

Agile Mentorship: A Longitudinal Exploratory Analysis

Heidi Lindroth^{1,2,3}, Caroline Shumaker^{3,4,5}, Britain Taylor^{3,6}, Zayn Boustani^{3,4,5}, and Malaz Boustani^{2,3}

¹Division of Nursing Research, Department of Nursing, Mayo Clinic, Rochester, Minnesota; ²Center of Aging Research, Regenstrief Institute, and ³Center for Health Innovation and Implementation Science, School of Medicine, Indiana University, Indianapolis, Indiana; and ⁴Department of Biology, ⁵Department of Psychological and Brain Sciences, College of Arts and Sciences, and ⁶The Luddy School of Informatics, Computing, and Engineering, Indiana University, Bloomington, Indiana

ORCID IDs: 0000-0002-5389-4701 (H.L.); 0000-0001-7678-2449 (C.S.); 0000-0003-2263-4525 (B.T.); 0000-0002-4659-1331 (Z.B.); 0000-0003-0330-677X (M.B.)

ABSTRACT

Effective mentorship relationships increase mentee academic success and satisfaction. However, existing mentorship models are limited by miscommunication, undefined roles, and mismatched goals. The agile mentorship process aims to address these limitations by leveraging insights from agile science and the existing evidence on effective mentorship models to support effective mentoring relationships in healthcare environments. To illustrate the agile mentorship process and the growth of a mentored clinician–scientist (H.L., first author), we describe the model and share qualitative findings generated from the independent analysis of 18 months of mentee reflections. In two iterative cycles, reflections ($n = 56$) were analyzed using exploratory content and relational analysis. Coauthors C.S. and B.T. employed inductive and deductive coding approaches to explore the data using an ontological lens. We discuss and share quotes representing the identified four main themes. Identification of shortcomings, adaptive

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Correspondence and requests for reprints should be addressed to Heidi Lindroth, Ph.D., R.N., Department of Nursing, Mayo Clinic College of Medicine and Science, 200 First Street SW, Rochester, MN 55905. E-mail: lindroth.heidi@mayo.edu.

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perspective, managing relationships, and personal growth. In addition, personal growth had three subthemes: Awareness, continual reflection, and toolkit development. In summary, the reflections of one mentee within the agile mentorship process illustrated the growth process which occurred within an effective mentorship relationship. The agile mentorship process is a scalable and sustainable framework that is adaptable to various career development processes. Further evaluation is needed to understand the longitudinal impact of the model on mentee performance and satisfaction.

Keywords:

mentorship; agile science; behavior change; model development

MENTORSHIP MATTERS

On a weekly, if not daily, basis, predoctoral students, postdoctoral fellows, and early career scientists are asked, “Who is your mentor?” “Do you have a mentor?” “Are you being mentored?” “How are you going to find a mentor?” This can lead to pressure to seek mentorship without a complete understanding of what mentorship means, how it is best structured, and how it may be beneficial. According to the Merriam-Webster dictionary, mentorship is a noun that means “the influence, guidance, or direction given by a mentor” (1). Mentorship is a process of information exchange within a hierarchical social relationship between a person with extensive experience in a particular career path (i.e., the mentor) and a person with relatively limited experience within the same career path (i.e., the mentee). Effective mentorship results in higher degrees of academic self-efficacy, productivity, and satisfaction for the mentee (2–9). However, gaps in communication on shared goals, undefined or wrongly perceived roles, limited communication channels for feedback, and the inability to establish psychological safety hinder the development of effective mentoring relationships (4, 5, 10, 11). Dr. Lindroth was lucky to escape the mentor–mentee battlefield of lost

intentions, miscommunications, and distrust. Instead, their experience was the opposite of many, gaining insight, skills, productivity, and tools. Although success could be attributed to the personal characteristics of the mentee or mentor, it is more likely because of the mentorship agreement and model employed at the start of the mentoring relationship, named the agile mentorship process. Dr. Lindroth has borne witness to several colleagues who have not been this fortunate, leading to disillusionment with academia, poor productivity, and dissatisfaction. To illustrate the agile mentorship process and their growth as clinician–scientist, we describe the model and share qualitative findings generated from the independent analysis of 18 months of Dr. Lindroth’s reflections as a mentee.

THE AGILE MENTORSHIP PROCESS

Over the past decade, the Indiana University Center for Health Innovation and Implementation Science leveraged insights from agile science to develop and deploy an agile mentorship process to support the career development of early investigators in healthcare research. This mentorship process aims to address the limitations identified by previous systematic and narrative reviews of existing mentorship models by providing

minimal guidelines on the structure of meetings, communication, and the establishment of shared goals and guidelines for the mentor–mentee relationship.

Agile science is an evolving and adaptive knowledge discovery and acquisition process for developing and implementing behavior change in the dynamic, constantly changing real world (12–16). The term agile refers to speed and adaptability (1). Agile (iterative) originated in software development and grew in popularity as the traditional waterfall approach (linear) could not keep up with the rapid software development needs of the Internet age (17). Agile promotes flexibility, adaptability, and resilience in response to uncertainty and constant change (15, 17, 18). Building on this work, agile science integrates insights from social cognitive theories. These include behavioral economics, complex adaptive systems, complexity science, and network science to understand, predict, and steer the behaviors of individuals and social organizations (12, 15, 16, 19, 20). Agile science supports the design of human-centered strategies and the processes and tools needed to rapidly implement these strategies in the real world. Subsequently, agile science provides the foundation to diffuse these strategies across various social networks. Figure 1 illustrates agile science as a complex adaptive human network.

The agile mentorship process operationalizes the principles of agile science to address the limitations of existing mentorship models. Like a complex adaptive human network, the agile mentorship process operates on a set of simple rules or minimal standard operating procedures (Table 1), including feedback loops (weekly meetings, meeting minutes, and reflections) and rules (safe space and communication) to support role definitions,

communication on shared goals, and the establishment of psychological safety. The feedback loops support frequent and structured communication throughout the relationship. This framework is scalable and sustainable for use in low-resource environments.

Our objective is to begin to understand the structures, attributes, and skills needed to create an effective mentoring relationship using agile science. Although this analysis and discussion represent the experience of one mentee, we intend for this to lend insight into how the agile mentorship process could be scaled, tested, and sustained with additional mentees and institutions.

EXAMINATION OF ONE MENTEE'S EXPERIENCE

We employed an ontological qualitative content and relational approach to analyze all available reflections from a single mentee (H.L.) during their Indiana University Center for Health Innovation and Implementation Science agile mentorship process. The mentee was not involved in the overall analysis. Any disagreements that occurred between coders (C.S. and B.T.) were resolved by H.L. (the mentee).

Ontological research investigates a person's reality by understanding their lived experience, including feelings, thoughts, and behaviors (21). By applying this research lens longitudinally to a mentee's postmentorship reflections, we sought to explore how the mentee's lived experience, behaviors, and productivity changed throughout the agile mentorship experience. We employed both inductive (codes emerge from text) and deductive (preassigned codes applied to text) coding approaches to explore the data using an ontological lens (21–25).

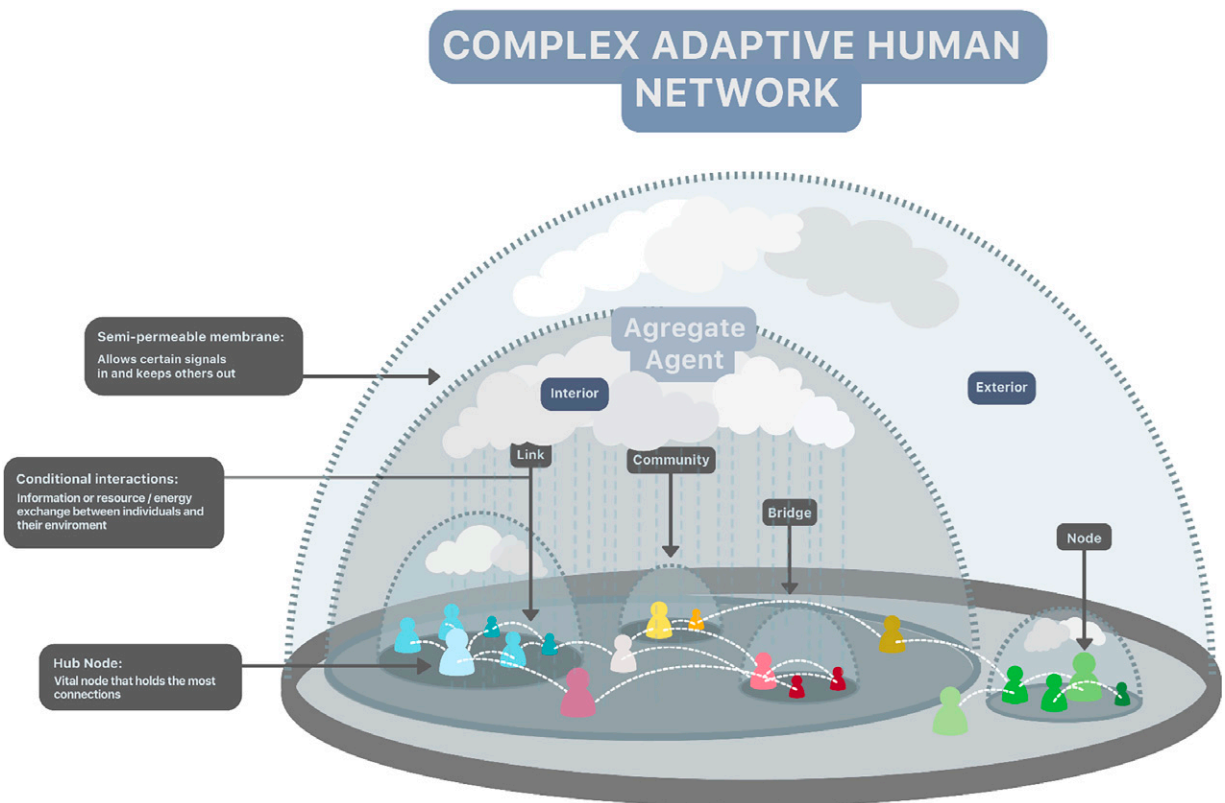


Figure 1. The concepts of agile science and the complex adaptive system of the agile mentorship process are illustrated. The mentor (hub node) and mentees (members of the community) have conditional interactions (or links, dotted lines) which are influenced by the interior and exterior environments. Signals, or influences from the exterior environment, are filtered by the semipermeable membrane which surrounds the mentor–mentee agile mentorship process. The positive and negative feedback loops continuously influence the mentor–mentee relationship. This figure was developed from the book *Signals and Boundaries: Building Blocks for Complex Adaptive Systems* by John H. Holland (19).

The study was planned retrospectively. The length of the mentee’s postdoctoral fellowship defined the time. This qualitative analysis did not meet the definition of human subjects research; therefore, institutional review board approval was not obtained.

Data Collection

The mentee selected for this analysis was the first mentee in the agile mentorship process to use the practice of reflections as an additional feedback loop after each meeting with a designated mentor. Prior mentees using the agile mentorship process did not practice reflection and therefore were excluded from this analysis. Mentee reflections were

emailed weekly after mentorship meetings as part of the predefined minimal standard operating procedures for deploying the agile mentorship process (*see* Table 1). Reflections were on the basis of the content discussed in the weekly meeting, emotions and behaviors experienced and/or observed, items communicated, decisions, and progress toward outlined goals. The mentee completed a total of 56 postmentorship meeting reflections over the 18-month period (9/1/2018–7/1/2020).

Data Analysis

Reflections were analyzed using an exploratory ontological approach with content and relational analysis (21, 25–28). We conducted analyses in

Table 1. Agile mentorship process, minimal standard operating procedure

At start	Mentor–mentee pledge* <ul style="list-style-type: none"> This is a set of guidelines that define the roles and expectations of the mentoring relationship.
Weekly ritual	Approximately 30 min 1:1 meeting and a summary of the meeting with a reflection Global Performance Scorecard shared with the mentor
Format of meeting	Mentee shares the following in a meeting to summarize the past week: <ul style="list-style-type: none"> Crises (defined as a personal or professional situation that is paralyzing); Noise (defined as a personal or professional situation causing mentee stress but not preventing progress); Positive (defined as something positive which occurred that week); Discussion(s)/question(s).
Guidelines	Safe space, established psychological safety, Nonjudgmental, actionable feedback provided to the mentee Defined preferred communication channels (i.e., virtual, in-person, or phone call)
Quarterly	Mentor team meeting (primary mentor + three interdisciplinary members + mentee)
Outcomes†	<ul style="list-style-type: none"> Define wildly important goal leading and lagging measures Develop brand (vision, mission, values, and why statement) Develop skills in agile science, emotional intelligence, communication, and networking

*Mentor–Mentee Pledge: An example is available in Supplementary Table E2.

†Mentee Outcome Definitions:

- The Wildly Important Goal (WIG) was defined at the start of the mentorship relationship. Progress towards this goal was measured using outlined leading and lagging measures and was tracked weekly on a Global Performance Scoreboard (GPS). A GPS and WIG are illustrated with Figure 3.
- Brand development involved the mentee outlining their vision, mission, values, and why statement for use in elevator pitches, introductions, and networking. An example worksheet is available in Supplementary Table E3.
- Skills in Agile Science involved the application of underlying theories (behavioral economics, complexity science, and network science) to understand, predict, and nudge behavior of both the overall system and the individual human.
- Skills in emotional intelligence include the identification, understanding, and application of emotions to confidently manage communication, conflicts, and anxiety, empathize with others, and problem solve.
- Skills in communication included the interpretation and application of nonverbal, verbal, written, open and closed-loop channels.
- Skills in networking including associative thinking, networking for discovery vs resource, observation, and questioning.

two iterative cycles (Figure E1 in the data supplement). An initial readthrough organized reflections in chronological order and identified preliminary themes. This initial readthrough informed the selection of coding methods for the first cycle. The first cycle applied an inductive and deductive approach using *in vivo*

coding (inductive) and affective and simultaneous coding (deductive) methods. Affective codes included emotion, values, processes, and versus. Figure E2 defines these codes. After the completion of the first cycle coding, magnitude coding investigated the dimensionality of the data. We evaluated code frequencies and

overlaps. We also applied code mapping to transition to the second cycle of analysis. We applied an inductive approach in the second cycle, resulting in the emergence of categories and overarching themes. The conceptual depth of the analysis was examined by reviewing the range of evidence drawn from the data to illustrate the themes and the resonance with existing literature (23). Direct quotes are shared which exemplify identified themes.

Microsoft Excel was used for the codebook and analysis. A codebook and analytic memos were maintained and discussed at monthly meetings (C.S. and B.T.) to reach an intercoder agreement. The lead author (H.L. and mentee) resolved disagreements. The mentor (M.B.) did not participate in the analysis.

OVERARCHING THEMES OF MENTEE GROWTH

In total, there were 56 postmentorship meeting reflections. These were segmented

into statements ranging in length from one to three sentences for a total of 381 statements. The themes identified in the first stage included checking assumptions, communication, goal-setting, and perspective shift. In the second stage of coding, large overlaps occurred between the values codes and two other codes: process codes ($n = 39$) and emotion codes ($n = 28$) (Figure E3). In the third and final coding stage, we identified four overarching themes: 1) identification of shortcomings; 2) adaptive perspective; 3) managing relationships; and 4) personal growth (Figure 2).

1) Identification of shortcomings. Value codes indicating mentee self-identified weaknesses and mentor-identified weaknesses inform this overarching theme. Self-identified weaknesses included emotional control, communication skills, time management, and the navigation of conflicts. Mentor-identified weaknesses included perfection paralysis and meeting set deadlines. These shortcomings



Figure 2. The interconnectivity of the four main themes which emerged during the agile mentorship process is displayed: identification of shortcomings, personal growth, adaptive perspective, and managing relationships. The outcomes of the agile mentorship process are building WIG, brand development, and research and leadership skill development. WIG = wildly important goals.

were present throughout all phases of the mentor–mentee relationship. The reflections on shortcomings shifted from individually focused to system-focused and included strategies, processes, and tools to navigate challenges.

“Realizing and understanding what paralyzed by perfection means for me was an important milestone.”

- 2) Adaptive perspective. The mentee frequently mentioned the ability to view problems from various perspectives. The practices used to understand various perspectives included: active listening, mindfulness practices, tools to minimize bias, and assumption checking. Furthermore, several versus codes describe this major theme as the mentee reflected on opposing behaviors or work settings.

“In order to build and maintain an agile (or creative) mind, I feel it is a very purposeful process of continual reflection and divergent thinking on the same matter. If I was an engineer, how would I approach this problem? If I was a scientist, what would I do? It is similar to zooming in and out. It is also similar to the adaptive, creative process.”

- 3) Managing relationships. The mentee frequently mentioned the perception of self and others, building and maintaining teams and relationships, communicating effectively, and gaining approval and input from others. Descriptions included how the emotional tone and response were present in different communication, collaborations, and systems. The mentee described the development of a self-monitoring system, tying these themes into personal growth and adaptive perspective.

“I also appreciate the discussion about how to manage emotions over email. It is easy to jump to conclusions, judge situations incorrectly, and spend emotional energy trying to clarify communication when it would have been solved faster and without as much emotion in-person or over the phone.”

- 4) Personal Growth. This theme is represented by three distinct subthemes: 1) awareness; 2) continual reflection; and 3) toolkit development. These subthemes

were cyclical, starting with the achievement of previous goals and setting new goals (iterative temporal phases).

- 4a. Awareness. The mentee’s belief (or awareness) of the ability to grow, and awareness of areas in which growth is necessary (self- or mentor-identified), formed a vital part of the early phases of mentorship. Once areas of growth were identified, the mentee often noted conscious awareness of how they were intrinsically changing to accomplish forward progress. In later phases, awareness of goal attainment was noted in the reflections, including recognition of the habits that were required to achieve each goal.

“I feel that I grow every week in how I think, how I approach research, and how I observe and/or interact with my environment.”

- 4b. Continual reflection. This subtheme represents the importance of reflection through the mentorship relationship. This is represented through the development phases as the mentee adjusted their reflections to not only reflect on the recent mentorship meeting but also include situations or previous meetings that required different skills in decision-making and communication. For example, in earlier phases, the practice of actively checking assumptions was a strategy the mentee often described in the reflections. It appears that this practice was used often in mentorship meetings and aided in recognizing that assumed facts or perspectives should not be used in decision-making unless proven to be accurate. As development phases progressed, subjective and objective observations were mentioned frequently in the reflections, among other skills the mentee was developing. These skills were often described in the context of assumption checking, communication, decision-making, goal-setting, and a growing degree of emotional intelligence within and outside of the mentorship meetings.

“The reflections are largely from my perspective or how I felt about the situation and not sheer observations of the environment and system around me.”

- 4c. Toolkit development. Developing tools to aid self-awareness and emotional sensors to gain feedback and insight into behavior emerged as a subtheme to personal growth. These tools included the following:
- 1) understanding how humans interpret and respond to information on the basis of their cognitive heuristics (29, 30);
 - 2) development of situational awareness and the ability to improvise quickly to adapt to different situations and emotions;
 - 3) examining situations and decisions from multiple degrees and viewpoints, coined as zooming in and out to see both the details and overview; and
 - 4) development of emotional intelligence, both with themselves and when interacting with others. The mentee described applying these practices to decision-making, goal-setting, and communication throughout the mentorship relationship. The mentee described being encouraged to apply these tools to evaluate risk and reward, recognize and minimize bias, and develop self-control and decision-making.

“Talking through my system 1 reaction helped tremendously as well as the actual lived experience. My self-awareness is improving, and after my reaction, I could see where I still needed to improve and grow.”

Additional quotes for each theme are shared in Table E1.

MENTOR PERSPECTIVE

The mentor (M.B.) shared his reflection on the agile mentorship process.

“The agile mentorship process requires having mentors who are willing to put the mentee first, spend the needed time and space with the mentee, and constantly model vulnerability to build and maintain the psychological safety which would allow

timely, actionable, and nonjudgmental feedback and reflection. As the mentor, I learned these essential attributes of a successful mentor from my own mentor. However, practicing such attributes was very hard and required constant mindfulness. Especially when my mentee accepted a very good offer from another institution. It was very hard to practice paying it forward. What helped me the most to cope was the investment I received from my mentor and the belief that my mentee would pay it forward. Having a mentor with a mindset of a long-term investment in building and maintaining an open source scientific community is crucial for the success of the agile mentorship process.”

ADDITIONAL METRICS OF SUCCESS

The mentee (H.L.) shared additional metrics of success, outlined in Table 2, from the start of their postdoctoral fellowship (August 2018) to the initial submission of this manuscript (July 2022) as they continued the mentor–mentee relationship with the mentor (M.B.) over the past 4 years. Productivity was measured using the global performance scoreboard outlined in Table 1 and illustrated in Figure 3.

IMPORTANCE OF AGILE MENTORSHIP PROCESS

The benefits of successful mentorship relationships extend beyond the immediate term. Successful mentees are not only more successful in academic metrics such as publications but are also more satisfied with their professional work. In addition, these mentees are likely to adapt and incorporate lessons learned through their mentorship into future mentorship relationships, essentially paying forward the time, tools,

Table 2. Reports the productivity recorded by the mentee using the described global performance scoreboard

	2017	2018	2019	2020	2021
Publications					
First/second/coauthor (total)	4/1/1 (6)	4/1/1 (6)	3/2/2 (13)	2/3/5 (23)	2/1/6 (32)
Grant applications					
Submitted/funded (total)	6/0 (6)	1/0 (7)	0/0 (7)	3/1 (10)	13/4 (23)

Table 2 reports on the productivity of one mentee using the global performance scoreboard, an essential component of the agile mentorship process. Timeline: Predoctorate 2017. Started a postdoctoral fellowship in August 2018. Postdoctoral fellow from 2019 to July 2020. Started a full-time scientist position in August 2020. Full-time scientist position in 2021.

perspectives, agile mindset, and important lessons learned. In this paper, we described our findings of an exploratory, ontological qualitative content and relational analysis of reflections from a mentee during a 2-year structured mentorship model titled agile mentorship process. We identified four key themes named identification of shortcomings, adaptive perspective, managing relationships, and personal growth, each defining an area in which the agile mentorship process promoted change within the mentee. These themes evolved and were iterative, each theme building on previous growth. Previous qualitative studies and systematic reviews report similar findings, demonstrating support for the agile mentorship process (4, 5). Longitudinal studies of multiple mentees are needed to evaluate the model entirely. We have outlined how the agile mentorship process may have contributed to each identified theme.

THE MENTOR–MENTEE PLEDGE

Establishing trust and psychological safety at the inception of the mentorship relationship through a mentor–mentee pledge (Tables 1 and E2) likely contributed to the theme of identification of

shortcomings. Critical to the ability to openly share displeasure and desire for change is psychological safety. The mentor–mentee pledge laid a foundation for the creation of psychological safety. The mentee described feeling safe in objectively identifying deficits, reflecting on progress weekly, and, as goals were met, identifying additional goals on the basis of the nonjudgmental feedback received. There was a shift observed from internal to external shortcomings over the time of analyzed reflections. This may indicate the critical role of mentorship in coaching mentees on how to become more self-aware, objectively identify flaws, and proactively work to change. The presence of negative emotional codes throughout the relationship may suggest that personal and professional growth is facilitated by displeasure and a desire for change. Although there are codes of fear and frustration, the role of a mentor may be to assist a mentee in identifying these negative emotions as motivation for positive change.

STRUCTURED MENTORSHIP MEETINGS WITH FEEDBACK LOOPS

The weekly practice of structured meetings followed by reflection likely influenced the themes of adaptive perspective, managing relationships, and

GLOBAL PERFORMANCE SCORECARD

Wildly Important Goal:

EXAMPLE: Independently funded scientist investigating methods to prevent and manage delirium

Leading Measures:

EXAMPLE: Grants (#in ideation, #under review, #in press, #scored, #funded)

Lagging Measures:

EXAMPLE: Obtain 40 manuscripts with 16 first author manuscripts by Dec 31, 2022

COUNTER OF PUBLICATIONS | # OF GRANTS

	First Author	Second Author	Third Author	Total	Under Review	Submitted	Funded
Week ₁							
Week ₂							
Week _n							
Total							

TIME TRACKER (#HRS/WEEK)

	Writing Grants	Writing Research Paper	Project Related Activities	Total Time Planned
Week ₁				
Week ₂				
Week _n				
Total				

Figure 3. Illustrates the Global Performance Scorecard (GPS) developed within the Agile Mentorship Process to track the wildly important goal, leading, and lagging measures.

Wildly Important Goal (WIG): The first component of the Global Performance Scorecard (GPS) is the WIG and the lagging and leading measures that track progress towards achieving the outlined WIG. The example that is shown is from a postdoctoral fellow focused on preventing and managing delirium. The leading measures are process measures. The lagging measures are outcome measures. These are informed by the book titled *“The 4 Disciplines of Execution. Achieving your Wildly Important Goals.”* by Chris McChesney and Sean Covey (31).

For the Pub/Grant Tracker: Pictured above are examples of the GPS tracker for the leading measures of publications and grants. Other important components of these tracking sheets might be # of publications/grants in preparation or ideation, # of publications/grants under mentee’s control, etc.

For the Time Tracker: The “time invested” tracker is to support the mentee in understanding where there might be inefficiencies in time (email, social media, etc.) and how much time is invested towards leading measures (time writing publications, time writing grants).

personal growth. The mentee used the established communication channel to receive honest and nonjudgmental feedback on thoughts, perspectives, observations, and actions each week. These learnings were iterative and summative as limited time passed between meeting points, and growth could be reviewed and expanded. Awareness, the practice of continual reflection, and the mentee's toolkit, each a subtheme of personal growth, emerged as the mentee obtained deeper insights into self-awareness, communication, and human and system behaviors. The practice of weekly reflection after the mentorship meetings seemed to help further the mentee's ability to evaluate situations from multiple angles (zoom in and out). This introspection may have helped further the practice of mindfulness as the description of the practice became more refined in the later phases of the mentee's growth. The weekly mentorship meetings were a form of rapid iteration cycles which assisted the mentee in continually reviewing, discussing, and reflecting on goals and learning, promoting growth. These phases culminated in the achievement of the predefined outcomes: to develop a brand, define a wildly important goal, and achieve outlined skills. Further formal evaluation is needed to understand the impact of the agile mentorship process on career satisfaction, research proliferation, and reciprocal mentoring of future mentees.

FIRM FOUNDATION FOR MENTORSHIP USING AGILE SCIENCE

The outlined agile mentorship process promoted discussion and reflection, which ultimately led to growth in the mentee and encouraged emergent behavior

leading to further discovery and reinforcement. The principles of the social cognitive theory were incorporated to support the needed behaviors of the mentor and mentee (30). Cognitive biases were proactively addressed using several nudges: 1) the mentorship pledge served as a commitment to the relationship and established roles and behaviors that the mentor and mentee would practice; 2) weekly meetings provided structured, routine access to the mentor; 3) the weekly meeting format (crises, noise, positives, and discussion) established a normal, default behavior in which novel and relevant information was exchanged; and 4) predetermined outcomes shaped how goals were defined and achieved. The mentee was incentivized to achieve these outcomes as their attainment would lead to funding and academic achievement. Each week provided feedback to the mentee on the progress toward each outcome. Lastly, the quarterly mentorship team meetings, including both the primary mentor and an additional mentorship panel (Table 1), provided an opportunity to share progress, address existing barriers from multiple perspectives, and continue forward momentum.

This longitudinal ontological qualitative analysis is limited in generalizability by its sample size as it describes the experience of one mentee in the agile mentorship process. Furthermore, although the mentee (H.L.) did not participate in the analysis, the interpretation and reporting of the results could be biased toward support of the model (confirmation bias), and formal analysis is needed to confirm the impact of the mentorship process.

CONCLUSIONS

The reflections of one mentee within the agile mentorship process illustrated the growth process that occurred within an effective mentorship relationship. Agile science informs the agile mentorship process, a scalable and sustainable framework that is adaptable to various career development processes. Further evaluation is needed to understand the longitudinal impact of the model on mentee performance and satisfaction.

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