needed to develop an assessment of the model's impact on student learning. Participant 4 notes that given the complexity of the model, it is likely that one method of assessment will not be sufficient. Instead, educators have considered assessing master adaptive learning through multiple indicators. Participants discussed learner self-assessment and coaching as two promising indicators of MAL assessment. This finding is supported in the literature as Epstein et al. (2008) explain that self-assessment involves analyzing your own performance to independently address self-development, which can be fostered through coaching (Cutrer et al., 2018).

Self-assessment is an essential component of the MAL model, as assessing is a phase of the MAL model. As Participant 6 described, effective and successful learners are those who can assess their learning gaps and address them. Thus, self-reflection is important when self-assessing. Self-reflection and being a reflective practitioner supports learners as they not only

identify learning gaps but think critically about what these learning gaps mean for them and how to address learning gaps appropriately.

Coaching is central to the self-assessment process, as it provides external feedback to learners (Cutrer et al., 2018). Participant 4 explained that coaches meet with students multiple times to provide feedback to learners on their performance. During these meetings, coaching can assess whether students are progressing through the MAL model and if they understand what it means to be a master adaptive learner. Participants 4 and 12 note that their institutions use a portfolio system to track students' progress through the curriculum while providing assessment feedback to identify areas of strength and improvement. This finding is supported in the literature as a strategy for longitudinal assessment of the MAL model. Stringer et al. (2019) explain that longitudinal assessment of MAL behavior determines if students are growing to become MALs.

Theme 4: Overcoming a Punitive Culture

The fourth theme, overcoming a punitive culture, supported by two sub-themes, system barriers and facilitating a shared vision, aimed to address the impact of the learning environment and culture on MAL implementation. It is not surprising that barriers to and facilitators of implementation raise concern when a new curriculum or learning method is introduced. It is important to understand barriers and facilitators from medical educators' point of view because they are responsible for establishing MAL as a new way of learning.

Barriers often lie within the learning environment and educational setting—barriers described by participants related to anything that impeded the implementation of the model. At the same time, facilitators create a shared vision among educators, which creates a learning environment that supports the MAL model. Findings indicated that participants encountered

barriers when implementing the MAL model. However, barriers can be addressed to encourage the MAL model in the medical education curriculum.

In the study, participants noted that time, environment, policies, and procedures are barriers to MAL implementation. While each of these barriers plays a role in how MAL is implemented, a more considerable barrier discussed was the fixed mindset of educators. Educators are responsible for developing medical education curricula, which involves determining how much time is devoted to each learning objective, the structure of the classroom and clinical settings, and policies and procedures followed within the learning environment (Auerbach et al., 2020; Cutrer et al., 2018; Roberts et al., 2019).

Participants agreed that both educators and students have fixed mindsets regarding medical education. Students often struggle to adapt to a learning model like MAL, which encourages asking questions and identifying weaknesses. However, for this to change for students, participants agreed that medical educators must move away from a trainer-trainee mentality in medical education. This mentality fosters an environment where students are afraid to acknowledge weaknesses and ask questions (Kercheval et al., 2022; Murray et al., 2022). If afraid to acknowledge weakness or ask questions, learners will be unable to identify and address knowledge gaps and develop the habits of mind that support lifelong, adaptive learning.

Participant 1 explained that medical educators need to create a learning environment in which students feel comfortable speaking up and know it is okay if they do not know the answer. Creating this type of environment is the responsibility of medical educators; therefore, medical educators must have the knowledge and skills to cultivate this environment. Participants noted that medical educators need faculty development to learn how to create a learning environment for adaptive learning and encourage this throughout the institution's culture. Literature confirms

that medical educators play a role in establishing the culture of the learning environment (Cutrer et al., 2018; Regan et al., 2022). Murray et al. (2021) discuss the need for faculty development to support the development of skills that foster a culture of adaptive learning.

Theme 5: Future Adaptive Expert

The fifth theme, future adaptive expert, addressed the second sub-research question, how can the MAL model be combined with futures literacy to prepare future-ready physicians? Participants identified several characteristics of a “future-ready MAL physician.” Characteristics included curiosity, openness to new ideas, willingness to step outside of one’s comfort zone, taking charge of own learning, sense of awareness, and leadership. Participants noted that adaptive expertise is critical to being “future-ready” because an adaptive expert is also open to learning and innovation. Additionally, teaching adaptive expertise involves taking learners out of their comfort zone and challenging their ability to respond to novelty and complexity to foster innovation (Merritt et al., 2022; Mylopoulos, 2020; Steinert et al., 2021).

However, some participants noted that the MAL model does not convey a clear connection between MAL and adaptive expertise. Participant 13 noted that it is not naturally explained in the model how it would help build or facilitate functioning in moments of uncertainty. Participant 2 explained that the model asks you to embrace uncertainty but does not indicate how you train people to be more comfortable with uncertainty. Futures literacy is defined as the capacity to encounter uncertainty and use it as a resource for innovation and new knowledge (Miller, 2018). As discussed below, futures literacy can be applied to the MAL model as a technique for training to be comfortable with uncertainty.

Interpretation of Findings

The study's findings on medical educators' experiences with the MAL model revealed new insights into how the model has been implemented and how it can be expanded to better prepare future physicians for the future of healthcare. The participants shared a variety of experiences and perspectives on the MAL model. They noted the model's importance as a learning model for preparing physicians for the future of healthcare. The study's 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.

Participants felt that future physicians should learn to be change agents of their learning and build habits of lifelong learning. They noted that as medical educators, they 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. The participants shared that they aim to create a culture of learning that facilitates asking questions and being comfortable with failure. This means that educators, along with the support of the educational institution, must address systems and processes that inhibit this type of culture and instead work together to create a shared vision for adaptive learning. The application of the model varied among participants. Some participants deliberately implemented the MAL model, such as adjusting the curriculum to mirror the model. In contrast, other participants adopted the model's principles into their teaching style. The different applications of the model provide insight into the versatility of the model.

Discussion of Findings and Conceptual and Theoretical Frameworks

Conceptual and theoretical frameworks discussed in chapter two are rooted in adult learning theory and futures studies. These frameworks included adult learning theories, self-directed learning, lifelong learning, reflective practice, and futures literacy situated within futures studies. The following is a discussion of the findings through the lenses of the conceptual and theoretical frameworks.

Adult Learning Theories

Self-Directed Learning

As discussed previously, self-directed learning (SDL) emphasizes autonomy and individual freedom for adults to plan, conduct, and evaluate their learning through a self-initiated process using critical thinking and defined goals (Taylor & Hamdy, 2013). Several participants described aspects of SDL when discussing the goals of the MAL model. For example, participant 8 explained that workshops focused on teaching learners to be independent learners and that her goal is for students to have autonomy in their learning.

Lifelong Learning

Lifelong learning was central to the findings and lifelong self-improvement's first emergent theme. Lifelong learning encourages growth and helps physicians maintain the knowledge and skills needed to provide patient care over time (Derrick, 2003; Tagawa, 2008). Findings suggest that participants value lifelong learning and introduce the concept early in medical education. As mentioned in the section above, a participant described lifelong learning as a tool for continuous improvement in knowledge and practice to address gaps in knowledge and facilitate growth.

Reflective Practice

Reflective practice occurs when one critically assesses and reflects on their actions and behaviors to develop professional effectiveness (Peters, 1991). Findings from the study support the use of reflective practice when using MAL. Self-assessment and feedback are critical components of the MAL model. Reflective practice involves using reflection to think critically about actions and improve professional practice and workplace learning (Cocodia, 2014). Participants discussed the use of coaching and the importance of feedback, which incorporates internal and external reflection.

Futures Studies

Futures Literacy

In chapter two, the construct of a future-ready physician was introduced (see figure 6). A future-ready physician is an adaptive lifelong learner who uses systems thinking when encountering uncertainty and anticipatory knowledge to analyze the future of quality patient care and seek out novel approaches that will propel the future of medicine. As mentioned, findings indicate that some participants had concerns regarding the MAL model's connection to addressing uncertainty.

Literature supports the argument that healthcare is rapidly changing and adapting to changes is necessary. Given the rate at which change occurs, physicians will likely encounter times of uncertainty. While the MAL model fosters the skills to work through periods of uncertainty and is supported by adult learning theories such as self-directed learning, lifelong learning, and reflective practice, findings from this study 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. Therefore, the MAL model and futures literacy should be explored as combined approaches for anticipating and responding to uncertainty and creating better futures in healthcare.

Limitations

Although all participants were familiar with the MAL model, the extent of familiarity differed among participants. As noted in chapter four, some participants considered themselves early adopters of the model while others considered themselves implementers. Additionally, participants varied in their interactions with the model. Some participants conducted research, while some used the model to structure the curriculum, and some used only specific components of the model. Therefore, there was inconsistency in how the model was implemented. However, since this study aimed to understand medical educators' experiences with the model, uniformity in implementation was not warranted.

Another limitation included information not shared by participants. Some participants were reluctant to share specific examples of how they have used MAL or curriculum documents because they plan to use that information for future publication. Another limitation was the participants' knowledge of futures studies. When discussing the purpose of the study and the concept of a future-ready physician, participants needed more context regarding the meaning of future-ready. This limitation was addressed by briefly explaining futures studies and futures literacy to participants, but familiarity with futures studies may have provided participant responses that contained futures studies nuances.

While not a direct limitation of the study, the scope of the study is a limitation of the potential impact of the research. This research focused on MAL implementation at allopathic medical schools and is largely focused within allopathic medical schools. The impact of the study could be expanded to include osteopathic schools, which would provide a broader impact regarding futures literacy and lifelong learning for physicians. In addition, given osteopathic medical schools' foundational and philosophical focus on holistic patient care, the ideas and findings from this study may be further supported and well-received by those schools.

The design of qualitative studies is often discussed in the limitations section regarding generalizability. However, given the nature of qualitative research, the purpose of this study was not to generalize findings to all medical educators. Instead, the findings of this study add depth and understanding to how medical educators used the MAL model to prepare future-ready physicians for the changing dynamics of the healthcare system.

Recommendations and Implications for Practice

The existing literature focuses on the development and delivery of the MAL model. Given that the model is still in its infancy, there is little evidence on how medical educators are using the model in practice. It is essential to understand and explore the experiences of medical educators when implementing the MAL model and how the model is being used to prepare future physicians for the future of healthcare. The medical educators' experiences are important because it helps to understand how the model has transitioned from concept to practice, how the model interacts with the educational environment, and how the model is delivered in medical education.

This study explored medical educators' experiences preparing future-ready physicians for the future of healthcare. Findings indicated that preparation is an ongoing responsibility of

medical educators. Given this responsibility, faculty development will be central to additional educators implementing the MAL model in medical education. As discussed by participants and noted in the literature, medical educators are the drivers of the model. They not only introduce MAL to students but model what a master adaptive learner is and demonstrate adaptive expertise. Medical educators should focus on creating opportunities for faculty development on the MAL model.

Furthermore, educational institutions should support faculty development. Auerbach et al. (2020) found that institutional commitment to the MAL model is needed to create a culture that supports learning and provides appropriate resources. As discussed in the findings, for medical educators to successfully implement the MAL model and prepare future-ready physicians, the culture within medical education will have to change. Identifying knowledge gaps is foundational to the MAL model (Cutrer et al., 2019). However, if the medical education culture perpetuates a learning environment that learners perceive as punitive when questions are asked or when knowledge is lacking, learners will feel comfortable voicing knowledge gaps and seeking feedback from educators. Thus, medical educators should examine changes to policies and procedures as well as their own mindsets regarding best practices in medical education and the most effective practices for encouraging a learning environment that is not punitive. Faculty development on the MAL model, subsequent institutional commitment to the model, and changing the medical education culture supports the second, third, and fourth themes highlighted in this study's findings.

In regard to the first theme, when presenting the model to medical students, educators should consider students' perceived utility value of the model. Utility value, grounded in *expectancy-value theory*, refers to a learner's perceived usefulness of a task or concept (Eccles et

al., 1983; Wigfield, 1994). For example, a learner understands that a math course is valuable or important to doing well in a future chemistry course (Wigfield, 1994). Participants noted that teaching the MAL model can be challenging as learners do not immediately understand the benefits of adaptive expertise. Literature confirms that becoming a master adaptive learner occurs over time, which also means educators must continue to reiterate to students why MAL is valuable throughout their educational journey.

As discussed in the findings, some participants noted that a connection between MAL and adaptive expertise is missing. By incorporating futures literacy into practice, medical educators can begin to better connect MAL and adaptive expertise. To be an adaptive expert, a physician must be able to balance between routine practice and innovation (Mylopoulos & Woods, 2017). Being an adaptive expert involves being able to discern when a routine treatment will solve a patient's illness or when to begin to look outside of normal circumstances and begin to innovate solutions. As a framework for learning, futures literacy encourages the practice of anticipation (Sriprakash, 2021). An adaptive expert with skills to anticipate moves beyond a reliance on routine expertise toward the practice of innovation. Futures literacy in practice builds the skills needed for adaptive expertise in which physicians are not constrained by the past or routines but can move forward to an innovative future.

Recommendations for Future Research

As mentioned, the MAL model is still in its infancy. Thus, there are great opportunities for future research. The following are recommendations for future research in relation to the findings of this study. Future research should explore how medical educators use the MAL model in UME and GME. Given the lack of assessment of the model, it is recommended that medical educators further explore if MAL behaviors can be assessed and, if so, what this

assessment consists of. Participants only discussed the model in the context of the educational environment. To truly understand if physicians are prepared for the future of healthcare, a recommendation would be to conduct a study on physicians who are now practicing and attended a medical institution that implemented the MAL model. Furthermore, this research could explore how a practicing physician incorporates the MAL model into patient care. In addition to a longitudinal study on MAL, future research should explore the student perspective of MAL. Given that this study focused on medical educators' understanding of MAL, I think it is also necessary to understand medical students' perspective of MAL to better understand where students are in the process of becoming MAL. Findings from a study on the student perspective may give insight into when MAL and adaptive expertise should be introduced to students. While findings from this study explored medical educators' experiences and ideas about MAL, more research is needed to explore if there is a more appropriate time to introduce adaptive expertise such as before, during, or after clinical exposure. In addition to timing, research should explore if there should be a perceived "readiness" for introducing MAL to medical students. For example, if some students struggle to self-reflect, should they be expected to become a master adaptive learner at the same pace as a student who has developed critical self-awareness.

As discussed in the literature review, there are two degrees of medical school training in medical education: allopathic medicine (MD) and osteopathic medicine (DO). Future research may consider how the MAL model is implemented and adopted at allopathic medical schools versus osteopathic medical schools in relation to their foundational differences in patient treatment. For example, allopathic medical schools focus more on treating the disease, while osteopathic medicine is focused on holistic patient treatment (Kowarski, 2020). Since adaptive expertise and the MAL model promote a systems perspective, future research may explore

whether there is a difference in how change and the willingness to change are integrated into allopathic versus osteopathic medical schools.

As noted in the discussion of the findings and futures literacy, futures literacy combined with the MAL will better prepare future-ready physicians as faculty develop understandings of how to address possible, plausible, and desirable futures. This recommendation for future research addresses the fifth theme. 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). Thus, a futures literate MAL physician knows how to work through uncertainty and change to address knowledge gaps and anticipates uncertainty and novelty in the future. Future research should explore the relationship between the MAL model and futures literacy and how it can be implemented in the MAL model. This recommendation is foundational to incorporating future studies in medical education literature.

Chapter Summary

This basic qualitative study aimed to understand medical educators' experiences with the MAL model and adaptive expertise in medical education. The MAL model has been presented as a tool for developing adaptive expertise in future physicians, giving them the expertise to adapt to uncertainty in healthcare (Cutrer et al., 2019; Skochelak et al., 2020). The MAL model is a new concept in medical education, and there is little evidence of how medical educators have used it in the learning environment. Adult learning theories and futures studies provided the lens through which the study was conducted and analyzed. The literature review gives insight into the

current state of medical education, the development of the MAL model, and gaps in the literature.

The overall research question that guided this study was, “how do medical educators prepare future-ready MAL physicians for the future of healthcare?” Participant responses from semi-structured interviews and supplemental documents were used to answer the overall research question. The findings included 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, and (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 study adds to the MAL model literature and introduces future studies to medical education literature. As discussed in the implications, 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. Future research should also explore the MAL model and futures literacy to respond to uncertainty and facilitate anticipatory practices in medicine. As a framework, 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, but how you use change to rethink and question assumptions of the present will enable you to embrace complexity and uncertainty (Miller, 2018).

The conclusions of this study provide insight into medical educators’ experiences and ideas about the MAL model and how to expand the MAL model with the futures literacy

framework to elevate future-ready physicians' capacity to embrace change. This chapter provided a summary, discussion, and interpretation of findings, study limitations, implications for practice, and recommendations for future research. I close this chapter with a section on my thoughts on the meaning of this study and my reflections as the researcher.

Researcher Reflections

As we adjust to a post-pandemic world, some remain cautious about what the healthcare system may encounter next. While I do not think physicians can fully prepare for what we endured during the COVID-19 pandemic, there is no doubt that physicians need skills to address changes within the healthcare system. These skills include learning about healthcare from a systems perspective and considering factors that impact patient health inside and outside the doctor's office.

Working with aspiring healthcare professionals for over five years has given me a new appreciation for the commitment and training it takes to become a healthcare provider. These individuals spend countless hours training to learn skills needed to care for others. Therefore, medical education programs must consider how they prepare physicians for the future of healthcare and if they are equipped with the skills necessary to continue providing care in a changing system. Too often, people have encountered healthcare experiences where a provider may not have fully explored all possible avenues of care because of a lack of adaptive expertise. This is why a MAL model is essential for the medical education curriculum. Not only does it better prepare physicians to provide care, but it leads to better patient outcomes.

I did not learn of futures studies until entering my doctoral program. While it was initially intimidating, as I studied more, I became fascinated by learning about relationships with the future and how individuals prepare for and shape the future. Perhaps driven by my self-

proclaimed “planner” identity, I found discussions on understanding anticipation and how to manage uncertainties to enhance innovation crucial for our world. Futures studies is not about predicting the future but thinking about what is possible in the future and what actions you can take to change the future. For example, if a physician encounters uncertainty during patient treatment and takes the steps necessary to address it, they are inherently changing the future through adaptive expertise. This changes the future in the short term by altering a patient’s treatment in terms of a better plan of care, but it also changes the future in the long term by enhancing the physician’s knowledge and future treatment for other patients. At a systems level, understanding the impact of promoting certain medications can similarly be guided by a futures perspective that looks at the whole system’s impacts of practices. Such an approach may have avoided the current opioid addiction crisis we are now facing.

As I end my doctoral journey, I reflect on my amazing interactions inside and outside the classroom, with the literature, and with the research process. I have enjoyed the opportunity to explore my passions for medical education and adult education. I hope this research will support awareness, conversations, and actions on the advancement of medical education.

REFERENCES

- Anthoni, E., Van Leemput, M., Schoffelen, J., & Hannes, K. (2020). Futures studies. In P. Atkinson, S. Delamont, A. Cernat, J.W. Sakshaug, & R.A. Williams (Eds.), *SAGE Research Methods Foundations*. <https://www-doi-org.prox.lib.ncsu.edu/10.4135/9781526421036949493>
- Auerbach, L., Santen, S. A., Cutrer, W. B., Daniel, M., Wilson-Delfosse, A. L., & Roberts, N. K. (2020). The educators' experience: Learning environments that support the master adaptive learner. *Medical Teacher*, 42(11), 1270-1274. <https://doi.org/10.1080/0142159X.2020.1801998>
- Baker, G. (2020). Covid diary: Finding direction within disruption. *NZ Business + Management*, 34(3), 8–10
- Beck, J.B., Long, M., & Ryan, M. S. (2020) Into the unknown: Helping learners become for comfortable with diagnostic uncertainty. *Pediatrics*, 46(5), e2020027300.
- Bélanger, P. (2011). *Theories in adult learning and education*. Barbara Budrich Publishers. <https://doi.org/10.3224/86649362>
- Bhopal, A. (2015). Attitude and the 21st century doctor. *Lancet Global Health*, 3(3), e126-e127. doi:10.1016/S2214-109X(14)70376-6
- Bjursell, C. (2020). The COVID-19 pandemic as disjuncture: Lifelong learning in a context of fear. *International Review of Education*, 66(5-6), 673-689. <https://doi.org/10.1007/s11159-020-09863-w>
- Borkan, J. M., Hammoud, M. M., Nelson, E., Oyler, J., Lawson, L., Starr, S. R., & Gonzalo, J. D. (2021). Health systems science education: The new post-Flexner professionalism for

the 21st century. *Medical Teacher*, 43(sup2), S25–S31.

<https://doi.org/10.1080/0142159X.2021.1924366>

Branzetti, J., Gisondi, M. A., Hopson, L. R., & Regan, L. (2022). Adaptive expertise: The optimal outcome of emergency medicine training. *AEM Education and Training*, 6(2), e10731-n/a. <https://doi.org/10.1002/aet2.10731>

Caffarella, R. S. (1993). Self-directed learning. *New directions for adult and continuing education*, 57, 25-35.

Candy, P. C. (1991). *Self-direction for lifelong learning: A comprehensive guide to theory and practice*. Jossey-Bass.

Chen, J. (2017). Playing to our human strengths to prepare medical students for the future. *Korean Journal of Medical Education*, 29(3), 193-197. doi:10.3946/kjme.2017.65

Cocodia, E. A. (2014). Developing a career development program for medical sciences students: Reflecting "in" and "on" practice. *Higher Education Studies*, 4(6), 24-30.
<http://doi.org/10.5539/hes.v4n6p24>

Coghlan, D. & Brydon-Miller, M. (Eds.) (2014). *The sage encyclopedia of action research*. Thousand Oaks, CA: Sage Publications, Inc.

Combes, J. R., & Arespachaga, E. (2012). Physician competencies for a 21st century health care system. *Journal of Graduate Medical Education*, 4(3), 401-405. doi:10.4300/JGME-04-03-33

Corbin, J. and Strauss, A. (2008) *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage Publications, Inc.

- Cordon, C. P. (2013) System theories: An overview of various system theories and its application in healthcare, *American Journal of Systems Science*, 2(1), 13-22. doi: 10.5923/j.ajss.20130201.03.
- Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Creswell, J. W. & Poth, C. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Cross-Durrant, A. (1984). Lifelong education in the writings of John Dewey. *International Journal of Lifelong Education*, 3(2), 115–125.
<https://doi.org/10.1080/0260137840030205>
- Cutrer, W. B., Miller, B., Pusic, M. V., Mejicano, G., Mangrulkar, R. S., Gruppen, L. D., Hawkins, R. E., Skochelak, S. E., & Jr, D. E. M. (2017). Fostering the development of Master Adaptive Learners: A conceptual model to guide skill acquisition in medical education. *Academic Medicine*, 92(1), 6.
- Cutrer, W. B., Atkinson, H. G., Friedman, E., Deiorio, N., Gruppen, L. D., Dekhtyar, M., & Pusic, M. (2018). Exploring the characteristics and context that allow master adaptive learners to thrive. *Medical Teacher*, 40(8), 791–796.
<https://doi.org/10.1080/0142159X.2018.1484560>
- Cutrer, W. B., Pusic, M. V., Gruppen, L. D., Hammoud, M. M., & Santen, S. A. (Eds.). (2019). *The master adaptive learner*. Elsevier.
- Cutrer, W. B., Spickard, W. A., Triola, M. M., Allen, B. L., Spell, N., Herrine, S. K., Dalrymple, J. L., Gorman, P. N., & Lomis, K. D. (2021). Exploiting the power of information in

medical education. *Medical Teacher*, 43(sup2), S17–S24.

<https://doi.org/10.1080/0142159X.2021.1925234>

Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work organizations: The state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, 4(1), 19-43. <https://doi.org/10.1146/annurev-orgpsych-032516-113108>

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations Scale: Self-determination in personality. *Journal of Research in Personality*, 19, 109– 134.
[https://doi.org/10.1016/0092-6566\(85\)90023-6](https://doi.org/10.1016/0092-6566(85)90023-6)

de Marrais, K. (2004). Qualitative interview studies: Learning through experience. In K. deMarrais & S. D. Lapan (Eds.), *Foundations for research* (pp.51–68). Mahwah, NJ: Erlbaum.

Denzin, N. K. (1970). *The research act: A theoretical introduction to sociological methods*. Chicago, IL: Aldine.

Denzin, N. K., & Lincoln, Y. S. (2011). *The sage handbook of qualitative research*. Thousand Oaks, CA: Sage Publications, Inc.

Derrick, M.G. (2003). Creating environments conducive for lifelong learning. *New Directions for Adult and Continuing Education*, 2003(100), 5-18. <https://doi.org/10.1002/ace.115>

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. The Macmillan Company.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Random House Publishing Group

- Dweck, C. S., & Molden, D. C. (2017). Mindsets: Their impact on competence motivation and acquisition. In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (pp. 135–154). The Guilford Press.
- Dyche, L., & Epstein, R. M. (2011). Curiosity and medical education: Supporting curiosity in medical education. *Medical Education*, 45(7), 663-668. <https://doi.org/10.1111/j.1365-2923.2011.03944.x>
- Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J., & Midgley, C. (1983). Expectancies, values and academic behaviors. In Spence, J. T. (ed.), *Achievement and Achievement Motives* (pp. 75-146). W. H. Freeman, San Francisco.
- Edje, L., & Price, D. (2021). Training future family physicians to become master adaptive learners. *Family Medicine*, 53(7), 559–566. <https://doi.org/10.22454/FamMed.2021.192268>
- Edwards, R., Ranson, S., & Strain, M. (2002). Reflexivity: towards a theory of lifelong learning. *International journal of lifelong education*, 21(6), 525-536.
- Epstein, R. M., Siegel, D. J., & Silberman, J. (2008). Self-monitoring in clinical practice: A challenge for medical educators. *The Journal of Continuing Education in the Health Professions*, 28(1), 5-13. <https://doi.org/10.1002/chp.149>
- Facer, K., & Sriprakash, A. (2021). Provincialising futures literacy: A caution against codification. *Futures*, 133,102807. <https://doi.org/10.1016/j.futures.2021.102807>
- Farrell, T. S. C. (2012). Reflecting on reflective practice: (Re)visiting Dewey and Schön. *TESOL Journal*, 3(1) 7-16. <https://doi.org/10.1002/tesj.10>

- Fergnani, A. (2020) Mapping fifty years of futures studies scholarship (1968-2017). In R. Slaughter & A. Hines (Eds.), *The knowledge base of futures studies 2020* (pp. 24-47). Association of Professional Futurists.
- Ferry, N. M., & Ross-Gordon, J. M. (1998). An inquiry into Schön's epistemology of practice: Exploring links between experience and reflective practice. *Adult Education Quarterly* (American Association for Adult and Continuing Education), 48(2), 98-112.
<https://doi.org/10.1177/074171369804800205>
- Fleener, M.J. (2022). Futures Literacy for Adult Learning: Hopeful Futures in Complex Worlds. For Petra A. Robinson, Kamala V. Williams, Maja Stojanovic (Eds.), *Global Citizenship for Adult Education: Advancing Critical Literacies for Equity and Social Justice*. Routledge, pp. 42-53.
- Fleener, M.J. (2002). *Curriculum dynamics: Recreating heart*. New York: Peter Lang.
- Flick, U. (2018). *The SAGE Handbook of Qualitative Data Collection*. SAGE Publications Ltd.
- Freire, P. (1998). *Pedagogy of freedom: Ethics, democracy, and civic courage*. Lanham: Rowman & Littlefield Publishers.
- Frenk, J., Chen, L., Bhutta, Z. A., Cohen, J., Crisp, N., Evans, T., Fineberg, H., Garcia, P., Ke, Y., Kelley, P., Kistnasamy, B., Meleis, A., Naylor, D., Pablos-Mendez, A., Reddy, S., Scrimshaw, S., Sepulveda, J., Serwadda, D., & Zurayk, H. (2010). Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet*, 376(9756), 1923-1958.
[http://dx.doi.org/10.1016/S0140-6736\(10\)61854-5](http://dx.doi.org/10.1016/S0140-6736(10)61854-5)
- Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, 48(1), 18–33. <https://doi.org/10.1177/074171369704800103>

- Gisoni, M. A., Branzetti, J., Hopson, L. R., & Regan, L. (2020). Sustainable engaged accountable learners. *AEM Education and Training*, 5(2), e10470.
<https://doi.org/10.1002/aet2.10470>
- Gonzalo, J. D., Dekhtyar, M., Starr, S. R., Borkan, J., Brunett, P., Fancher, T., Green, J., Grethlein, S. J., Lai, C., Lawson, L., Monrad, S., O'Sullivan, P., Schwartz, M. D., & Skochelak, S. (2017). Health systems science curricula in undergraduate medical education: Identifying and defining a potential curricular framework. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(1), 123–131.
<https://doi.org/10.1097/ACM.0000000000001177>
- Grant, A., McKimm, J., & Murphy, F. (2017). *Developing reflective practice: A guide for medical students, doctors and teachers*. Wiley-Blackwell.
- Gruppen, L., Dekhtyar, M., Roberts, N. (2019). How does master adaptive learning interact with the learning environment? In. W.B. Cuter, M. V. Pusic, L. D. Gruppen, M. M. Hammoud, & S. A. Santen (Eds.), *The master adaptive learner* (pp. 116-124). Elsevier.
- Hägström, M., & Schmidt, C. (2021). Futures literacy – To belong, participate and act!: An educational perspective. *Futures*, 132, 102813.
<https://doi.org/10.1016/j.futures.2021.102813>
- Han, E., Yeo, S., Kim, M., Lee, Y., Park, K., & Roh, H. (2019). Medical education trends for future physicians in the era of advanced technology and artificial intelligence: An integrative review. *BMC Medical Education*, 19(1), 1-15. doi:10.1186/s12909-019-1891-5
- Hauer, K. E., Iverson, N., Quach, A., Yuan, P., Kaner, S., & Boscardin, C. (2018). Fostering medical students' lifelong learning skills with a dashboard, coaching and learning

- planning. *Perspectives on Medical Education*, 7(5), 311–317.
<https://doi.org/10.1007/s40037-018-0449-2>
- Heino, H. (2021). Knowledge creation and mobility in and through futures workshops. *Futures & Foresight Science*, 3(1), 1-14. <https://doi.org/10.1002/ffo2.63>
- Houle, C. (1961). *The inquiring mind*. Madison: University of Wisconsin Press.
- Hunkins, F. P., & Ornstein, A. C. (1989). Curriculum innovation and implementation. *Education and Urban Society*, 22(1), 105-114.
- Illeris, K. (2009). *Contemporary theories of learning: Learning theorists -- in their own words*. London: Routledge.
- Jarvis, P. (2010). *Adult education and lifelong learning: Theory and practice*. Taylor & Francis Group.
- Jordi, R. (2011). Reframing the concept of reflection: Consciousness, experiential learning, and reflective learning practices. *Adult Education Quarterly*, 61(2), 181-197.
<https://doi.org/10.1177/0741713610380439>
- Kazemier, E. M., Damhof, L., Gulmans, J., & Cremers, P. H. M. (2021). Mastering futures literacy in higher education: An evaluation of learning outcomes and instructional design of a faculty development program. *Futures*, 132(102814), 1-9.
<https://doi.org/10.1016/j.futures.2021.102814>
- Kercheval, J. B., Khamees, D., Keilin, C. A., Markovitz, N. H., & Losman, E. D. (2021). Coping with COVID-19: Medical students as strong and responsible stewards of their education. *Perspectives on Medical Education*, 10(3), 187-191. <https://doi.org/10.1007/s40037-021-00650-3>

- Kim, J. W., Myung, S. J., Yoon, H. B., Moon, S. H., Ryu, H., & Yim, J.J. (2020). How medical education survives and evolves during COVID-19: Our experience and future direction. *PLOS ONE*, *15*(12), e0243958. <https://doi.org/10.1371/journal.pone.0243958>
- Knowles, M. S. (1975) *Self-directed learning*. New York Association Press.
- Kotzee, B. (2012). Private practice: Exploring the missing social dimension in ‘reflective practice.’ *Studies in Continuing Education*, *34*(1), 5–16.
<https://doi.org/10.1080/0158037X.2012.660521>
- Kowarski, I. (2020, December 29). *The difference between D.O. and M.D degrees*. USnews.com.
<https://www.usnews.com/education/best-graduate-schools/top-medical-schools/articles/2019-11-07/the-difference-between-do-and-md-degrees>
- Kramer, N. J., & Smit, J. (1977). *Systems thinking: Concepts and notions*. Leiden: Martinus Nijhoff
- Kua, J., Lim, W.-S., Teo, W., & Edwards, R. A. (2021). A scoping review of adaptive expertise in education. *Medical Teacher*, *43*(3), 347–355.
<https://doi.org/10.1080/0142159X.2020.1851020>
- Lajoie, S. P., & Gube, M. (2018). Adaptive expertise in medical education: Accelerating learning trajectories by fostering self-regulated learning. *Medical Teacher*, *40*(8), 809–812.
<https://doi.org/10.1080/0142159X.2018.1485886>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications, Inc.
- Lomis, K. D., Santen, S. A., Dekhtyar, M., Elliott, V. S., Richardson, J., Hammoud, M. M., Hawkins, R., & Skochelak, S. E. (2021). The accelerating change in medical education

- consortium: Key drivers of transformative change. *Academic Medicine*, 96(7), 979–988.
<https://doi.org/10.1097/ACM.0000000000003897>
- Mai, C., & Clark, B. (2016). SMART: A program to enhance self-directed learning. *Journal of graduate medical education*, 8(3), 451–452. <https://doi.org/10.4300/JGME-D-15-00588.1>
- Mann, K., Gordon, J., & MacLeod, A. (2009). Reflection and reflective practice in health professions education: A systematic review. *Advances in Health Sciences Education: Theory and Practice*, 14(4), 595-621. <https://doi.org/10.1007/s10459-007-9090-2>
- Manzone, J. C., Mylopoulos, M., Ringsted, C., & Brydges, R. (2021). How supervision and educational supports impact medical students' preparation for future learning of endotracheal intubation skills: A non-inferiority experimental trial. *BMC Medical Education*, 21(1), 102-102. <https://doi.org/10.1186/s12909-021-02514-0>
- Martin, C. M. (2018). Complex adaptive systems approaches in health care—A slow but real emergence? *Journal of Evaluation in Clinical Practice*, 24(1), 266-268.
<https://doi.org/10.1111/jep.12878>
- McGinn, D. (2021, August 28). How 'pivot' became the pandemic buzzword, for better or for worse. *Globe & Mail* [Toronto, Canada], A15.
<https://link.gale.com/apps/doc/A673482400/BIC?u=ncliveecu&sid=summon&xid=afbcf6f3>
- Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult and Continuing Education*, 2001(89), 3-14. <https://doi.org/10.1002/ace.3>
- Merriam, S. B. (2008). Adult learning theory for the twenty-first century. *New Directions for Adult and Continuing Education*, 2008(119), 93-98. <https://doi.org/10.1002/ace.309>

- Merriam, S. B., & Grenier, R. S. (Eds.). (2019). *Qualitative research in practice: Examples for discussion and analysis*. John Wiley & Sons, Incorporated.
- Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation* (4th ed.). John Wiley & Sons.
- Merritt, C., Santen, S. A., Cico, S. J., Wolff, M., & Pusic, M. (2022). Punctuated equilibrium: COVID and the duty to teach for adaptive expertise. *The Western Journal of Emergency Medicine*, 23(1), 56-58. <https://doi.org/10.5811/westjem.2021.11.55268>
- Mezirow, J. (1981). A critical theory of adult learning and education. *Adult Education*, 32(1), 3–24. <https://doi.org/10.1177/074171368103200101>
- Mifflin, B. M., Campbell, C. B., & Price, D. A. (2000). A conceptual framework to guide the development of self-directed, lifelong learning in problem-based medical curricula. *Medical Education*, 34(4), 299-306. <https://doi.org/10.1046/j.1365-2923.2000.00564.x>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.
- Miles, M.B., Huberman, A.M. & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*. Sage, London.
- Miller, R. (2015). Learning, the future, and complexity. An essay on the emergence of futures literacy. *European Journal of Education*, 50(4), 513–523. <https://doi.org/10.1111/ejed.12157>
- Miller, R. (Ed.). (2018). *Transforming the future: Anticipation in the 21st century*. Routledge. <https://doi.org/10.4324/9781351048002>
- Mortensen, J. K., Larsen, N., & Kruse, M. (2021). Barriers to developing futures literacy in organisations. *Futures*, 132, 102799. <https://doi.org/10.1016/j.futures.2021.102799>

- Munro, S., Kornelsen, J., Wilcox, E., Kaufman, S., Bansback, N., Corbett, K. & Janssen, P. (2020) Implementation of shared decision-making in healthcare policy and practice: A complex adaptive systems perspective. *Evidence & Policy*, *16*(3), 393–411, DOI: [10.1332/174426419X15468571657773](https://doi.org/10.1332/174426419X15468571657773)
- Murphy, B. (2021, October 28). *Do vs. MD: How much does the medical school degree type matter?* American Medical Association. <https://www.ama-assn.org/medical-students/preparing-medical-school/do-vs-md-how-much-does-medical-school-degree-type-matter>
- Murray, S., Koksma, J., Haramati, A., Bonnefoy, E., Zary, N., Bill, W., Wolkenhauer, O., Price, S., & Kummerle, D. (2021). Imagining the future of learning in healthcare: The game 2019 #futuristforum. *Journal of European CME*, *10*(1), 1-9. <https://doi.org/10.1080/21614083.2021.1984076>
- Mylopoulos, M. (2020). Preparing future adaptive experts: Why it matters and how it can be done. *Medical Science Educator*, *30*(S1), 11–12. <https://doi.org/10.1007/s40670-020-01089-7>
- Mylopoulos, M., Brydges, R., Woods, N. N., Manzone, J., & Schwartz, D. L. (2016). Preparation for future learning: A missing competency in health professions education? *Medical Education*, *50*(1), 115–123. <https://doi.org/10.1111/medu.12893>
- Mylopoulos, M., & Regehr, G. (2009). How student models of expertise and innovation impact the development of adaptive expertise in medicine. *Medical Education*, *43*(2), 127–132. <https://doi.org/10.1111/j.1365-2923.2008.03254.x>
- Mylopoulos, M., & Woods, N. N. (2017). When I say ... adaptive expertise. *Medical Education*, *51*(7), 685–686. <https://doi.org/10.1111/medu.13247>

- Mylopoulos, M., Kulasegaram, K., & Woods, N. N. (2018). Developing the experts we need: Fostering adaptive expertise through education. *Journal of Evaluation in Clinical Practice*, 24(3), 674–677. <https://doi.org/10.1111/jep.12905>
- Narang, A., Velagapudi, P., Rajagopalan, B., LeBude, B., Kithcart, A. P., Snipelisky, D., & Sinha, S. S. (2018). A new educational framework to improve lifelong learning for cardiologists. *Journal of the American College of Cardiology*, 71(4), 454–462. <https://doi.org/10.1016/j.jacc.2017.11.045>
- Orsino, A., & Ng, S. (2019). Can adaptive expertise, reflective practice, and activity theory help achieve systems-based practice and collective competence? *Canadian Medical Education Journal*, 10(3), e55-60. <https://doi.org/10.36834/cmej.53182>
- Osterman, K. F. (1990). Reflective practice: A new agenda for education. *Education and Urban Society*, 22(2), 133-152.
- Otaki, F., Naidoo, N., Al Heialy, S., John Baptiste, A.M., Davis, D., & Senok, A. (2020). Shaping the future-ready doctor: A first-aid kit to address a gap in medical education. *International Journal of Medical Education*, 11, 248–249. <https://doi.org/10.5116/ijme.5fad.2d3a>
- Papanagnou, D., Ankam, N., Ebbott, D., & Ziring, D. (2021). Towards a medical school curriculum for uncertainty in clinical practice. *Medical Education Online*, 26(1), 1972762. <https://doi.org/10.1080/10872981.2021.1972762>
- Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.
- Patton, M. (2015) *Qualitative research and evaluation methods*. (4th ed) Thousand Oaks, CA: Sage Publications, Inc.

- Perrin, P. B., Pierce, B. S., & Elliott, T. R. (2020). COVID-19 and telemedicine: A revolution in healthcare delivery is at hand. *Health Science Reports*, 3(2), e166-n/a.
[doi:10.1002/hsr2.166](https://doi.org/10.1002/hsr2.166)
- Peters, J. M. (1991). Strategies for reflective practice. *New Directions for Adult and Continuing Education*, (51), 89-96. <https://doi.org/10.1002/ace.36719915111>.
- Peterson, L. E., Blackburn, B., Bazemore, A., O'Neill, T., & Phillips, R. L. (2014). Do family physicians choose self-assessment activities based on what they know or don't know? *The Journal of Continuing Education in the Health Professions*, 34(3), 164-170.
<https://doi.org/10.1002/chp.21247>
- Poli, R. (2019). *Anticipation and the philosophy of the future*. In: Poli R. (eds) Handbook of Anticipation. Springer, Cham. https://doi.org/10.1007/978-3-319-91554-8_10
- Pouru-Mikkola, L., & Wilenius, M. (2021). Building individual futures capacity through transformative futures learning. *Futures*, 132(102804).
<https://doi.org/10.1016/j.futures.2021.102804>
- Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education*, 35(2), 66-67.
<https://doi.org/10.1080/19325037.2004.10603611fa>
- Pusic, M. [BWH Education Institute]. (2020, September 10). *The Master Adaptive Learner Framework: A Metacognitive approach to clinician learning* [Video]. YouTube.
<https://www.youtube.com/watch?v=jek8cyUeRDE>
- Pusic, M. V., Santen, S. A., Dekhtyar, M., Poncelet, A. N., Roberts, N. K., Wilson-Delfosse, A. L., & Cutrer, W. B. (2018). Learning to balance efficiency and innovation for optimal

adaptive expertise. *Medical Teacher*, 40(8), 820–827.

<https://doi.org/10.1080/0142159X.2018.1485887>

Quirk, M., & Chumley, H. (2018). The adaptive medical curriculum: A model for continuous improvement. *Medical Teacher*, 40(8), 786-790.

<https://doi.org/10.1080/0142159X.2018.1484896>

Rapley, T., & Rees, G. (2018). Collecting documents as data. In U. Flick *The sage handbook of qualitative data collection* (pp. 378-391). SAGE Publications Ltd,

<https://dx.doi.org/10.4135/9781526416070.n24>

Ratnapalan, S., & Lang, D. (2020). Health care organizations as complex adaptive systems. *The Health Care Manager*, 39(1), 18-23. <https://doi.org/10.1097/HCM.0000000000000284>

Regan, L., Hopson, L. R., Gisondi, M. A., & Branzetti, J. (2022). Creating a better learning environment: A qualitative study uncovering the experiences of master adaptive learners in residency. *BMC Medical Education*, 22(1), 141-141. <https://doi.org/10.1186/s12909-022-03200-5>

Regnier, K., Chappell, K., & Dimitra, T. V. (2019) The role and rise of interprofessional continuing education. *Journal of Medical Regulation*, 105(3): 6–13. doi:

<https://doi.org/10.30770/2572-1852-105.3.6>

Richardson, D., Kinnear, B., Hauer, K. E., Turner, T. L., Warm, E. J., Hall, A. K., Ross, S., Thoma, B., Van Melle, E., & on behalf of the ICBME Collaborators. (2021). Growth mindset in competency-based medical education. *Medical Teacher*, 43(7), 751–757.

<https://doi.org/10.1080/0142159X.2021.1928036>

- Roberts, N. K, Van Eck, R. N. & Lee, R. (2019). How and where do I teach my learners about the master adaptive learner model? In. W.B. Cuter, M. V. Pusic, L. D. Gruppen, M. M. Hammoud, & S. A. Santen (Eds.), *The master adaptive learner* (pp. 83-88). Elsevier.
- Roessger, K. M. (2014). The effects of reflective activities on skill adaptation in a work-related instrumental learning setting. *Adult Education Quarterly*, 64(4), 323–344.
<https://doi.org/10.1177/0741713614539992>
- Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.
- Roulston, K. (2010). *Reflective interviewing: A guide to theory and practice*. Los Angeles, CA: SAGE.
- Rubin, H. J., & Rubin, I. S. (2011). *Qualitative interviewing: The art of hearing data* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Saldaña, J. (2016). *The coding manual for qualitative researchers*. Thousand Oaks, CA: Sage Publications, Inc.
- Saleh, M., Agami, N., Omran, A., & El-Shishiny, H. (2008). A survey on futures studies methods. *The 6th International Conference on Informatics and Systems INFOS IEEE*, Cairo-Egypt: INFOS2008
- Sargeant, J., Armson, H., Chesluk, B., Dornan, T., Eva, K., Holmboe, E., Lockyer, J., Loney, E., Mann, K., & van der Vleuten, C. (2010). The processes and dimensions of informed self-assessment: A conceptual model. *Academic Medicine*, 85(7), 1212-1220.
<https://doi.org/10.1097/ACM.0b013e3181d85a4e>
- Sargeant, J., Eva, K. W., Armson, H., Chesluk, B., Dornan, T., Holmboe, E., Lockyer, J. M., Loney, E., Mann, K. V., & van der Vleuten, C. P. M. (2011). Features of assessment

- learners use to make informed self-assessments of clinical performance. *Medical Education*, 45(6), 636-647. <https://doi.org/10.1111/j.1365-2923.2010.03888.x>
- Sawatsky, A. P., Ratelle, J. T., Bonnes, S. L., Egginton, J. S., & Beckman, T. J. (2017). A model of self-directed learning in internal medicine residency: A qualitative study using grounded theory. *BMC Medical Education*, 17(1), 31-31. <https://doi.org/10.1186/s12909-017-0869-4>
- Schiavone, F., & Ferretti, M. (2021). The futureS of healthcare. *Futures*, 134(102849). <https://doi.org/10.1016/j.futures.2021.102849>
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Sears, D. (2017). Preparation for future learning. In K. Peppler (Ed.), *The SAGE encyclopedia of out-of-school learning*, (pp. 614-616). Thousand Oaks, CA: Sage Publications, Inc. <https://www.doi.org/10.4135/9781483385198.n235>
- Sethuraman, K. R. (1995). Medical education: Principles and practice. *National teacher training centre, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, India*.
- Skochelak, S. E., Hammoud, M. M., Lomis, K. D., Borkan, J. M., Gonzalo, J. D., Lawson, L. E., & Starr, S. R. (Eds.). (2020). *Health systemics science* (2nd ed.). Elsevier
- Skochelak, S. E., Lomis, K. D., Andrews, J. S., Hammoud, M. M., Mejicano, G. C., & Byerley, J. (2021). Realizing the vision of the lancet commission on education of health professionals for the 21st century: Transforming medical education through the accelerating change in medical education consortium. *Medical Teacher*, 43(sup2), S1-S6. <https://doi.org/10.1080/0142159X.2021.1935833>

- Smith, S. R. (2004). The meta-curriculum in medical education. *Medicine and Health Rhode Island*, 87(8), 236-9.
- Smyre, R., & Richardson, N. (2016). *Preparing for a world that doesn't exist-yet: Framing a second enlightenment to create communities of the future*. John Hunt Publishing.
- Stanford Medicine. (2020). The rise of the data-driven physician. *Stanford medicine 2020 health trends report*. Retrieved September 13, 2020 from med.stanford.edu.
- Steinert, Y., Irby, D. M., & Dolmans, D. (2021). Reframing faculty development practice and research through the lens of adaptive expertise. *Medical Teacher*, 43(8), 865–867. <https://doi.org/10.1080/0142159X.2021.1931081>
- Stringer, J. K., Gruppen, L. D., Ryan, M. S., Ginzburg, S. B., Cutrer, W. B., Wolff, M., & Santen, S. A. (2022). Measuring the master adaptive learner: Development and internal structure validity evidence for a new instrument. *Medical Science Educator*, 32(1), 183-193. <https://doi.org/10.1007/s40670-021-01491-9>
- Stringer, J. K., Wolff, M., & Santen, S. A. (2019). How do you measure the master adaptive learner? In W.B. Cuter, M. V. Pusic, L. D. Gruppen, M. M. Hammoud, & S. A. Santen (Eds.), *The master adaptive learner* (pp. 72-82). Elsevier.
- Sturmberg, J.P., O'Halloran, D.M. and Martin, C.M. (2012), Understanding health system reform – a complex adaptive systems perspective. *Journal of Evaluation in Clinical Practice*, 18, 202-208. <https://doi-org.prox.lib.ncsu.edu/10.1111/j.1365-2753.2011.01792.x>
- Tagawa, M. (2008). Physician self-directed learning and education. *The Kaohsiung Journal of Medical Sciences*, 24(7), 380-385. [https://doi.org/10.1016/S1607-551X\(08\)70136-0](https://doi.org/10.1016/S1607-551X(08)70136-0)
- Tannebaum, R. P., Hall, A. H., & Deaton, C. M. (2013). The development of reflective practice in American education. *American Educational History Journal*, 40(1), 241-259.

- Taylor, D. C. M., & Hamdy, H. (2013). Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher*, 35(11), e1561–e1572. <https://doi-org.prox.lib.ncsu.edu/10.3109/0142159X.2013.828153>
- Taylor, S. J., Bogdan, R., & DeVault, M. L. (2016). *Introduction to qualitative research methods: A guidebook and resource*. John Wiley & Sons.
- Tough, A. (1971). *The adult's learning projects: A fresh approach to theory and practice in adult education*. Toronto: Ontario Institute for Studies in Education.
- Tracy, S. J. (2010). Qualitative quality: Eight “big-tent” criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), 837-851.
<https://doi.org/10.1177/1077800410383121>
- Tracy, S. J. & Hinrichs, M. M. (2017). Big tent criteria for qualitative quality. In J. Matthes, C.S. Davis and R.F. Potter (Eds). *The international encyclopedia of communication research methods*. (pp. 1-10) John Wiley & Sons, Inc.
<https://doi.org/10.1002/9781118901731.iecrm0016>
- United Nations Education Scientific and Cultural Organization (UNESCO). (2020). *Futures literacy. An essential competency for the 21st century*. Retrieved January 12, 2022, from <https://en.unesco.org/futuresliteracy/about>
- UNESCO Institute for Lifelong Learning. (2020). *Embracing a culture of lifelong learning contribution to the futures of education initiative: Report: A transdisciplinary expert consultation*. Hamburg, UIL. Retrieved January 13, 2022, from <https://unesdoc.unesco.org/ark:/48223/pf0000374112/PDF/374112eng.pdf.multi>
- van Woezik, T. E. T., Koksma, J. J.-J., Reuzel, R. P. B., Jaarsma, D. C., & van der Wilt, G. J. (2021). There is more than ‘I’ in self-directed learning: An exploration of self-directed

learning in teams of undergraduate students. *Medical Teacher*, 43(5), 590–598.

<https://doi.org/10.1080/0142159X.2021.1885637>

Van Eck, R. N., Gullett, H. L., Lamb, S. M., Krouse, H. J., Mazzurco, L. W., Lage, O. G., Lewis, J. H., & Lomis, K. D. (2021). The power of interdependence: Linking health systems, communities, and health professions educational programs to better meet the needs of patients and populations. *Medical Teacher*, 43(sup2), S32–S38.

<https://doi.org/10.1080/0142159X.2021.1935834>

Wakefield, D., Bayly, J., Selman, L. E., Firth, A. M., Higginson, I. J., & Murtagh, F. E. (2018).

Patient empowerment, what does it mean for adults in the advanced stages of a life-limiting illness: A systematic review using critical interpretive synthesis. *Palliative Medicine*, 32(8), 1288–1304. <https://doi.org/10.1177/0269216318783919>

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, 6(1), 49–78.

<http://www.jstor.org/stable/23359359>

Wilson-Delfosse, A. L. & Fall, L. H. (2019). How will the master adaptive learner process work in the classroom? In W.B. Cuter, M. V. Pusic, L. D. Gruppen, M. M. Hammoud, & S. A. Santen (Eds.), *The master adaptive learner* (pp. 89-103). Elsevier.

Wolff, M., Deiorio, N. M., Miller Juve, A., Richardson, J., Gazelle, G., Moore, M., Santen, S. A., & Hammoud, M. M. (2021). Beyond advising and mentoring: Competencies for coaching in medical education. *Medical Teacher*, 43(10), 1210-1213.

<https://doi.org/10.1080/0142159X.2021.1947479>

Wolff, M., Ross, P., Jackson, J., Skye, E., Gay, T., Dobson, M., Hughes, D. T., & Morgan, H. K. (2020). Facilitated transitions: Coaching to improve the medical school to residency

continuum. *Medical Education Online*, 26(1), 1856464-1856464.

<https://doi.org/10.1080/10872981.2020.1856464>

Wolff, M. & Santen, S. (2019). What is the role of self-assessment in the master adaptive learner model? In W.B. Cuter, M. V. Pusic, L. D. Gruppen, M. M. Hammoud, & S. A. Santen (Eds.), *The master adaptive learner* (pp. 64-71). Elsevier.

Wolff, M., Stojan, J., Buckler, S., Cranford, J., Whitman, L., Gruppen, L., & Santen, S. (2020). Coaching to improve self-directed learning. *The Clinical Teacher*, 17(4), 408-412.

<https://doi.org/10.1111/tct.13109>

Yeager, D. S., & Dweck, C. S. (2020). What can be learned from growth mindset controversies? *The American Psychologist*, 75(9), 1269-1284. <https://doi.org/10.1037/amp0000794>

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Thousand Oaks, CA: Sage Publications, Inc.

APPENDICES

Appendix A: Consent Form

Title of Study: Educating for uncertainty: A qualitative study on preparing future-ready physicians through adaptive learning. (eIRB #)

Principal Investigator(s): Elizabeth Locklear, [REDACTED]

Funding Source: None

NC State Faculty Point of Contact: Dr. Jayne Fleener, [REDACTED]

Collaborating Researchers: None

What are some general things you should know about research studies?

You are invited to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate, and to stop participating at any time without penalty. The purpose of this research study is to gain a better understanding of medical educators' experiences with the Master Adaptive Learner model to better prepare future physicians with the skills to address uncertainty. We will do this through Zoom interviews to discuss how you became familiar with the model and how you have implemented the model at your institution. We will also discuss how the model has guided your teaching efforts.

You are not guaranteed any personal benefits from being in this study. Research studies also may pose risks to those who participate. You may want to participate in this research because of your expertise in medical education. This research will add to the growing literature on the Master Adaptive Learning model. You may not want to participate in this research if you do not feel comfortable sharing your experiences with the model.

Specific details about the research in which you are invited to participate are contained below. If you do not understand this form, please ask the researcher for clarification or more information. A copy of this consent form will be provided to you via email from the researcher. If, at any time, you have questions about your participation in this research, do not hesitate to contact the researcher(s) named above or the NC State IRB office. The IRB office's contact information is listed in the *What if you have questions about your rights as a research participant?* section of this form.

What is the purpose of this study?

The purpose of the study is to better understand adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the Master Adaptive Learner model at medical schools within the United States.

How many people will be in the study?

There will be approximately 10 to 15 participants in this study.

Am I eligible to be a participant in this study?

In order to be a participant in this study, you must agree to be in the study and have experience using the Master Adaptive Learner model with medical students in the classroom or clinical setting.

You cannot participate in this study if you do not meet the inclusion criteria.

What will happen if you take part in the study?

If you agree to participate in this study, you will be asked to do all of the following:

1. Participate in a Zoom (virtual conferencing) interview about your experiences as a medical educator using the Master Adaptive Learning model in the classroom, clinical setting, and/or research.
2. Participate in an audio-recorded interview. All identifying information will be removed from data analysis.
3. You may be asked to share program materials or documents to enhance your description of how you are implementing MAL.
4. Provide curriculum documents or materials (i.e., syllabi, course objectives, curriculum maps) that support the Master Adaptive Learner model at your educational institution.
5. Participate in potential brief follow-up conversations for clarification.

The total amount of time that you will be participating in this study is 60 to 90 minutes.

RECORDING AND IMAGES

As a part of this research, I would like your consent to audio record you. I will ask for your verbal consent at the beginning of the interview.

RISKS AND BENEFITS

There are minimal risks associated with participation in this research.

The study's procedures are not considered risky, and the interview questions will focus on your personal experiences. Before the interview, participants will be reminded that they can stop the interview at any time and skip any question. Furthermore, should this occur, all direct identifiers will be removed from transcription and data analysis.

There are no direct benefits to your participation in the research. The indirect benefits include a contribution to the literature and research that will inform the future of healthcare and prepare future healthcare providers to adapt to the changing healthcare system.

RIGHT TO WITHDRAW YOUR PARTICIPATION

You can stop participating in this study at any time for any reason. To do so, just stop any research activity you are doing or contact the researcher, Elizabeth Locklear, at

[REDACTED] You can also contact the faculty advisor for this research, Dr. Jayne Fleener, at [REDACTED]

If you choose to withdraw your consent and stop participating in this research, you can expect that the researcher(s) will redact your data from their data set, securely destroy your data, and prevent future uses of your data for research purposes wherever possible. This is possible in some but not all cases.

CONFIDENTIALITY, PERSONAL PRIVACY, AND DATA MANAGEMENT

Trust is the foundation of the participant/researcher relationship. Much of that principle of trust is tied to keeping your information private and, in the manner, I have described to you in this form. The information that you share with me will be held in confidence to the fullest extent allowed by law.

Protecting your privacy as related to this research is of utmost importance to me. There are very rare circumstances related to confidentiality where I may have to share information about you. Your information collected in this research study could be reviewed by representatives of the University, research sponsors, or government agencies (for example, the FDA) for purposes such

as quality control or safety. In other cases, I must report instances in which imminent harm could come to you or others.

How I manage, protect, and share your data are the principal ways that I protect your personal privacy. Data that will be shared with others about you will be de-identified.

De-identified. De-identified data is information that at one time can directly identify you, but that I will record this data so that your identity will be separated from the data. I will have a master list with your code and real name that I can use to link to your data. You will be renamed during the Zoom session so that your name does not appear in the transcript. When the research concludes, there will be no way your real identity will be linked to the data I publish.

Future use of your research data

To help maximize the benefits of your participation in this project, by further contributing to science and our community, your de-identified information will be stored for future research and may be shared with other people without additional consent from you.

Compensation

There is no compensation for participating in this study.

WHAT IF YOU HAVE QUESTIONS ABOUT THIS STUDY?

If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the student researcher, Elizabeth Locklear, [REDACTED]

[REDACTED] You can also contact the faculty advisor for this research, Dr. Jayne Fleener, at [REDACTED]

What if you have questions about your rights as a research participant?

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact the NC State IRB (Institutional Review Board) office. An IRB office helps participants if they have any issues regarding research activities. You can contact the NC State University IRB office at IRB-Director@ncsu.edu, 919-515-8754, or [fill out a confidential form online at https://research.ncsu.edu/administration/participant-concern-and-complaint-form](https://research.ncsu.edu/administration/participant-concern-and-complaint-form)

CONSENT TO PARTICIPATE

Participant will be asked to provide verbal consent before the interview begins.

Thank you for your consideration.

Appendix B: Interview Protocol

IRB#

Title: Educating for uncertainty: A qualitative study on preparing future-ready physicians through adaptive learning.

Time of interview:

Date:

Place: Zoom

Study Description:

Healthcare is becoming more complex as new technology and innovations impact the healthcare delivery system and patient care. As we have seen in the wake of COVID-19, adapting to the changing dynamics of healthcare is essential for maintaining effective and quality patient care. A proactive rather than reactive approach to healthcare better equips healthcare providers and future providers with the tools and strategies needed to adapt to change without patient care disruption. Several medical schools across the country have adopted the Master Adaptive Learner (MAL) model. Current literature shows that the MAL model can be used as a strategy to prepare future-ready physicians to respond to the changing dynamics of healthcare. However, existing literature does not address how undergraduate medical educators experience learning and teaching adaptive expertise.

The purpose of the proposed research is to better understand adaptive expertise in medical education and medical educators' experiences teaching and learning to teach the MAL model at AMA Accelerating Change in Medical Education member institutions. For this qualitative study, medical educators who have had experience with the MAL model will be interviewed to understand the MAL model, implementation of the MAL model, and development of future-ready physicians. Interview data will be used to answer the research questions that guide this study.

Interview Process:

1. Explain the interview process with the participant.
2. After introducing the study and discussing the informed consent with the participant, I will turn off the camera and begin to record the conversation by first asking for informed consent for participating in the research.
3. Series of open-ended questions. The questions will focus on the MAL model and how you prepare future-ready physicians.
4. Questions are grouped into three categories and two subcategories.
5. The audio recording and generated transcript will be retained for analysis.
6. The interview will last between 60 to 90 minutes.

Review of consent:

Verbal Consent Script

You were provided a consent form for this study in a previous communication. You were invited to participate in this qualitative study given your expertise and work within healthcare and knowledge and use of the Master Adaptive Learner model. There are minimal risks to participating in this interview. Data will be de-identified following the interview.

Do you have any questions?

If you decide not to participate in the study at any time, the interview will end.

My contact information and my faculty advisor's contact information are provided on the consent form previously sent to you if you have questions or concerns.

Do you have any questions or concerns before we begin? If not, I will begin the recording by asking for your consent to participate.

[Begin recording]

Do you consent to participate in this research?

Do you consent to be audio recorded?

Background Information:

1. How long have you taught at your institution?
2. Do you consider yourself an early adopter or implementer of the new MAL approach?
 - a. How long have you been using the MAL approach?
3. Are you considered an early, middle or late career medical educator?
4. What interests you in preparing future medical professionals?

Interview Questions:

Introduction – Master Adaptive Learning

1. What is your current role and/or contribution to the Master Adaptive Learner model?
 - a. Follow up - What were your initial thoughts regarding the model?
 - i. Potential probes:
 1. Are there some parts that are easier to teach?
 2. Are there some parts that are harder to teach?
 3. How does it differ from how you taught before?

Category I – The MAL Curriculum

2. Please describe the context in which you teach the MAL model?
 - a. Classroom or clinical setting?

- b. 1st, 2nd, 3rd, 4th-year students, residents, fellows?
- c. Other health professions students?
- d. The number of students you teach
- e. How long have you been teaching it?
- f. How did you learn to teach it?

Subcategory A – MAL Basics

- 3. How do you describe MAL and its lifelong implications to your students?
 - a. How do you encourage key characteristics of MAL such as motivation, curiosity, resilience in students?
- 4. What would you describe as the ideal learning environment for teaching MAL?
 - a. What are barriers to MAL implementation?
 - b. What are the facilitators of MAL implementation?

Subcategory B - Teaching

- 5. What resources do you use to guide your teaching of MAL?
 - a. Assignments, references, guest speakers?
- 6. What resources or support does your institution provide to implement MAL?
 - a. Do you feel you have them currently?
 - b. How would you recommend finding them?
- 7. What curriculum documents or materials (i.e., syllabi, course objectives, curriculum maps) might you share with me that give a sense of how MAL is implemented at your institution?
- 8. In your experience, how have students responded to the four phases of MAL?
 - a. Are there some phases more challenging than others?
 - b. How do students work through challenges?

Subcategory C - Indicators

- 9. What indicators do you use to assess students' value and understanding of MAL in their role as a physician?
 - a. Can you provide more detail?
 - b. Are there parts of the model that are easier or harder to assess?

Category II – Preparing future-ready physicians

- 10. How would you describe a master adaptive future-ready physician?
 - a. Can you provide an example?

Closing Questions

- 11. What else should I be thinking about?
- 12. Can you think of anyone else you think I should be interviewing?

Closing:

We have come to the end of the interview. It was very nice talking with you and thank you for your participation. Should a follow up for clarification be needed, is it okay to reach out to you later?

Thank you again for your time and participation.

Appendix C: Sub-Research Questions and Interview Questions Alignment

Sub-Research Question	Question Prompts	Interview Question
<p>RQ1: What are medical educators' experiences with and ideas about the MAL model? In particular,</p>	<p>How do medical educators convey the value of MAL to future physicians?</p>	<ul style="list-style-type: none"> • How do you describe MAL and its lifelong implications to your students?
	<p>How do medical educators use the MAL model to guide teaching efforts to promote the development of future-ready MAL physicians?</p>	<ul style="list-style-type: none"> • What is your current role and/or contribution to the Master Adaptive Learner model? • Please describe the context in which you teach the MAL model. • What resources do you use to guide your teaching of MAL? • In your experience, how have students responded to the four phases of MAL?
	<p>What indicators do medical educators use to assess the knowledge of MAL in future physicians?</p>	<ul style="list-style-type: none"> • What indicators do you use to assess students' value and understanding of MAL in their role as a physician?
	<p>What barriers and facilitators do medical educators encounter when implementing MAL?</p>	<ul style="list-style-type: none"> • What would you describe as the ideal learning environment for teaching MAL? <ol style="list-style-type: none"> a. What are barriers to MAL implementation? b. What are the facilitators of MAL implementation?
<p>RQ2: How can the MAL model be combined with futures literacy to prepare future-ready physicians?</p>		<ul style="list-style-type: none"> • How would you describe a master adaptive future-ready physician?

Appendix D: Recruitment Letter

Dear (enter participant's name):

I am a doctoral student at NC State University in the Educational Leadership, Policy, and Human Development department. I received your contact information from (insert appropriate answer, i.e., online, recommendation). I am currently completing my dissertation research, which focuses on learning to adapt to uncertainty. I am interested in medical educators' experiences with the Master Adaptive Learner model. I am particularly interested in your experiences learning about the model, implementing the model with your students, and the impact you think it will have in preparing future medical professionals.

After reviewing the AMA website, Master Adaptive Learner literature and (insert name of medical school) website, I see that (insert name of medical school) is a leader in adopting the Master Adaptive Learner model. Given your experience with the model, I would like to request your participation in this study through a virtual interview. The interview will be conducted via Zoom and will ask a series of open-ended questions about your experiences with the Master Adaptive Learner model and how you believe this model will prepare future physicians for the changing dynamics of the healthcare system. The interview will be recorded and will last between 60 to 90 minutes.

Please feel free to reach out if you have any questions or concerns.

I appreciate your time and consideration as I genuinely feel this model is essential for preparing future-ready physicians.

Sincerely,


Elizabeth Locklear

Appendix E: Figure Copyright Permissions

Figure 1. Health Systems Science Curricular Domains

NC STATE 

Re: Obtain permission request - Book (1220583) [211122-002308]
2 messages

Rights and Permissions (ELS) <Permissions@elsevier.com> Sun, Nov 21, 2021 at 6:33 PM
Reply-To: "Rights and Permissions (ELS)" <Permissions@elsevier.com>


Dear ,

Thank you for contacting the Permissions Granting Team.


We acknowledge the receipt of your request and we aim to respond within seven business days. Your unique reference number is 211122-002308.

Please avoid changing the subject line of this email when replying to avoid delay with your query.

Regards,
Permission Granting Team

From:
Date: 21/11/2021 11.33 PM

Submission ID: 1220583
Date: 21 Nov 2021 11:33pm

Name: Ms. Elizabeth Locklear
Institute/company:


Type of Publication: Book

Title: Health Systems Science
ISBN: 9780323694629
Auhtors: Editor: Susan E. Skochelak
Year: 2020
From page: 9
To page: 9
Chapter number: 1
Chapter title: What is Health Systems Science? Building an Integrated Vision

I would like to use: Figure(s)

Quantity of material: 1
 I am the author of the Elsevier material: No
 Elsevier author is involved in my project: No

In what format will you use the material: Electronic
 Translation: No

Proposed use: Reuse in a thesis/dissertation

Material can be extracted: No

Additional Comments / Information:

This email is for use by the intended recipient and contains information that may be confidential. If you are not the intended recipient, please notify the sender by return email and delete this email from your inbox. Any unauthorized use or distribution of this email, in whole or in part, is strictly prohibited and may be unlawful. Any price quotes contained in this email are merely indicative and will not result in any legally binding or enforceable obligation. Unless explicitly designated as an intended e-contract, this email does not constitute a contract offer, a contract amendment, or an acceptance of a contract offer.

Elsevier Limited. Registered Office: The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, United Kingdom, Registration No. 1982084, Registered in England and Wales. [Privacy Policy](#)

Rights and Permissions (ELS) <Permissions@elsevier.com>
 Reply-To: "Rights and Permissions (ELS)" <Permissions@elsevier.com>

Mon, Nov 22, 2021 at 1:08 AM

Dear ,

We hereby grant you permission to reprint the material below at no charge in your thesis subject to the following conditions:

1. If any part of the material to be used (for example, figures) has appeared in our publication with credit or acknowledgement to another source, permission must also be sought from that source. If such permission is not obtained then that material may not be included in your publication/copies.

2. Suitable acknowledgment to the source must be made, either as a footnote or in a reference list at the end of your publication, as follows:

"This article was published in Publication title, Vol number, Author(s), Title of article, Page Nos, Copyright Elsevier (or appropriate Society name) (Year)."

3. Your thesis may be submitted to your institution in either print or electronic form.

4. Reproduction of this material is confined to the purpose for which permission is hereby given.

5. This permission is granted for non-exclusive world English rights only. For other languages please reapply separately for each one required. Permission excludes use in an electronic form other than submission. Should you have a specific electronic project in mind please reapply for permission.

6. As long as the article is embedded in your thesis, you can post/share your thesis in the University repository.

7. Should your thesis be published commercially, please reapply for permission.

This includes permission for the Library and Archives of Canada to supply single copies, on demand, of the complete thesis. Should your thesis be published commercially, please reapply for permission.

This includes permission for UMI to supply single copies, on demand, of the complete thesis. Should your thesis be published commercially, please reapply for permission.

8. Posting of the full article/ chapter online is not permitted. You may post an abstract with a link to the Elsevier website www.elsevier.com, or to the article on ScienceDirect if it is available on that platform.

Kind regards,
Subash Balakrishnan
Copyrights Coordinator
ELSEVIER | HCM - Health Content Management
Visit [Elsevier Permissions](#)

From: Administrator
Date: Sunday, November 21, 2021 11:33 PM GMT

Dear ,

Thank you for contacting the Permissions Granting Team.

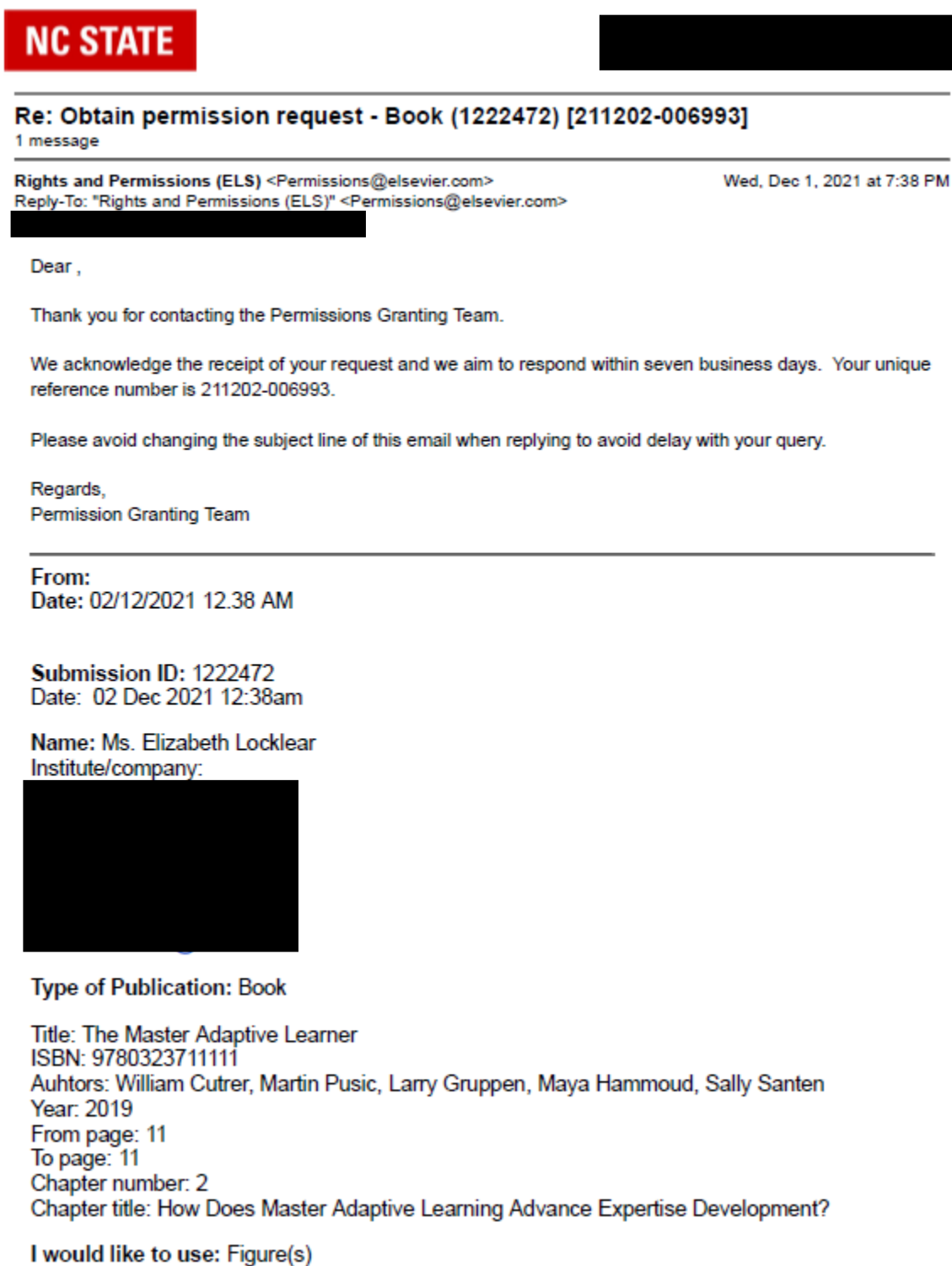
We acknowledge the receipt of your request and we aim to respond within seven business days. Your unique reference number is 211122-002308.

Please avoid changing the subject line of this email when replying to avoid delay with your query.

Regards,
Permission Granting Team

From:
Date: Sunday, November 21, 2021 11:33 PM GMT
[Quoted text hidden]
[Quoted text hidden]

Figure 2. Dreyfus Model of Expertise



Quantity of material: 1
I am the author of the Elsevier material: No
Elsevier author is involved in my project: No

In what format will you use the material: Print and Electronic
Translation: No

Proposed use: Reuse in a thesis/dissertation

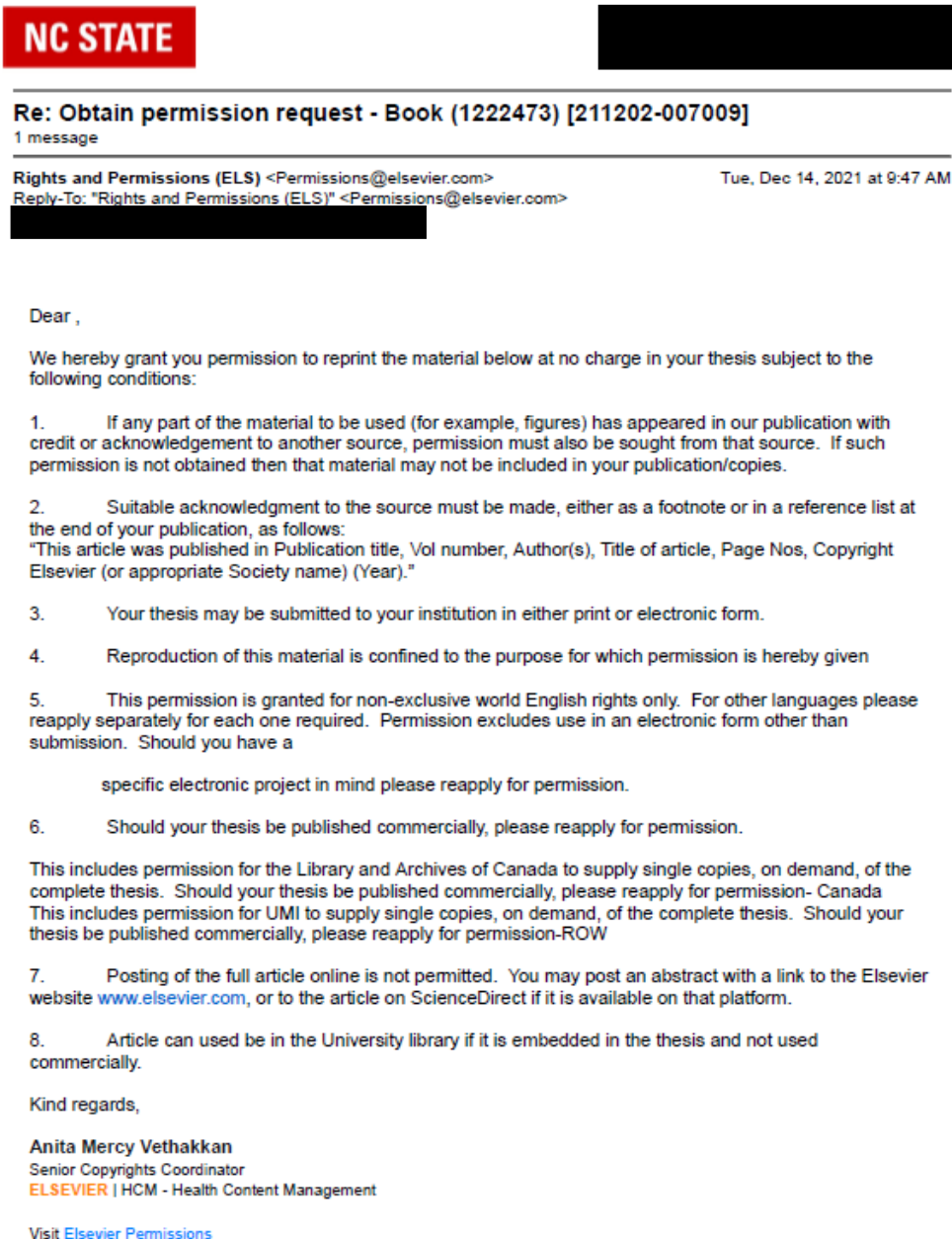
Material can be extracted: No

Additional Comments / Information:

This email is for use by the intended recipient and contains information that may be confidential. If you are not the intended recipient, please notify the sender by return email and delete this email from your inbox. Any unauthorized use or distribution of this email, in whole or in part, is strictly prohibited and may be unlawful. Any price quotes contained in this email are merely indicative and will not result in any legally binding or enforceable obligation. Unless explicitly designated as an intended e-contract, this email does not constitute a contract offer, a contract amendment, or an acceptance of a contract offer.

Elsevier Limited. Registered Office: The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, United Kingdom, Registration No. 1982084, Registered in England and Wales. [Privacy Policy](#)

Figure 3. Adaptive Expertise Dreyfus Model



From: Administrator
Date: Thursday, December 02, 2021 12:41 AM GMT

Dear ,

Thank you for contacting the Permissions Granting Team.

We acknowledge the receipt of your request and we aim to respond within seven business days. Your unique reference number is 211202-007009.

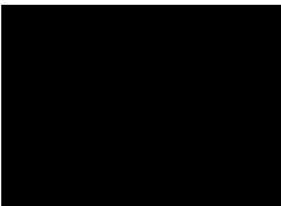
Please avoid changing the subject line of this email when replying to avoid delay with your query.

Regards,
Permission Granting Team

From:
Date: Thursday, December 02, 2021 12:41 AM GMT

Submission ID: 1222473
Date: 02 Dec 2021 12:40am

Name: Ms. Elizabeth Locklear



Type of Publication: Book

Title: The Master Adaptive Learner
ISBN: 9780323711111
Auhtors: William Cutrer, Martin Pusic, Larry Gruppen, Maya Hammoud, Sally Santen
Year: 2019
From page: 57
To page: 57
Chapter number: 5
Chapter title: Which Cognitive Processes Are Involved in the Master Adaptive Learner Process?

I would like to use: Figure(s)

Quantity of material: 1
I am the author of the Elsevier material: No

In what format will you use the material: Print and Electronic
Translation: No

Proposed use: Reuse in a thesis/dissertation

Material can be extracted: No

Additional Comments / Information:

This email is for use by the intended recipient and contains information that may be confidential. If you are not the intended recipient, please notify the sender by return email and delete this email from your inbox. Any unauthorized use or distribution of this email, in whole or in part, is strictly prohibited and may be unlawful. Any price quotes contained in this email are merely indicative and will not result in any legally binding or enforceable obligation. Unless explicitly designated as an intended e-contract, this email does not constitute a contract offer, a contract amendment, or an acceptance of a contract offer.

Elsevier Limited. Registered Office: The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, United Kingdom, Registration No. 1982084, Registered in England and Wales. [Privacy Policy](#)
