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***Fundamental Principles of Metacognition:  
A Qualitative Study of Metacognition, Pedagogy and Transformation***

A DISSERTATION

submitted by

Philip Ralph Hulbig

**In partial fulfillment of the requirements  
For the degree of Doctor of Philosophy**

LESLEY UNIVERSITY SCHOOL OF EDUCATION

February 22, 2021

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Fundamentals of Metacognition:  
A Qualitative Study of Metacognition, Pedagogy and Transformation

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Graduate School of Education  
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PhD. Educational Studies  
Individually Designed Specialization

**Approvals**

*In the judgment of the following signatories, this Dissertation meets the academic standards that have been established for the Doctor of Philosophy degree.*

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## ABSTRACT

This study investigated the transformative quality of a metacognitive education. It examined a transformative metacognitive education from both the subjective personal perspective of the student who has gone through the process of transformation and the more objective pedagogical perspective of the professors who work to bring forth such transformational experiences in their students. Through interview and analysis these perspectives were integrated to produce a pedagogical theoretical framework derived from experience and grounded in observations about metacognition across various scientific disciplines. The personal elements of metacognition that promote educational transformation from within the students were contrasted with the pedagogical approaches of the educators from the program that stimulated the transformation. The study compared and contrasted the theoretical and pedagogical insights gained from interviews of eight senior professors from Curry College's Program for the Advancement of Learning (PAL), with this writer's lived transformative experience years before as a student at that program. The study identified core pedagogical elements for teaching transformative metacognition and self-regulation. The findings ground metacognitive educational approaches to foundational neuropsychological elements of learning and perception. These findings suggest metacognitive education could be applied widely across educational environments, ages, and skill levels to support human development, productivity, and regulatory behaviors. It was found that one of the chief attributes of a metacognitive education was that it empowered self-authorship, particularly in those students traditionally disempowered by disability, disadvantage or prejudice. Future inquiry into educational approaches that improve and promote transformative self-directed learning are needed to broaden the scope of these findings beyond this study's small and highly targeted sample. Findings suggest that a metacognitively focused educational pedagogy produces a student teacher relationship capable of promoting the self-regulatory behaviors needed to develop self-authorship and personal transformation.

*Keywords:* Metacognition, transformative learning, self-directed learning, self-authorship, Program for the Advancement of Learning, Learning Conversation, General Theory of Metacognitive Instruction

*This doctoral study is dedicated to my father, Ned Bradford, Gertrude Webb and my wife Laurene. Ned for teaching me metacognition, Gertrude for teaching Ned, Laurene for reminding me of the importance of it when I forgot, and my father who made this all possible.*

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*In loving memory of my father who did not live to see me finish.*

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## CHAPTER 1

### INTRODUCTION

#### Statement of the problem

Metacognition, succinctly defined, is the ability to think about one's thinking (Flavell, 1979). It plays a fundamental neuropsychological role in the processes of learning (Flavell, 1979; Nelson, 1996; Shimamura; 2000; Schraw et al., 2006; Quigley et al., 2019), and is deeply embedded into many effective education practices (Schmitt & Newby; 1986; Dunlosky & Metcalfe, 2009). An individual's practice of metacognition can lead to an educational transformation (Mezirow, 1975, 1991) as the personal habits of self-directed learning and self-authorship (Kegan, 1982, 1996) are developed over the course of their lives. The transformational qualities of a metacognitive education have been less studied than the impact of metacognitive strategies on specific areas of study (Desoete & De Craene, 2019; Schraw et al., 2006), educational routines (Dunlosky & Metcalfe, 2009; Vandenbroucke et al., 2018) or even metacognition's neurological components (Fernandez-Duque et al., 2000; Fleming et al., 2014; Wong et al., 2018). However, the self-transformative aspects of metacognition hold the hope that widely implemented educational approaches can be developed that positively address different ways of knowing, different ways of learning and differing levels of personal productivity. This study addressed two questions toward this end: **What are the fundamental components of metacognition related to learning and teaching, and how do the educational techniques of metacognition lead to transformative learning experiences?**

The goal of this introduction is to prepare the reader for a study that has utilized a unique research model to capture data about an equally unique and important phenomena in human learning, the transformative learning experience. For this study I collected data from both a

student and teacher perspective. Part of what makes the method of the study unique is that I am the student subject whose transformative learning experience is also being presented. I am also the researcher interviewing professors from the program that was responsible for my educational transformation.

While metacognition is the subject of this study it is important that the reader knows that the subject of metacognition is being approached through the lens of transformation. This transformative learning experience is written from a student's first-person reflective perspective, and is presented later in this chapter as the researcher's personal reflection. The Personal Reflection section of Chapter One presents my connection to the research, and lived experience as a student, who went through Curry College's Program for the Advancement of Learning (PAL). The narrative is intended to provide background information and data about the student-teacher interactions that occur in the PAL program, and a sample of the personal data points utilized in this study's methodology.

### ***Forms of Discourse and Data***

Data in this dissertation will be presented in both first person narrative and third person formats. The juxtaposition of perspective in this dissertation is a purposeful way of representing both data and process. It is an attempt to represent, and stimulate, the methods of metacognitive thinking that integrates these differing modes of thinking. How the brain is capable of integrating various perspectives, models and modes of thinking is not yet well understood. This question is described as the binding problem (Isbister et al., 2018) of neuropsychology. Metacognition's role in conscious integrative thinking suggests it is a process that plays a role in 'binding' the neurocognitively distinct ways of knowing that exist within and between individuals.

Metacognitive analysis integrates perspectives. The three core perspectives integrated are represented through the writing. The intrapersonal subjective perspective is represented narratively and written in first person. The second, more interpersonal mode of thinking is presented through the interviews of the eight professors of the PAL program. This is a conversational style that requires a shifting between subjective and objective analysis as the result of interactions with another person. It is captured in the conversational quotes from the interviews in Chapter Four. Conversational modes of learning were found significantly related to metacognitive learning and are discussed in Chapter Five. The third perspective is represented through a review of the literature on metacognition in Chapter Two and the deep analysis of the data in the final chapter. This understanding is written in the third person mode of academic writing. Aspects of perspective shifting, from first person to third person, have been maintained in this dissertation to allow a qualitative experience of the cognitive integration that takes place between these subjective and more objective modes of thinking as the reader processes the findings presented<sup>1</sup>. It is also intended to induce a level of metacognitive awareness that is demonstrative of the study's conclusions about the phenomena.

Changes in the narrative format of this dissertation are intended to signal to the reader important shifts in perceptual stance. This requires readers to be more active in their reading, connecting objective understanding with subjective understanding; such connections are not always possible to represent overtly in the text without distracting from the core narrative or

---

<sup>1</sup>Subjective perspective is a first person, largely qualitative perspective that holds primary the experiences, feelings and perceptions of the mind of the individual. Objective perspective is a third person, largely quantitative perspective that holds primary the abstract, intelligible, and cognitive processes of the mind that perceive relationships which transcend experience revealing conceptual patterns. There are many representations of this perceptual shifting from first person to third person in communication, language and writing, but it is also can be found represented in artwork, or even video games where you can play either behind the eyes of the character in first person, or from the third person view, looking down on the character as an object in the field of game play.

objective construction. From a writer's perspective, this is a curious feature of the subtle limitations of both first- and third-person descriptive approaches. The subjective, first person perspective is able to capture subtle details, particularly motivational and emotional details that are not easily represented objectively. Inversely, the objective third person perspective is able to link ideas and express connections more clearly and concisely, but only by removing many of the specific, yet possibly obscuring details of the subjective mode.

### ***Elucidating Connections with Metacognition***

Subjective perspective can also obscure broader objective connections precisely because of its ability to convey emotional and motivational data. For example, I find it difficult to talk about my early schooling from a first-person perspective without presenting the school's position negatively. This is because, from my subjective standing point, particularly at that time, my experiences were overwhelmingly negative. However, I caution the reader to refrain from simplifying the complexity of the narrative. Details in the narrative connect powerfully to later insights in the dissertation and to educational issues in a broader context. Many connections remain embedded in the text and were not further elucidated in order to remain focused on the dissertation's more central themes of metacognition, development and pedagogy.

The reasons behind the school's actions are an example of connections that were not fully elucidated in the personal narrative. From the school's perspective it was simply responding to the relevant facts of the situation. School personnel were using their subjective experience, training, and knowledge about learning and human potential to both determine and justify their actions. As the writer, I have taken great care to present what I remember about growing up as a "special education" student in the public school. This is the perspective produced by a lived response to the school's decisions. So, while the school's reasons for acting must be inferred, the

forces that compelled their actions are important in that they develop a deeper understanding of the data presented.

### ***Theory of Mind***

First person descriptions invite the reader into a more personal understanding of an individual's theory of mind than objective approaches. A theory of mind is an internal, cognitive heuristic used by individuals to explain their behavior, and predict the behaviors of others (Gallagher & Frith, 2003). In the narrative investigation of my metacognitive development, the high school made certain predictions and treated me in certain ways, not because they had nefarious intentions, but because they had seen students like me before. They had seen what happened to students who present with my educational profile. Professionally, they understood a specific learning disability to be a permanent, neurobiological fixture of my being. From a practical perspective, they believed that if you could not read, write or do math your options in life would be limited. Moreover, their ability to address the academic challenges of individual students were also limited. Their decisions were often proclaimed out of practicality and an intent to be realistic about the situation.

### ***Social Replication***

A theory of mind is replicated across a culture like a meme (Spitzberg, 2014) producing the social mechanisms of its own justification. Part of the reason I struggled to learn to read and write during my formative years of schooling, was I also believed in the fixed and permanent nature of my Specific Learning Disability (SLD). Learning was harder for me, writing seemed impossible. Subjectively, I had bought into the common limiting perspective that there were only so many hours in a day. Why would I want to spend my limited time in a classroom where I was constantly reminded of my academic weakness, my lower educational prospects, and the general



hopelessness of my situation. Why try (Corrigan et al., 2009)? It seemed more sensible to put my limited time into use doing other things besides school.

The goofing around in class and skipping school that I engaged in as a response to my situation, however, would be the very things the school would later point back to as predicted and justification for their actions. Actions that when viewed from the first-person perspective can be seen as promoting the behavior. This is how a culture of a society, or institution, can play a role in this process inadvertently producing the very social conditions that reinforce a student's limitation. A problem that can occur even as the institution produces mission statements and strategies to address student problems.

### ***Repairing the Damage***

In their interviews, the professors of PAL described their often-herculean struggles to undo the ingrained beliefs of inadequacy and limitation held by their students. Such beliefs of limitation are all too easily adopted by those anxious students, who are most likely to experience failure. Students for whom failure has become a regular and recurring feature of their education, like myself, often find themselves living out roles that are predicted by school personnel or parents, and yet desired by no one, least of all the student. When this kind of experience is described in first person detail, an emotional landscape comes into view that can more properly inform other more objective vantage points.

The eight professors interviewed for this study utilized a different theory of mind, and as a result, approached the education of their students differently. The limitations identified as learning disabilities in the earlier paradigm, by these professors' theory of mind, were confronted as “problems to solve” (Subject B). Over the 50 years that the PAL program has been in place at Curry College, its professors have enabled neurologically diverse students to both demonstrate

the capacity for success at this advanced level of education and imbued the capacity to become self-directed self-authors of their own lives.

As a student, I was somewhat surprised when I first learned about metacognition and the processes of thinking about thinking. The reflective practices of metacognition seemed obvious and ubiquitous. Despite the intimidating sound of the word metacognition, the idea of thinking about one's thinking hardly seems like anything special. However, I believe it will become clear, by the end of this study, that metacognition only appears easy and obvious because it is a fundamental feature of our learning and consciousness.

Through this research, I invite the reader to contemplate the connections revealed through the insights of these professors of metacognition. For me, this is a culmination of a lifetime's work. More specifically, this is a qualitative study of a teaching approach utilized by the PAL program that will come to be identified as the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) and a general theory of metacognitive instruction that has educational transformation as its goal for all students.

## Research Questions

This study has focused on two questions:

1. **What are the fundamental components of metacognition related to learning and teaching?**
2. **How do the educational techniques of metacognition lead to transformative learning experiences?**

This study was conducted utilizing a mix of methods involving case study interviews and reflective narratives. A grounded model of analytical discovery was employed through the coding and categorization of the collected data, and a standardized model of coding was employed across both case and narrative investigation. The initial goal of research was to allow the data to drive the analysis and insights revealed. The research methods used complemented each other well in this regard, providing grounding insights into metacognition and its educational practice.

Initially, the data drawn from interviews settled around questions of pedagogical practices. Categorically identifiable differences in the way PAL professors' approach metacognitive learning were identified. A second round of questioning inquired how professors integrated scientific information into their practice. Then a grounded analysis of what these professors felt were the primary features of metacognition were integrated with the narrative analysis producing a methodology capable of deeply investigating how learning transformations were triggered through metacognition and how one could teach to produce such transformation.

Questions related to PAL pedagogy had been identified by an earlier pilot study (Hulbig, 2018). These insights were refined through this study and grounded by a more conceptual investigation into the role and manifestations of metacognition in practice. Along with uncovering details as to how these professors practiced their craft, the study investigated how these professors personally conceptualized the concept of metacognition and how they felt it was best developed. By comparing and contrasting these professors' insights with my own, an understanding about the core learning and developmental elements of metacognition were revealed. From these elements, a general theory about metacognition's relationship to learning and cognition was uncovered.

### **Dr. Webb and the Program for the Advancement of Learning**

One of the first individuals to champion the educational use of metacognition to help students with learning disabilities better regulate their learning was Dr. Gertrude Webb (1989). Dr. Webb established the PAL Program at Curry College in 1970. Curry is a small four-year liberal arts college in Milton, Massachusetts, with an historic emphasis on developmental education (Abrams, 2016). The college's mission emphasizes, "an inclusive community of diverse learners and educators, committed to continuing our legacy of developing effective communicators with reflective and critical thinking skills" (Curry College Mission Statement, 2020) Today, Curry has a population of 2,800 students, 475 of whom receive services for learning disabilities. PAL was the nation's first college-level program for students with language-based learning difficulties, and it is currently considered one of the top schools for students with learning disabilities (Sorensen, 2018).

PAL was first established by Dr. Webb to serve students who had the intelligence and drive to succeed in college, but whose history of learning differences posed a major obstacle to

their success. Dr. Webb, herself, was no stranger to the obstacles that can obscure one's path to success. Born in 1916 to Lithuanian immigrants who originally named her Goldie, she began using the name Gertrude after an experience with a teacher who directed her to change it because they considered Goldie too ethnic a name for Roxbury, Massachusetts at that time (McKenna, 2012). She went on to graduate from Teachers' College of Boston in 1937 and achieved a level of education that was uncommon for women at that time. With her husband's support, she became an important leader in the development of Massachusetts Chapter 766 laws that guaranteed educational programs for students with special needs (McKenna, 2012).

According to her daughter, Heidi, Gertrude's lifelong passion for supporting those with learning differences came from her experience raising her own children and seeing the struggles of students with learning disabilities in her classroom (personal conversation, 2016). When Dr. Webb was director of the PAL program, she would leave out a communal jigsaw puzzle on a table for students to freely work on. Students who lingered to work on the puzzle would be treated to her story of a young boy she once taught who struggled with reading and writing at the school, but excelled at such puzzles. Dr. Webb would describe how this experience profoundly affected her thinking about learning because while she excelled at reading and writing, these were the weaknesses that defined this student's disability, and yet her analogous weakness with jigsaw puzzles was far from being considered a disability. This made her think about individual strengths and weaknesses differently, and question exactly what is meant when a person is described as learning disabled (Webb, personal conversation, 1992).

Dr. Webb's son Marc described her approach to teaching and learning as to first identify what the student can do well and focus on that. While not ignoring weaknesses, she would not make them the focus, but allow those things to come along as the student built up the

self-confidence needed to best address them properly (McKenna, 2012). Dr. Webb elaborated on this idea in an interview with the Boston Globe in 1992 where she said, “If we can look at all children as potentially successful learners, then we will strengthen their self-image, and they will bring increased energy to the more difficult tasks we would expect of them” (McKenna, 2012). These ideas illuminate a common theme relative to metacognition and the important role of the teacher in developing a student’s self-efficacy by developing an understanding of their strengths, weaknesses and self-confidence.

Webb’s approach was to teach self-regulatory behaviors by having students develop a close learning relationship with a PAL professor who would work with the students individually, or in small groups. Students would initially meet twice a week for one hour and thirty minutes with their PAL professors to help them develop the organizational, regulatory, planning and social skills needed to meet success in their college course work. Webb felt that group work was a particularly important feature because it allowed students to form learning relationships not only with their professor, but also with their peers. Today, the PAL program has expanded on this idea, developing many leadership opportunities for students to mentor and support peers.

Metacognitive knowledge was bolstered through the use of a workbook entitled *Tuning in to Learning* (Webb, 1989), which introduced students to information about their personal traits and their relationship to the neuro-cognitive functions of the brain. It contained relevant information on learning and sections designed to aid students in their understanding of their learning disability. This workbook was based on an earlier workbook called *Secrets to Successful Learning* (Webb, 1986). Webb strongly believed that understanding the emerging research on the brain was important for learners to come to understand their brain’s various functions and bring them under their unitary control (Webb, 1983). She believed that learning disabilities were

the result of regions of the brain not working in an integrated fashion, and that teachers could, “help our students develop competence through an understanding of the need for the brains to work together” (Webb, 1983, pg. 515).

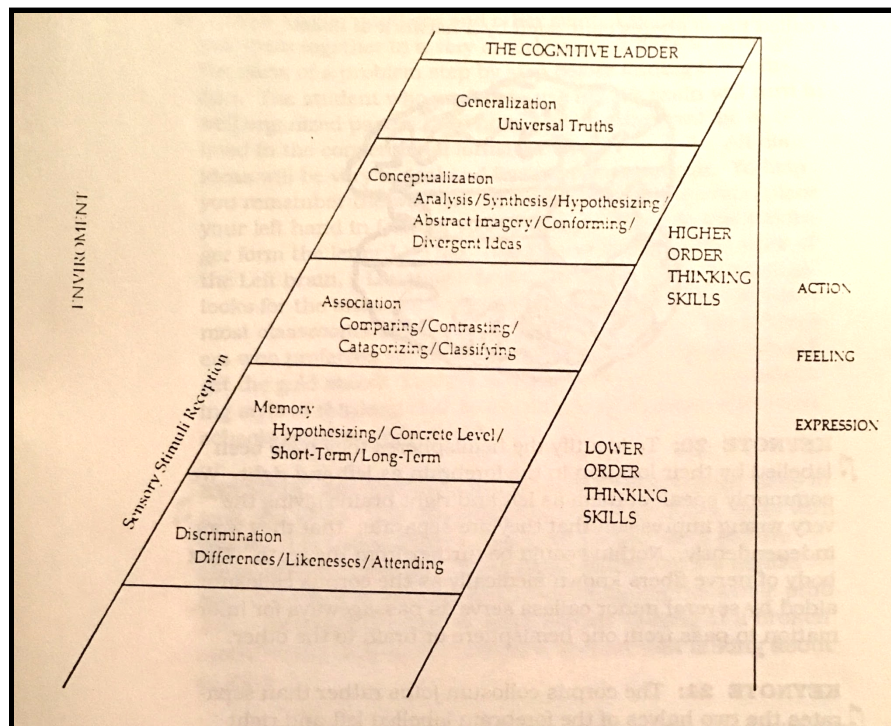
Dr. Webb felt that by providing a supportive system of self-development, students with learning disabilities could discover their personal and intellectual strengths. For Webb, teachers needed to connect with their students so that discussions about learning and how the brain worked would seem to be natural, and not forced. The use of the Wechsler Adult Intelligence Scale (WAIS) was integral to this process. At PAL, the WAIS was not simply used as a diagnostic tool, but also a mechanism to direct conversations about learning and the brain back to the student. (Webb, 1983). In this role, the WAIS became a bridge between highly abstract notions about the brain and learning, and the everyday lived experiences of students. For example, the subtests of the WAIS could be used to both identify a student's specific skills related to hemispheric function and identify how a student could utilize Wthese strengths to overcome their weaknesses.

In *Tuning in to Learning* Webb (1989) used many interactive elements and visual models to support understanding of the book's various concepts. Two of her unique constructions were the Cognitive Ladder and the Hierarchical Model of Active Learning. Both were visual models constructed to aid students in their conceptualizations and discussions of how the mind functions. The Cognitive Ladder, at first glance, appears to be a conceptualization much like Bloom's (1956) Taxonomy in form. Both arrange certain abilities of the mind in a hierarchical format, with the difference that Webb put memory in place of knowledge near the bottom of the hierarchy, and universal truth in place of evaluation at the top. However, Webb's intention was not to use her cognitive ladder to organize educational goals and objectives. The Cognitive

Ladder was intended to represent a cognitive hierarchy of forms of thinking, more in line with Vygotsky's (1934) "tools of thought" (p.176.) The cognitive ladder, like the WAIS, was used to bring abstract components of the mind into an individual's conscious attention, to be examined, developing a student's deeper understanding of their mind.

**Figure 1.1**

*The Cognitive Ladder*



*Note: Webb's Cognitive Ladder (1989)*

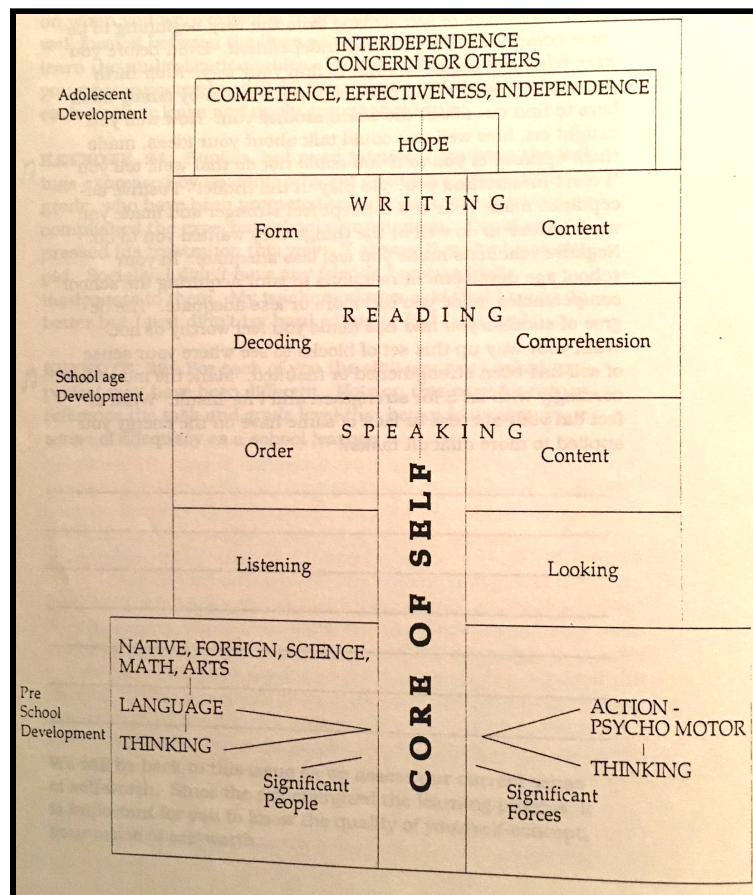
The Hierarchical Model of Active Learning (Webb, 1989) was developed out of another theme that was equally central to Webb's philosophy on metacognitive education. This was the development of the student's sense of self, which for SLD students was frequently damaged by their difficulties learning in school (Webb; 1972). Webb's Hierarchical Model of Active Learning was a visual representation of the developmental dynamics underlying motivation,



competence, independence and efficacy. For Webb, hope was an important ingredient for success, providing the motivation to work through the many adversities of life.

**Figure 1.2**

*Hierarchical Model of Active Learning*



*Note:* The Hierarchical Model of Active Learning (Webb, 1989)

Without hope, the trauma of failure in school was amplified, even crippling (Webb, 1972). To maintain hope throughout the developmental process was important, since hope was the force drawing the learner forward. Success was a critical element in this process, because hope was derived from personal success. Students who achieve enough personal success would develop the hope they need to engage in something new, extending themselves into new areas of learning (Webb, 1989). However, too much failure could cause a student to feel hopeless and

retreat from new learning and challenges. With hope, an individual could endure and persevere to find success; without hope a student would shrink away from challenges, seeing little chance of success, and become hopeless. In many ways, Webb's Hierarchical Model of Active Learning was an early conceptualization of how the growth oriented mindset delineated by Carol Dweck (Dweck, 1999, 2017; Dweck & Leggett, 1988) is developed in the individual learner.

Webb's most important insight into metacognitive learning is embodied in the basic structure of the PAL program, using the student-teacher relationship to support metacognitive regulation. Upon entering the program, students are paired with a PAL professor who meets with the student individually or in small groups to discuss their learning, planning, and organization. This metacognitive relationship between student and teacher facilitates personal conversations that evolve over time with the learner's development of self-efficacy and regulation. The goal of these conversations is for the student to develop and apply insights to personal responsibilities and goals. The teacher's responsibility in this process is to guide their student through the personal, interpersonal, and social demands of their lives at school, helping the students to develop strategies to meet these demands. Through an interactive process, the student's powers of reflection, self-assessment, personal improvement and self-regulation are established providing a regulatory foundation for the development of new skills.

This interactive process of metacognitive learning was first labeled, by PAL professor Dian Goss (Adelizzi & Goss, 1995), as the Learning Conversation (Pennini, 2006). According to Sue Pennini (2006) the term was first described in the literature by Harris-Augenstein, & Thomas (1991) as "a form of dialogue about a learning experience in which the learner reflects on some event or activity in the past. Ultimately, it is intended that people will internalize such conversations so that they are able to review the learning experience systematically for

themselves, but at the beginning, the learning conversation is carried out with the assistance of a teacher or tutor" (p. 180, cited in Pennini, 2006). Goss separated her conception, however, by identifying listening as a primary feature of this process (Pennini, 2006). She described these conversations as "about her students *from* them rather than from a report *about* them" (Pennini, 2006, p. 181). This study determined that PAL professors have continued to develop and refine the Learning Conversation into a highly skilled and specialized approach to learning. Due to the level of complexity and degree of individualization needed to engage in kind of learning, the program requires senior lecturers to possess a doctorate and extensive educational experience working with neurologically diverse populations.

Curry College has a long and rich history of supporting those with learning disabilities. Starting with Alexander Graham Bell, the American inventor who himself struggled with a SLD, once taught and served as chancellor of Curry's School of Oratory in the early 1900s (Abrahams, 2016). Regardless of whether it was always understood, Curry has played a unique role supporting SLD individuals at this level. Since Gertrude Webb's establishment of PAL in the 1970s, Curry and the program have grown both in size and prestige (Sorensen, 2018).

### **Personal Reflection and Narrative**

My interest in metacognition, the PAL program, and Dr. Webb are not accidental. I have had a transformative experience as a result of PAL's instructional approach. Here I present that story, which is an excerpt from the larger piece written about my formative intrapersonal perspectives on metacognition. My intent, as briefly described in the introduction of this chapter, was to capture the first-person phenomenological aspects of metacognitive development, from student to adult, and integrate them with the insights gained from interviewing the professors teaching in the program that made such an impact.

For this reason, I must clearly situate myself inside of this research. This narrative reflection of my formative experiences and personal metacognitive insights was coded and analyzed alongside the case study data collected from the eight PAL professors whose insights form the core of the data reviewed in subsequent chapters. Part of that narrative is being presented here as my personal reflection and situation within the research. I believe my experience brings a level of authenticity and uniqueness of perspective to this study, which can be utilized to bring a deeper understanding of the study's objective elements and insights.

My educational path to this point has not been typical or certain. As an elementary school student placed on an Individualized Education Program (IEP)<sup>2</sup> from the moment I arrived at school during kindergarten screening, I was unaware that there was anything really wrong with me. When I was being pulled out of class for all kinds of related services like speech and language, occupational therapy, and phonics, I just figured that everybody was being pulled out of class too. I had no idea that while I was separately doing Orton-Gillingham<sup>3</sup> the rest of the class was doing history or science.

I should have been tipped off by things like the reading race in fourth grade; my teacher had this big chart with everyone's name on it, which snaked around the whole classroom. For every page you read, you would get a sticker, so by the end of the year your sticker lines would

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<sup>2</sup> An Individualized Education Program (IEP) is a legal document that identifies a student's disability and outlines the approaches and supports used to address the student's specific learning needs. Only about 23% of students are identified as SLD as early as I was (<https://www.nclld.org/wp-content/uploads/2014/11/2014-State-of-LD.pdf>)

<sup>3</sup>Orton-Gillingham is a direct, explicit, multisensory, structured, sequential, diagnostic, and prescriptive way to address reading, writing, and spelling to students with SLD in the domain of language function. Methods of direct phonics instruction, such as Orton-Gillingham, have been shown to be among the most important interventions for students with reading and writing impairments.

run all the way around the room, wall to wall to wall, until they ended up back at the start/finish line. I remember I was one of two students that did not get enough stars to get off the starting wall. In fact, that really wasn't a fair comparison either, since the other student was a girl who had a heart condition and was constantly taken out of class for medical reasons. I can't remember ever missing a day that year. But I forget things, and like other aspects of my learning disability, sometimes I am not aware that I have forgotten.

It was not until junior high school that I really noticed that there were some big differences between the other students and me. It all happened in a rather traumatic fashion. I had been assigned the meanest teacher in the whole sixth grade, Mr. B. This was not unusual, I would always get the strict teacher if there was one teaching in that grade, and Mr. B was legendary. It was he who said one of the single, most scary things I had ever heard from a teacher up to that point. He said it in kind of a rage, but I can't for the life of me remember what I did to provoke him. He said, "You think you're funny, don't you Mr. Hulbig! Big funny man MR. HULBIG!" He called everyone Mr. or Miss., particularly when angry. "Well it won't be so funny in Jr. High, because that's when you'll find there is not as much time to play around because there is no recess!"

No recess! I remember being stunned by this. Recess was pretty much what I built my day around in elementary school. Recess was the only class I was kind of good at. So I panicked all summer. I double checked with anybody who might know the truth that there was no recess in Jr. High. Ironically, school finally arrived, and my new schedule listed a double block of "recess study." Like a wish fulfilled. I was vindicated! Mr. B had been wrong. I started tapping on the kid next to me.

“Hey, got recess?”

“No,”

“Well I do!”

Yes, I was that obnoxious, worse. It is not something anyone wants to admit to, but to be an adult survivor of special education, it is part of your history, and make up that you must contend. I believe you must come to terms with it. In this situation, however, I received my comeuppance as somebody finally read my own schedule to me, “That doesn’t say recess, you idiot,” they scoffed, “it says resource, you’re in the retard room<sup>4</sup>.”

I think that was also the first time I heard the term “retard room” used in context, but it still did not mean anything to me until I arrived. Sure enough, when I showed up to the tiny partitioned cluster of rooms for study, there were really retarded kids there, and I was there with them. That was when it hit me. Something **was** really wrong with me.

However, before I go any further with this story, I would like to say, as a teacher, I now have tremendous appreciation for Mr. B and his skill and artistry as a teacher. He had a great ‘schtick’. Schtick is one thing not generally taught in schools of education, but every good teacher learns to develop a schtick that improves their interaction and power of teaching. Mr. B’s schtick was perfectly devised for maximum impact on 6<sup>th</sup> grade students, particularly hyperactive boys like myself. His role was that of an unflappable and disciplined teacher with a tinge of military drill sergeant. He would show up for class in a military issued green button down shirt, buttoned to the top, a pair of Dickies often tucked into a pair of jet black ankle high combat boots. When things would get chaotic, he would start barking orders like the class was his

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<sup>4</sup> I believe it is important to point out here that I learned, decades later, that I was among the charter members of this program. At this time, this pull out model of special education had been in place for about a year at the school. So not only was I new to this program, but so was everyone else.

platoon coming unglued under surprise enemy attack. Discipline was key. Every student had an essential job in his class. Mr. B stressed their responsibility to not only do their job, but do it well. Everything was also highly regimented, and even though my capacity to perform his regimented routine was not the best, I learned a lot, and never felt bad or ostracized because Mr. B had this great way of getting students to come back and try again until you didn't fail at it, or at least you didn't seem to fail so badly.

My junior high special education class, on the other hand, was a daily exercise in fear and humiliation that I was unprepared for. This was back in 1982, just before most schools began to group special education students with their intellectual development in mind. At this time, public school resource rooms housed everyone on an IEP regardless of their disabilities. Since I did not know about clinical diagnoses like ADHD, Autism, Dyslexia, Down Syndrome, Muscular Dystrophy, or Bipolar Disorder, and I had not yet been exposed to the idea of metacognition, my 12-year-old mind needed some way to categorize what I was experiencing. All these different students in this class; what was my placement? At that time, I only had two categories, 'stupid' or 'crazy'. I knew I wasn't crazy, so I figured I was there because I was stupid. By this time, my difficulty with written language went way beyond most other students. I was about the worst speller in my resource class, a fact other students always pointed out for self-esteem reasons of their own.

In my general education classes, I simply could not do what the other students did. The teacher would ask for an essay and I could barely write a paragraph, and my best paragraphs still looked like hell. It didn't stop there. I could not erase without tearing the paper apart, leaving big splotches all over the paper. It seemed I could do nothing neatly. If I made a model airplane, I

would drown it in glue, and I applied paint so thick it always ran, making it look like a mangled mess. Everything I touched, I ruined.

These episodes were not great for my self-esteem. In Junior High, my classes started to be divided by level. Soon my good, goal driven, mainstream friends from elementary school were tracked away from me and into the higher level classes. This left me in lower level classes that were overloaded with students who simply did not care.

This reality was never specifically addressed, for self-esteem reasons, because at the time the prevailing belief was that if a student with a learning disability were to realize what was really wrong with them, the hit to their self-esteem would be one in which they would never recover. However, by this time, my segregation from those students who I believed were more worthy than me was clear. There were very few students in my classes who were interested in learning, and most were engaged in a radical defense of their self-esteem. In response, I developed coping strategies to help me get around the social awkwardness of being a dumb kid.

I probably did the least amount of reading and writing I had ever done during Jr. High. The intervention strategy used by my special education teachers made it easy to get away with. The less it looked like I could do, the less they would hold me to, and if I held out long enough, even those expectations would evaporate. Over time, this became a self destructive feedback loop. It also justified my earlier assumption that I was “stupid” not “crazy”. However, it is funny in a way, because as I look back on it now, I put so much effort into being “stupid” it **was** “crazy”!

When I first made the discovery that I could reduce the expectations on me by “playing dumb”, it was actually very self-affirming. Today, as a special education teacher, people always



comment on my tremendous patience; the irony is that my tremendous patience was forged over years of waiting out special education teachers until they got to a point where they would give up on me. Self-esteem is a funny thing; you can turn anything into a source of self-esteem regardless of how destructive it is. At first, I convinced myself that I was smarter than those “stupid” teachers who actually believed I was “dumb”, but over time, even without a metacognitive sense, it was clear that I was the “dumb” one. I mean, I must have been. People seemed to give up on me so easily. No one seemed to have any faith in me.

I withdrew. I found if I did nothing, no-one could really make me do anything. I didn't care, and I found that if I didn't care for a long enough period of time, whatever 'it' was went away: homework, science projects, and spelling. I tried to hide my many detention slips as long as I could until I would get caught. But, by then, it wouldn't matter. By then, I wouldn't care.

You get desensitized to reading programs. I became desensitized by the cards, all those years of being pulled out of social studies or science, the classes I liked, to do these cards and sounds I hated. I suppose I must thank all those people who kept feeding me phonics, because it was what I needed. I learned to spell phonetically correctly, though not actually correctly. But, it did remove any positive emotion I may have had for the reading process. However, I guess that was better than being left to spell non-phonetically.

Writing was, and continues to be, an exercise in humiliation for me. Getting the writing out of my head and onto a piece of paper was always tough enough, but then I would look back at what had just come out of my brain, it was disheartening. It was poorly written chicken scratch, spelled incorrectly, and not even really saying what I intended it to say. This is the hardest part of being dyslexic. Nothing feels worse than struggling to get an idea out to share,

and have it stare back at you in alien form. Which is real? The idea you had in your head, or this ugly, unintelligible version you created with your own hand.

If you are mentally healthy, you learn to develop a certain type of love and compassion for your creations. Good writers will go back and keep trying to fix the birth defects in their original work until they achieve a perfected state. But if you are not mentally healthy, once you are done giving birth to your creations, you become disgusted by how deformed they are. You give up on them. You let them struggle, wither, and die on their own. Like they were never a part of you. Like you don't care.

Over time you accumulate and internalize memories of failure that cannot be expressed; they become ingrained in repetitive behaviors that only promote helplessness. For example, when I was very young, I would write my whole name completely reversed time and time again. I can remember standing in front of the mirror with my mother looking at the name written on the piece of paper, a trick my mother had learned from reading *Good Housekeeping* magazine. "Do you see it," she would ask, "now it's the right way, do you see it?" And I can clearly remember looking at what I had written, looking back in the mirror, then back to the paper, then the mirror again, and having no clue what she was talking about. I did not see 'it', but I didn't want her to be disappointed in me. So I said, "I see it." I just was not sure what I was supposed to be 'seeing', and she did not seem satisfied until I admitted that I saw it. This is the first instance I can remember feeling helplessly unable to learn something.

Junior high began a downward spiral that reached a critical mass my sophomore year of high school. By this stage, I had received failing grades in pretty much everything. I had done so little it was hard to justify pushing me on in the way they had done in the past. I was already

placed in the lowest level classes offered at my regional high school, so in the interest of preserving my self-esteem, rather than holding me back, they proposed a plan for me to drop out of academic classes completely and go into a vocational program. My father was a carpenter. It probably sounded good on paper to them, but they did not know my father.

My father hit the roof when he heard this. “Why would I want that?” he balked, “I send him to school to learn things I can’t teach him. If he needs to learn how to do a trade, I can show him how to do that.” And he did. From that point on, during every school vacation period, I worked for my father. “I need you to teach him the things I can’t teach him, so he can go to college or whatever he wants to do,” my father continued.

At this point, the guidance counselor at the meeting inadvertently dropped what turned out to be a bombshell. He explained that since I was in the lowest level academic classes offered, there was realistically no way I would be able to make it into a college even if I was getting straight A’s. These were not college preparatory classes. I had been tracked out of that option years ago and my parents did not even know.

My father was shocked, then he said what I can honestly say was the scariest thing anyone said to me since Mr. B in sixth grade. “I want him pulled out of those damn classes and put into college prep classes! If he is going to fail I want him to at least fail classes that mean something.” It was clear that the guidance counselor had not planned for this contingency. I sat there in stunned silence as they argued. In the end, my father resolved to teach me a trade, and the school agreed to hold me back and move me up into college prep classes, with my usual special education support.

As a result of this meeting, some of the most important events that have affected my future occurred. The first, and probably the most important thing, was that for the first time I realized my parents actually thought more of me than I thought they did. Up to this point, I was the disappointment, the delinquent, the failure, the spastic freak they nicknamed Flip. For the first time in my life, during that meeting, I realized that these were labels that I had bought into about myself, but my parents did not. They had not given up on me like I thought they did, like I thought everyone had. College was a prospect I had never seriously contemplated, and why should I? I couldn't even pass the most basic high school classes, but they believed I could do it. I did not want to disappoint them. I had become accustomed to disappointing the people around me. It was easier that way. When people don't expect anything from you, you have a certain kind of freedom that is hard to express, because when you actually do attempt something, and fail, there is no let down, no disappointment. This was the main lesson I had taken away from school up to this point, and by this time it was more the source of my disability, more than my Dyslexia or ADHD or any other label you could put on me.

The other important thing that came out of this meeting was that my parents hired a tutor for me, two days a week. His name was Stan Edwards and he became the single most important person to my education. He was far from the typical educator. When I arrived at our first meeting, he was sitting at the end of a long table. He was leaning back with his cowboy boots up on the chair next to him and he was smoking a cigarette. I feel at this stage of the story I should reiterate the importance of 'schtick' to teaching.

Stan was the most unassuming of characters. He was honest, forthright, and clear. He was who he was, totally comfortable in his own skin. I wish I could remember what we talked about that night. I can picture clearly in my mind the small room located on the second floor of a

tiny real estate office. The built-in shelves loaded with books and knick-knacks, the ancient rug and the musty smell. I can tell you that after this first meeting, I was intrigued by his take of who I was. According to him, I wasn't "stupid" at all. I had a learning disability, whatever that meant. At the time, it didn't matter. For the first time, there was an alternative explanation for what was going on with me and a person who was willing to try and figure it out with me rather than tell me.

The first thing Stan did was give me the Wechsler Adult Intelligence Scale (WAIS). I had taken countless assessments before: academic; speech and language; psychological; and, even the WAIS itself. This assessment was different than any other, however; Stan spent the next few sessions, after administering it, explaining in detail what each of the tests meant, what it indicated about how my brain worked, and the implications that may have on the way I did things. For the first several sessions, I didn't do school work, but what we did do was more important to my educational life than anything that came before it. Now, as a teacher myself, I keep coming back to this moment and its significance. Often as educators we get wrapped up in our curriculum, our time lines, our scores, meetings, and endlessly grinding paper work. We forget that sometimes to better teach what a student needs to know from the curriculum, it may be important to put aside our standardized lesson plans and seize the moment to impart a broader lesson about how to achieve one's personal potential. These learning moments are far more personalized and can be far more important than the sum total of all the planned lessons combined. For me, this all important, off lesson plan lesson, was clearly identified by Stan as metacognition.

Stan revolutionized the way I looked at the world by teaching me to develop a metacognitive understanding of myself. Up until this point, I do not believe I really thought or

really learned. I reacted. Things existed in simple binary categories, like “stupid” or “smart.” However, thanks to Stan, I was learning about the range of thinking skills, and how some skills were held in high regard in some situations, but not in others.

What Stan did was far more profound than simply reviewing test results with his students. He explained neurology in terms that were understandable. He went over how each section of the test worked, what intellectual skills they tested for, and how these skills related to specific talents or differences. Suddenly, I realized that the goal of education was not simply learning things; it was about improving your own capacity to learn. By identifying your own learning strengths and weaknesses, you become more capable. Knowledge comes from the process of honing one’s skills and talents in any area you choose to extend, and weaknesses are mitigated by knowing what they are, trying to figure out how they work, and work around them or even with them.

How was Stan able to teach this concept to me? Again, it was not what he taught, but rather how he taught it. Stan had a much different teaching schtick from Mr. B. Stan was empathic and unassuming, almost naïve, but his naiveté was really a soft and unassuming way to get you to enter into a Socratic dialectic that examined your thoughts and ideas. He had a knack for drawing writing out of you. At this time in my life I was constantly drawing. I drew monsters mostly, often engaged in some kind of mayhem that I found entertaining. Art seemed the only real career opportunity open to me. Somehow Stan convinced me to write poetry; often just random thoughts or imagined song lyrics. The format had less rules related to grammar, and allowed me to better express my ideas. There was one poem Stan thought was very good. I no longer have a copy of it, but I can remember the first line, which went, “I am the child without any mind, lock me away for no-one to find.” It expressed my helplessness, and the new found

hope in my situation. After reading the poem with me he asked, “What would you do differently if you could run a school?”

This was a truly profound question for me at the time because up until that point I had always approached education in a fairly adversarial way. I had never given any thought that there could be other possibilities or other ways of doing it. I had never had enough personal attachment to school or teachers to even contemplate their perspective or what they were trying to achieve. By learning about my disability, I had developed a new appreciation for teachers. I also developed a new disdain. I became particularly combative with teachers who were, from my new perspective, not there to reach and teach students, but rather there to achieve some artificial sense of superiority through their authority. I was looking for conflict and found it. Stan was a good teacher, but I don't think anyone could have kept me out of trouble that year. With my newly acquired metacognitive knowledge, I became a particularly difficult and outspoken student.

However, my grades remained no better than C's and D's. This may not sound like a great achievement, but I had been moved up into college preparatory classes. It seemed an impossible feat, but despite this level increase, my grades had not gone down. I was holding my own, but I was running out of time. With one year of college preparatory classes under my belt, and the kind of grades that would not really impress anyone, Stan offered a possible solution to this problem.

Stan worked in the Program for the Advancement of Learning (PAL) at Curry College, which was, at the time, one of the only schools in the country with a program that specialized in helping students with learning disabilities through college. They also had a Center for Lifelong

Learning. Stan explained how this was my opportunity. The Center allowed people who were not enrolled as students to take classes at Curry for college credit without acceptance; you only had to pay the class fee. The plan for my senior year was that I would go to high school during the day, and after school I would drive to Milton to take classes at the college. Amazingly, college classes were not like high school, there was no goofing around in these classrooms. Also, the classes at Curry were smaller and discussion based, which suited my learning style much better. Rather than a mind numbing daily churn of practice work, there was a syllabus outlining what needed to be done, and the assignments came with predetermined dates; there were only a few assignments for each class. This gave me the time to focus on each task and do all my written work outside of class on a computer. It still took me a repulsively long time for each assignment, but since professors were not requiring me to generate much writing in the classroom, I could carefully type and edit my work before they saw it. Without my chicken scratch handwriting to tip them off, I could write in a way that they would never know I was learning disabled. For the first time, the ideas I was writing about were allowed to stand on their own. My ability to use and express ideas became more important than the mechanics. At the end of that first semester, while I was still pulling Cs and Ds in my high school classes, I was getting A's in my college classes. It seems a strange disconnect that this would be possible, but I think it says something very powerful and profound about learning and how we measure it.

When it came time to send out College applications, I sent out only one. At that time, it still seemed like a long shot. If I was going to get into college, the only college I could see I would possibly have a shot with was Curry. I dressed up for my college interview. Stan had coached me on what I would say. I was going to tell them I had learning disabilities that caused me to struggle in school, but now I knew myself better. I knew I would be able to be successful



in college because I had already taken two college classes and received A's. But, it did not happen like that at all.

Immediately upon entering the room, the college admissions officer asked me if I really wanted to go to a full four year college. He pointed out that there was a fine community college in my area, and that I might be better off going there. My emotion was pure desperation. He was cool and unimpressed. I returned back to my truck after the interview and cried like someone had died. In a way, someone did die. A person I felt I had just met. A person I wished I could have been. My guidance counselor was right; at 17, it was too late for college for me.

But then, what can only be called fate or luck happened. I was accepted to Curry. There I met my first PAL adviser, and the Director of the PAL program, Gertrude Webb, who taught the classes on Metacognition. These discussions about learning and neurology developed and fed an obsession for brain science, which has continued to this day. I graduated Cum Laude with a double major in English and Education and a minor in Psychology and also with distinction in the Alexander Graham Bell Honor Society.

Since then, I have worked with students identified as having emotional or learning differences in all grade levels from kindergarten to college. For most of those years, I have worked for various public-school systems and designed substantially separate special education programs for students like myself in the middle and elementary school levels. These programs supported students with a range of intellectual strengths, weaknesses, traumas, or socio-economic disadvantages. These classroom based programs generally had low numbers, and were designed with considerable flexibility to accommodate a broad range of neurological diversity. Much like the public-school program I attended as a student, the programs I ran

supported students with Attention Deficit Disorder, Specific Learning Disability, Autistic Spectrum Disorder, Bipolar Disorder, Schizophrenia, Obsessive Compulsive Disorder, Anxiety Disorder, Depression, Personality Disorders, conduct and oppositional disorders, and Post Traumatic Stress Disorder. The chief difference being that this student population was generally determined to be too explosive or behaviorally unpredictable to learn with the general student population.

I credit much of the success of these programs to what I learned, and how I used what I learned, at Curry, and particularly at PAL. Most students going through my programs would attain some level of inclusion with the general education population, many went on to college after high school. I even had one student who entered my program in the third grade doing 0% of his daily classwork, who, after working his way through my program and back into general education, went on to become valedictorian of his senior class.

Before I began my dissertation work, I had not spoken to anyone at Curry for over twenty years, despite applying and expanding upon the ideas I learned from PAL daily in my practice. I never lost the curiosity that the program developed in me about learning, the brain, and human development. Dr. Gertrude Webb's ideas on metacognition have been uniquely formative for me. I feel honored to have had the opportunity to return and conduct this study into the transformative educational techniques that helped to change my life, and enabled me to help change the lives of so many other students like me.

### **Definitions of Key Terms**

**Attention Deficit Hyperactivity Disorder (ADHD)** is a chronic condition marked by persistent inattention, hyperactivity, and impulsivity. It is identified by symptoms, such as high activity levels, difficulty remaining still for long periods of time, and limited attention spans, which are generally treated through the use of behavior modification and stimulant medications.

**Conditional knowledge** is the form of metacognitive knowledge that indicates an understanding of when and when not to use a specific strategy (Murphy, 2009; Pierce, 2003). It is an understanding of the terms and situational conditions that impact a cognitive experience.

**Cultural Deprivation** (Feuerstein et al., 1980) is a condition induced by a culture that reinforces modes of thinking that impair the ability to learn and behave flexibly. Rather than conceiving of the world as related through cause and effect, the individual conceives of the world as unrelated moments to be endured rather than comprehended. It is a situation where a person's formative experiences have left them ill equipped for complex problem solving.

**Declarative knowledge** is the learners' knowledge of their abilities and skills (Anderson et al., 2001). It refers to what a person intellectually knows (Pierce, 2003) or what he or she is consciously aware of as part of their learning, or more essentially a learner's knowledge of personal strengths and weaknesses (Murphy, 2009).

**Executive Dysfunction** is a neuropsychological disruption to cognitive processes that regulate, control, and manage other cognitive processes. Executive dysfunction produces disruptions in task-oriented behavior, habitual responses, goal setting, and planning behaviors (Baddeley & Wilson, 1988).

**Executive Functioning** refers to cognitive processes required to attain a goal. Executive function includes working memory, inhibitory control, attention control, and shifting. It involves

a learner monitoring their behavioral output through self-control and working memory (Jansiewicz, 2008).

**Individualized Education Program (IEP)** is a legal document that is developed for public school students in the United States needing special education. It is created through a team of the student's parents and district personnel who develop the educational approaches and supports that will address the student's specific learning needs.

**Learning Conversations** are metacognitive conversations designed to enable a student to develop the manners of thinking, habits of mind, and tools of self-regulation that promote the development of self-authorship (Kegan, 1982) and educational transformation (Mezirow, 1991).

**Metacognition** is defined as learning about learning (Flavell, 1979). Where the first learning refers to the action and behaviors of learning directed in pursuit of the second learning, which is a knowledge of discrete aspects of the subject of learning.

It is thinking that reflects back on thinking, and exerts control over learning behavior. It includes self-monitoring and purposeful direction of thought and learning (Quigle et al., 2019; Whitebread & Pino Pasternak, 2010). It is a kind of conscious thinking that transcends thinking and uses self-reference for purposefully directing behavior.

**Metacognitive Control** is described as the “conscious and non-conscious decisions that we make based on the output of our monitoring process. Control processes are revealed by the behaviors a person engages in as a function of monitoring” (Nelson, 1996, p.4).

**Metacognitive Knowledge (MK)** refers to an individual’s stored knowledge of how learning functions and how information is processed. It refers to an individual’s understanding of himself and others as conscious learners (Livingstone, 2003).

**Metacognitive Regulation (MR)** is the learner's ability to control his or her cognitive activities (Coutinho & Neuman, 2008). MR involves strategies of planning, monitoring, and evaluating (Schraw & Moshman, 1995).

**Objective Perspective** is a third person perspective that holds primarily the abstract, intelligible, and cognitive processes of the mind that perceive relationships which transcend experience, revealing conceptual patterns.

**Orton-Gillingham** is a direct, explicit, multisensory, structured, sequential, diagnostic, and prescriptive way to teach reading, writing, and spelling to individuals, with SLD in the domain of language function.

**Procedural knowledge** is the knowledge of dynamic strategies of thinking (Anderson et al., 2001; Murphy, 2009). It can be thought of as the steps involved in knowing how to do a task or process (Pierce, 2003).

**Qualia** is the basic instantiation of raw sensory data such as the redness or the smell of a rose.

**Self-Authorship** is a level of human development where the individual has both the self-understanding and the self-regulatory ability to direct their development by coordinating, integrating, acting/inventing values, beliefs, convictions, generalizations, ideals, abstractions, interpersonal loyalties, and intrapersonal states (Kegan, 1994).

**Self-Efficacy** refers to self confidence in one's ability to complete a task (Quigley et al., 2019).

**Self-Directed Learning** is a process in which the learner initiates their learning, with or without the help of others. They will possess the ability to diagnose their learning needs, formulate learning goals, identify resources and implement appropriate learning routines (Knowles, 1975).

**Self-Regulation** refers to the "monitoring and control of all aspects of human functioning, including emotional, social, and motivational aspects" (Whitebread and Pino Pasternak, 2010, p.

693). "Self-regulation is about the extent to which learners are aware of their strengths and weaknesses and the strategies they use" (Quigley et al., 2019, p.8).

**Self-regulated learning** refers to the use of self-regulation by an individual to control and direct their learning.

**Specific Learning Disabilities (SLD)** is a disruption in the underlying psychological processes involved in understanding. It may present as an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations that are considered specific because they are not part of a global intellectual impairment. The condition is considered to be the result of highly specific organic factors such as perceptual disabilities, brain injury, and dyslexia, rather than environmental factors like culture, economic disadvantage or limited English proficiency. SLD is also separate from sensory impairments in vision or hearing, motor disabilities or intellectual impairment.

**Subjective perspective** is a first person, largely qualitative perspective that holds primarily the experiences, feelings, motivations and perceptions of the mind of the individual.

**Transformation** is an expansion of consciousness, worldview and specific capacities facilitated through a consciously directed process of accessing, assessing and critically analyzing the underlying premises of oneself definition (Mezirow, 1995).

**Wechsler Adult Intelligence Scale (WAIS)** is a series of tests designed to measure intelligence and cognitive ability. Created by David Wechsler in 1955, the WAIS is generally used as part of a standard battery of tests used to identify and diagnose learning disabilities and other neurological conditions. This test was central to PAL's metacognitive approach. It is currently in its fourth edition (WAIS-IV) released in 2008 and is produced and updated by the Pearson company.

### **Significance of the Study**

The most immediate and direct contribution of this study will be to the Program for the Advancement of Learning (PAL). The data from this study will help the PAL program better understand their unique definition of metacognition and instructional practice. It will serve as a record of the development of the program's primary pedagogical approach, the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006). It will provide valuable insight into how the program's professors presently define, design, and implement their metacognitive educational program for future researchers. Data from this study could also be used by the institution to better understand and refine the program's practices. Likewise, it will enable other institutions with similar learning goals to integrate some of PAL's best practices, like the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006), into their own programs.

The most significant aspect of this research is how it identifies and organizes the deeply foundational constructs of the neuropsychological phenomena of metacognition. Metacognition is more than a pedagogy. It is a fundamental quality of learning that can be improved and directed. It is a quality that works imperceptibly in the background of our cognitions, like memory, but can also be called upon to be intentionally employed when needed. The power of metacognitively based teaching strategies is that they tap into and develop this innate ability, which is significant due to metacognition's integration with all other cognitive skills, allowing the individual to develop and improve those skills. This foundational approach to metacognition could be used to support researchers studying learning by defining new areas of study that integrate metacognitive elements from across many scientific fields studying the phenomena.

The ability to contemplate and evaluate one's thinking transcends all scientific and creative domains. It connects deeply intrapersonal cognitive experiences with the interpersonal dialectic learning experiences and the goals of institutions of learning looking to develop more objectively successful and humane models of instruction. Moreover, the broad findings of metacognition's role in self-development, and its elucidation of approaches like the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006), could also be used to support therapeutic institutions outside of traditional educational settings such as family counseling, coaching, or in health care. Finally, the neuropsychologically foundational metacognitive pedagogy uncovered in this study, I believe, could promote the education practices needed to make transformational learning experience a central and commonplace occurrence in the educational lives of more students.

### **Limitations of the Study**

This study was limited to eight participants. Participants were drawn from senior faculty in the PAL program. First person descriptions of the transformative learning experience were only collected from this researcher. Because this is a qualitative study, generalizability is limited by the methodological constraints of qualitative research. The research presents participants' beliefs about metacognition, their pedagogical practices, and how they integrated new knowledge into their practice. Chapter 3 contains a wider description of specific delimitations of this study, constraints on its validity and the approaches used to address these issues.



### **Overview of Each Chapter in the Dissertation**

The opening chapter of this dissertation discussed the nature of this research. The first chapter introduced the reader to the shifting narrative styles used to integrate the writing with the metacognitive research presented. This first chapter also provided an explanation of the problems being researched, a detailed history of Dr. Gertrude Webb and the PAL program, a glossary of key words related to the research, limitations and significance of the study.

Chapter 2 reviews the pertinent literature on metacognition and its effect on human development. This review presents an overview from various scientific domains that have made important contributions to the field. The chapter describes the metacognitive phenomena from historical, educational, evolutionary, neurological, psychological, and processing perspectives.

Chapter 3 outlines the methodological approaches of the study. It details the procedures of the case study interviews and personal narrative data collection. It also outlines the grounded theoretical approach developed to analyze the data. This chapter describes the role of the researcher as well as constraints of validity and bias and the measures taken to limit their impact.

Chapter 4 presents the data and a discussion of the themes uncovered in the analysis of the interviews and personal narrative reflection. The processes that lead to the elucidation of the findings through data analysis are described.

In Chapter 5, discussion of the findings of the study are presented. These findings are subdivided. The first subdivision of findings is about PAL's identified approach to Metacognitive education called the Learning Conversation (Pennini, 2006). The next subdivision discusses a General Theory of Metacognitive Intervention (GTMI) and metacognitions relationship to fundamental processes of learning and self-transformation. The final subdivision of the chapter grounds metacognition to phenomena in neuropsychology, physics and information processing.

## CHAPTER 2

### LITERATURE REVIEW

#### Overview of Chapter

Various viewpoints regarding metacognition are explored in this review of the literature. These perspectives are evolutionary, historical, pedagogical, psychoneurological, phenomenological, and information and computational processing. Over the course of this chapter, each of these varying approaches will highlight aspects of metacognitive thinking, defined here as thinking that reflects on thinking, and attempts to control behavior through the understanding gained. Each domain covered in this review brings perspective, and valuable data identifying the central defining features of metacognition. Most importantly, the amalgamated definition presented here carries with it behavioral ramifications that make it scientifically testable and applicable to the learning conversations of experienced PAL Professors.

#### Historical Perspective

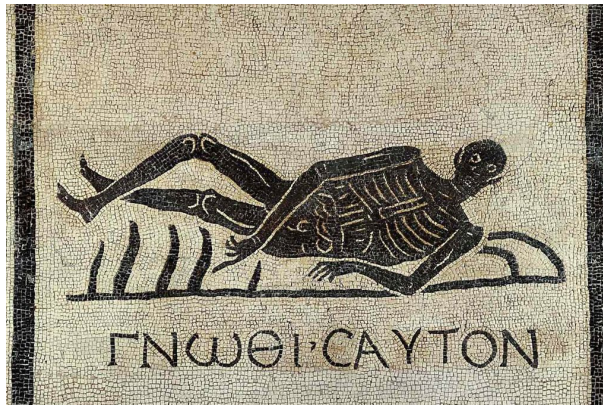
In his influential and paradigmatic article *Metacognition and Cognitive Monitoring*, John Flavell (1979) first described metacognition as “thinking about thinking” or “cognition about cognition” (p.906). However, the idea of using self-knowledge to promote human development and understanding is an ancient idea. Over three thousand years ago, the phrase “Know thyself and thou shall know the universe and God” was carved on the Temple of Apollo at Delphi in ancient Greece and was attributed to Socrates by Plato in his *Dialogues* (Hamilton, 1961; Vyshedskiy, 2014). However, the phrase is also attributable to the Pharaoh Imhotep and the Egyptian book of the Dead which states, “Name yourself in your heart and know who you are” (Ellis, 2009, p xxxviii).

Literary and metaphorical evidence of metacognitive thinking is ubiquitously demonstrated across ancient societies and is reflected in the historical record of mental synthesis

collected by Andrey Vyshedskiy (2014). In China, the practice was identified by Lao Tzu in the 33rd verse of the Tao, “Knowing others is intelligence; knowing yourself is true wisdom. Mastering others is strength; mastering yourself is true power (Mitchell, 1989).” Some of the earliest expressions of the idea of an interaction between a subjective/experiential self and an objective/contemplative self that can regulate achievement of higher and more developed behavior (Kegan, 1986, 1996; Nelson, 1996; Nelson & Narens, 1990) are expressed metaphorically in the Hindu Rigvadaś parable of the Body and Soul:

Two birds with fair wings, inseparable companions; Have found refuge in the same sheltering tree. One incessantly eats from the fig tree; the other, not eating, just looks on. (De Nicolás, 2003, p.66)

These ancient references to the metacognitive practice of knowing oneself seems to point to a much deeper understanding of the learning process than would be expected from primitive cultures. This may be the result of the modern shift to compulsory public education. Modern systems shifted the focus of instruction from discourse to discipline, with an emphasis on the identification of skills in a population over the development of an individual’s skills and talents, as was seen in more ancient times. Paulo Freire (2018) describes this modern style of education in his book *Pedagogy of the Oppressed* as the banking model of education, and has suggested that what has come to be seen as education is more a mechanism of state and cultural control. It would seem that ancient cultures had a far more sophisticated conception of learning than realized by later modern cultures and religions that sought to promote greater social cohesion.

**Figure 2.1***Know Thyself*

*Note:* From excavations in the convent of San Gregorio, Via Appia, Rome, Italy.  
(The artist is unknown. Public domain)

The idea that understanding one's own cognitive faculties can have a beneficial impact on one's learning and development is not even a recently rediscovered idea. William James in 1890, made one of the earliest references in modern western psychology to the self-observing power of the brain. John Dewey (1997, 2007), the great American teacher and philosopher, placed self-reflection as the most crucial component of both learning and a healthy democracy. Modern investigations of metacognition did not start until 1965 when J. T. Hart completed the first research on memory and the feeling-of-knowing, considered to be one of the first modern studies of a metacognitive skill (Harten, 2014).

The study of the influence of conscious, self-reflective, metacognitive thinking on behavior was overshadowed for much of the 20th century by the dominance of Skinner's (2011) behaviorist conception of the mind as a black box. This form of radical behaviorism saw consciousness as epiphenomenal and believed it to have minimal to no impact on real human action. Behaviors were seen as the result of conditioning. However, by the time Flavell (1979) wrote his seminal work on metacognition, behaviorism's dominance was beginning to wane, as

its adherents failed to demonstrate their claims conclusively (Chomsky, 1959; Harzem, 2004, Virués-Ortega, 2006). This set the stage for deeper neurocognitive investigations into human learning and development using paradigms that more fully appreciate the role of conscious thought and behavioral choice.

Metacognition's unique relationship to consciousness makes it an important methodological and investigational concept in this domain. It provides an experimental framework capable of probing the neurological relationship of not just cognition, but also of conscious behavior, and its relationship to discrete tasks of memory and performance. Due to this, most research into metacognition and executive function have proceeded on separate tracks, (Mazzoni & Nelson, 1998; Nelson et al., 1994) with neuroscientists focusing on the relationship between executive control, brain regions and behavior using adults in laboratory settings, and traditional metacognitive researchers focusing on the learning of children in classroom based naturalistic settings.

### **Pedagogical Perspective**

Metacognitive interventions have been shown to be tremendously important to pedagogy, particularly in supporting individuals with neurologically based learning disabilities in academic settings (Brown, 1978; Dunlosky & Metcalfe, 2009; Dweck, 2017; Webb, 1989). Metacognitive self-regulation is considered to be among the most impactful approaches to supporting learners who come from poor and disadvantaged backgrounds (Bransford et al., 2000; Quigley et al., 2019) Many metacognitive educational approaches have achieved success integrating research on metacognition into their programs (Dweck, 2008; Medina, 2011; Tanner, 2012; Webb, 1989). Metacognition has been shown to be a defining feature of successful education routines (Bransford et al., 2000; Hattie, 2012), and many researchers (Mancini et al., 1991; Pace, 1991;

Price, 1991; Weinert, 1987) have identified various ways metacognitive processes affect learning.

Metacognition has also had a strong influence on the development of special education interventions and programs (Dumont et al., 2010; Wong, 1986). Early metacognitive research into learning disabilities (LD) often involved the teaching of phonemic awareness and the development of efficient reading and studying skills (Wong, 1986). Discoveries that regulation skills correlated with low blood flow to regions of the brain's frontal lobes, like what is seen in attention deficit hyperactivity disorder (ADHD) (Amen, 1995), led to the identification of a broader category of learning disability termed executive dysfunction (Miller, 2006).

Investigation into the nature of executive dysfunction has not only greatly impacted the study of students with learning disabilities, like ADHD, but has also led to new diagnostic procedures and treatments for elderly patients with a behavioral-variant form of frontotemporal dementia (Wong et al., 2018).

A common research model in this domain is contrasting high- and low-achieving students in relation to their degree of self-monitoring and evaluation (Andrade, 1999). Generally, the highest performing and most independent learners use a number of metacognitive strategies such as: setting goals, planning, monitoring performance, restructuring physical/social conditions to improve learning, managing time efficiently, and self-evaluation (Zimmerman, 2010).

Alternatively, those with poor metacognitive skills tend to be identified as a person with a specific learning disability (SLD) and demonstrate a poorer ability to maintain and generalize learned skills (Wong, 1986) or monitor their own comprehension, particularly in reading (Garner, 1981; Garner & Kraus, 1981; Garner & Taylor 1982). This metacognitive inability to identify inconsistencies in comprehension was earlier described by Markman (1979) as a

“comprehension failure” (p.987). The fact that SLD students demonstrate weaker than average metacognitive skills is perhaps best exemplified by Garner and Kraus (1981) who discovered that most SLD students wrongly assume that the purpose of reading is effective decoding rather than the understanding of meaning. This assumption was part of a wider mindset that affected the quality of reading comprehension impacting the SLD student’s ability to connect specific tasks to new problems, situations or interpretational meaning (Dweck, 2017).

Flavell (1979) helped to clarify the nature of these comprehension failures by identifying four interacting processes of metacognition involved with cognitive monitoring. The first process was metacognitive knowledge (MK), which he described as “cognitive creatures” (Flavell 1979; p. 906), or the factual part of knowledge which describes how things are (Anderson, 1981). MK generally falls into three categories: declarative knowledge (Efklides, 2008), procedural knowledge, and conditional knowledge (Schmitt & Newby, 1986; Schraw & Moshman, 1995). Declarative knowledge is knowledge of personal strengths and weaknesses that work to support an individual's procedural knowledge, or general knowledge of the steps involved in how to do a task (Pierce, 2003). However, because metacognition is a process that is dynamic in nature, procedural knowledge is often embedded in the context of an event, thereby making it difficult to transfer abstractly (Clark & Voogel, 1985) and thereby producing knowledge that is situationally conditional. For example, an individual who possesses such conditional knowledge would not only be aware of the strategies involved with their thinking, when approaching a specific task, but they would also be aware of the internal and external environmental conditions that would best facilitate their learning.

Flavell’s (1979) three other metacognitive processes, metacognitive experience; goal/task; and actions/strategies, have since been consolidated into one category described as

metacognitive regulation. Murphy (2008) described metacognitive regulation as “Selecting, predicting, planning, scheduling, goal setting, allocating resources, ordering coordinating, and action or strategy necessary to the accomplishment of an action or goal *prior* to learning” (p. 16). Nelson (1996) described metacognitive control as the real time conscious and non-conscious decisions made based on the output of a monitoring process. He felt that, “Control processes are revealed by the behaviors a person engages in as a function of monitoring” (Nelson 1996, p.4) making them accessible for objective scientific study. For example, when a learner notices internal frustration building at a difficult problem, through her use of cognitive monitoring, what she behaviorally does to regulate these feelings would be considered metacognitive control, which could be identified and potentially measured scientifically. Nelson’s framework and research has enabled broader interdisciplinary communication between the fields of neurology, cognitive psychology and developmental psychology, which have been able to use similar methodologies in their approach to the subject (Schwartz & Perfect, 2002).

As early as 1978 Brown, questioned whether the phenomena coming to be described as metacognition was the result of various interactions between conscious and unconscious components to learning. The idea that there are identifiable conscious and unconscious factors that affect a person's ability to regulate their own learning formed the basis of self-regulated learning theory (SRLT). SRLT introduced a broad conception of learning that described how many different aspects of behavior are coordinated to contribute to achieving a goal (Lewis & Litchfield, 2011). The idea of self-regulated learning (SRL) grew out of work done by Albert Bandura (1997) in social cognitive theory.

SRL suggests that development requires an individual to give simultaneous attention to both the cognitive and metacognitive dimensions of their reasoning (Kuiper & Pesut, 2004) and,



thus, it has been suggested that metacognition is a substructure of broader self-regulation (Shaw, 2006). However, SRL interventions, to date, have focused on using concrete learning tasks within specific learning contexts (Dignath, 2008; Schuster et al., 2000). The task-specific nature of SRL's cognitive and motivational regulation approaches have been found to have limited transference when compared with metacognitive skills, which are more transferable and generalizable to a variety of learning tasks (Schuster et al., 2000). Moreover, Schuster et al., (2000) found, "no empirical study to date has shown transfer of SRL in learning tasks that differ substantially from the training tasks in the study (p. 456). This ability to take a learning strategy that is effective in one situation and apply it to a different, yet analogous situation where it could also be effective is called "far transfer." Metacognitive skills when paired with SRL strategies in a hybrid manner have demonstrated both near and far skill transfer (Schuster, et al., 2000), and have been shown to enhance performance across learning domains (Crowley & Kundera, 2020; Ohtani & Hisasaka, 2018)

Generally, SRL considers the processes that stimulate and maintain cognitions, behaviors, and affects, while developing the declarative knowledge, procedural knowledge and conditional knowledge of the learning process (Murphy, 2008; Pierce, 2003; Zimmerman, 2010). Researchers like Garcia (1995) felt SRLT more readily included critical emotive and motivational links to cognition. Garcia conceptualized SRLT as extending beyond the conscious cognitive components of metacognition to include an individual's environmental and social experience, which impact resource-management strategies in the regulation of cognition, motivation and effort.

Bandura's (1989) initial notions of behavior resulting from the imitation of role models, such as parents and teachers, through exposure and observation, expanded on earlier

environmentalist and behaviorist models to include social reinforcement as drivers of behavior. SRLT has attempted to bridge aspects of cognitive, environmental and behavior to produce adaptive behavior (Zimmerman, 1990). However, paradoxically, SRLT ideas become hard to partition from ideas of metacognition, and its central tenet of learning about learning. In many ways SRLT is talking about the same features as metacognitive researchers utilizing different vocabulary. Future investigations will undoubtedly help to clear these confusions.

The most important aspects of SRLT and metacognitive research has been on pedagogy and identifying modes/techniques that enhance the effectiveness of teaching and learning. For example, strong research (Dunlosky; 2013) has differentiated between teaching (Hattie, 2012) and learning (Simmons; 2019) techniques that are most effective in supporting learning and development. Much of this research presents a direct challenge to traditional practices and beliefs about teaching and learning, particularly those utilized most frequently in banking style schools (Freire, 2018). Often teachers in these institutions are not given the time, or professional development, needed to familiarize and integrate this research into their daily practice (Wong, Balleine & Kumfor, 2018). However, the impact and effectiveness of metacognition has fundamentally changed the way educators and researchers approach their craft. This is an impact that will no doubt continue to affect the field of education.

### **Evolutionary Perspective**

Metacognition is a distinguishing component of human cognition (Dunlosky & Metcalfe, 2009). Rudimentary examples of metacognition have been seen in other species (Hampton, 2009) ranging from rats (Foote & Crystal, 2007; Templer, 2019) to dolphins (Smith et al., 1998), with chimpanzees demonstrating the strongest sense of metacognition (Beran et al., 2015). However, even rudimentary metacognitive behaviors are a rare adaptation and have failed to be

conclusively demonstrated in other species, such as the pigeon (Sutton & Shettleworth, 2008), and even other primates, like the Capuchin monkey (Basile et al., 2009). Moreover, while there is no evidence that any animal is capable of the systematic metacognitive reasoning seen in humans (Kornell, 2014), evolutionary evidence for the advanced development of metacognitive ability seen in humans is beginning to be uncovered.

New technologies will continue to push our understanding of the minds of other species. For example, a procedure called Neuropixel can record the whole brain activity of small genetically engineered animals like fish and mice (Abbot, 2020) that were bred to express a molecule that fluoresces when their neurons fire. The technology is able to image thousands of individual neurons, interacting in real time. One study (Marques et al., 2020) of zebrafish larvae found three neuron groups: one that remained activated during hunting, one that remained activated during exploration and a third that activated as the fish switched states. The changes in activation triggered by the third state were not always related to hunger (Marques et al., 2020), and may be evidence that even at early evolutionary stages of development, there are neuronal systems engaged in mediating choice making, which may be the possible neurocognitive forerunners of the metacognitive capacities seen in more complex organisms.

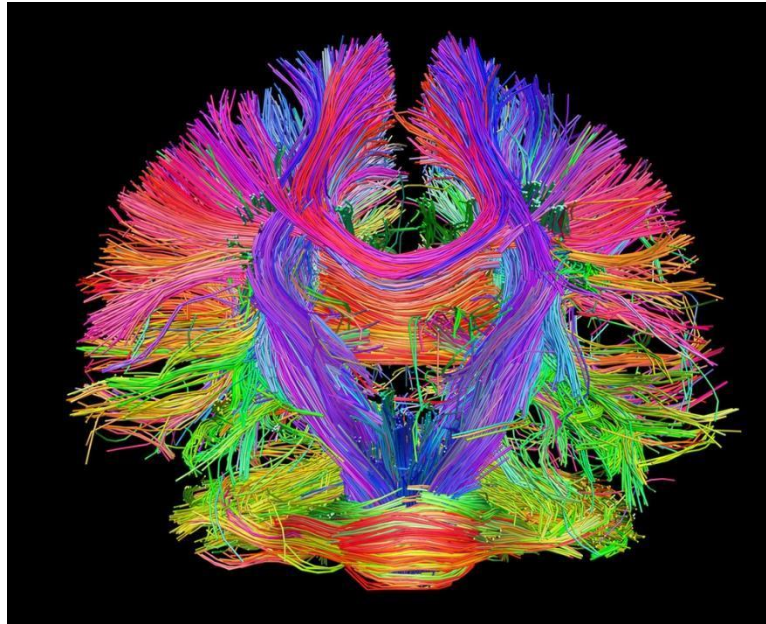
### **Neural Perspectives**

Metacognitive methodologies have played an important role in the study of the brain and mind. The conceptual framework of metacognitive research first laid out by Flavell (1979) and then later delineations by Nelson (1996) have enabled certain activities of conscious cognition to be better studied scientifically. Thanks to modern imaging technologies such as functional magnetic resonance imaging (fMRI), positron-emission tomography (PET), and single-photon emission computerized tomography (SPECT) complex representations of the brain's different

regions have been created, and their involvement in various kinds of cognitions have been inferred (Gerhard et al., 2011), providing new ways to conceptualize what is occurring in the brain. Metacognition's unique relationship to consciousness and behavior has always made it an important methodological and investigational construct in the domain of psychology, but now with the advent of advanced imaging technologies we are able to do experiments into the functional interconnectedness of the brain and mind.

How the physical organ of the brain is able to achieve metacognitive monitoring and metacognitive control is of strong interest to researchers. Developing a deeper, more nuanced neurological conception of metacognition holds the hope of producing new interventions that could improve human learning, development, productivity, and mental health more generally. Thanks to the accumulating evidence gained from brain imaging techniques, large scale atlases of brain areas and their functions have been produced to facilitate research (Domingos, 2015; Iqbal et al., 2018; Zeng et al., 2016). Possibly the most ambitious imaging initiative is sponsored by the National Institutes of Health called the *Human Connectome Project*, whose goal is to build a “network map” of the brain's physical connections (Gerhard et al., 2011). This map of the anatomical and functional connectivity of a healthy human brain has already led to some amazing visualizations of the brain and could lead to important research breakthroughs in the future.

One area of the brain that is highly correlated to the kinds of self-regulatory behaviors seen in metacognition are the frontal lobes (Fernandez-Duque et al., 2000). Even before the wide use of fMRI and imaging technologies, this area of the brain was implicated through

**Figure 2.2***Network Map of the Brain*

*Note:* The anatomical and functional connectivity of the frontal lobe as visualized by the Human Connectome Project (Gerhard et al., 2011).

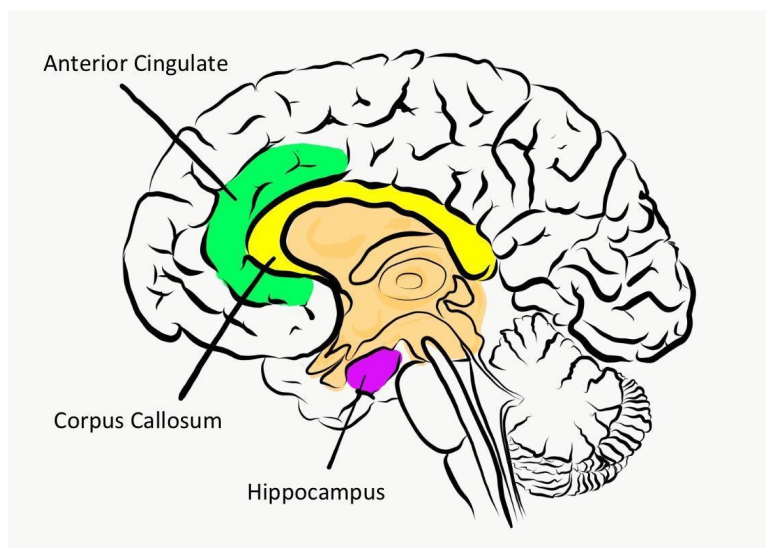
impairments to executive function caused by damage of the frontal cortex called Dysexecutive Syndrome (Baddeley & Wilson, 1988). Neuroimaging investigations have been able to extend these findings by providing very detailed maps of the damaged brain, and nuanced investigations of the interactions between various areas involved in this syndrome. Moreover, neuroimaging has led to the identification of localizable frontal regions that are involved in different metacognitive skills (Allen et al., 2017; Fernandez-Duque et al., 2000). Psychological and behavioral investigations that predate the use of these technologies have served as helpful methodological frameworks for modern imaging studies. For example, Fernandez-Duque, Baird and Posner (2000), utilizing a similar methodological structure to Heart's 1965 experiment on

feeling-of-knowing (FOK), were able to correlate these kinds of judgments with the frontal areas using fMRI.

Another area of the brain shown to have definitive involvement in metacognition is the interior region surrounding the frontal corpus callosum called the anterior cingulate (AC). Initial studies by Bench et al., in 1993 using PET scans identified this area of the frontal lobe's involvement and attentional control during a Stroop task. A Stroop task has subjects identify the color of a written word, rather than reading the word, they must name the color. Such incongruities between perceptions and meanings produce a measurable delay in response time, called semantic interference. Further fMRI investigations by Peterson et al. (1999) using this construct identified that the anterior cingulate activates a distributed attention network that is arranged spatially, depending on the specific attentional demands of the task. The work of Peterson et.al. (1999) and others like Carter et al. (1998), suggests that the AC is involved in error monitoring and detection.

### Figure 2.3

#### *Anterior Cingulate*



*Note:* Anterior Cingulate in relation to the Corpus Callosum and Hippocampus (Hulbig; 2018)

However, our understanding of the relationship between the AC and error monitoring and detection is not settled. It has been observed by Carter et al. (1998) that the activity in these brain regions seems to increase as a result of response competition to the semantic interference seen in the Stroop task. This response competition between neurons occurs during both correct and incorrect response conditions. This suggests that rather than errors themselves, the AC activates when it detects conditions where errors are likely to occur (Allen et al., 2017). Plus, the AC is not the only region of the brain associated with activation during these kinds of semantic interference tasks (Allen et al., 2017; Fleming et al., 2014; McCurdy et al., 2013), certain areas of the parietal lobes, called the precuneus, show significant activation. This area, like the AC, is internally located between midbrain structures and the outer layers of the cerebral cortex. Connections between parietal and prefrontal areas show considerable involvement in episodic memory and reflective self-awareness (Haier et al., 2009).

These imaging techniques are helpful only in as far as they are carefully paired with a behavioral methodology (Shimamura, 2000), and there are limits to the explanatory power of these techniques. Neuroimaging studies identify areas of metabolic upregulation or downregulation by identifying changes in blood flow and nutrient absorption. The assumption is that areas of the brain that are working harder during a given task will require more oxygen and nutrients, thereby requiring an increased flow of blood to regions where greater amounts of cognitive work are being done. Even if this assumption is correct, and these imaging technologies are identifying areas of the brain that are working hardest during specific tasks, they do not tell exactly what is occurring or what the specific cellular interactions are. Regardless, these studies provide physical evidence from which to build theories that expand our

understanding of the connections between neural and cognitive activities in the brain, which presently are driving research.

However, neuroimaging technology is only capable of making inferences about what is occurring based on large scale patterns of brain activation. This does not rule out that there may be small scale activations that are also important, or activations that are occurring that are important to cognition, but do not leave a signature that can presently be detected. This fact was recently evidenced by an investigation by Stringer, Michaelos, & Pachitariu (2019) who utilized a new methodology that allows researchers to investigate the activation patterns of small clusters of individual neurons in larger regions of the brain traditionally identified as specializing in vision. Counter to expectations, they found that the individual neurons in these regions did not consistently show specialized firing when presented with the same stimulus. This means that while regions of the brain may be localized for certain functions using fMRI, when these regions are examined at a more fine-grained level, the neurons that make up those regions may not always be reacting to the same stimulus in the same way. Findings such as these demonstrate the tenuousness of theories of neuroscience, and that more robust theories of the future will require multiple data points capable of integrating both different research and methodological approaches as well as differing disciplines and traditions of investigation to extrapolate out the true meaning of these neuroimaging findings.

### **Psychological and Developmental Perspectives**

Subjective, introspective, cognitive, and psychological approaches to understanding the mind occupy a rich and unique research space that is increasingly becoming accessible to neurobiological investigations. Increasingly, the interdisciplinary blending of neurophysiological and psychological understandings are producing nuanced theories and new avenues of



investigation, which in turn are producing new and more effective intervention. Today, many disorders of the mind are most effectively treated with combination therapies involving physiological, biological often chemical, and psycho-cognitive interventions (Busch & Sandberg, 2012; Picardi & Gaetano, 2014; Vitiello, 2009).

The practice of psychology has been inherently based on self-reflective principles since Freud's identification that subconscious elements were powerful, and often hidden, drivers of human behavior. Freud identified several subconscious and conscious defense mechanisms that were later enumerated by his daughter Anna Freud in 1936 (Lipot, 1956). George Valiant (1993) identified a developmental difference between the various psychological defenses, placing them on a continuum from mature to immature. Mature psychological defenses allowed for the holding of two opposing ideas without distortion, whereas less mature defenses involved a distortion of perception or experience when confronted with the same information. Frequently, these distortions support the individual in avoiding an issue or idea that does not fit into their present conceptual schema of the world. Valiant (1993) identified a psychologist's chief role as helping patients identify distortions in their perception and develop more mature coping mechanisms.

**Table 1**

*Valiant's Psychological Defense Mechanisms*

<b>Developmental Level</b>	<b>Defense Mechanism</b>	<b>Definition</b>
Mature defenses	Suppression	Postponing gratification
	Altruism	Doing for others over the self.
	Sublimation	Channeling or harnessing of emotional energy toward a higher goal.
	Anticipation	Realistic planning for the future.

	Humor	The ability to see life as funny. The highest of defenses according to Freud.
Intermediate defenses	Reaction formation	A distortion of the value of a feeling or idea to make it seem more or less important than it really is.
	Repression	Hiding one's true thoughts and emotions from the mind
	Displacement	A detachment from thought and emotion
	Isolation/Intellectualization	A detachment from emotion using the intellect
Immature defenses	Dissociation	Neurotic denial of reality
	Projection	When the object is turned into subject
	Passive Aggression	Self sabotage of ideas or individuals to avoid an issue
	Hypochondria	Sublimation of psychological pain into physical pain.
	Fantasy	Creation of an artificial world
	Acting Out	Total loss of behavioral control

*Note:* Valiant (1993) identified that less mature defenses involve a distortion of experience or a manipulation of perceptual input, whereas mature defenses involve new modes of processing perception that enable productive action.

Interestingly, it was found that hemispheric neglect patients who have had stroke damage to their right hemisphere, often suffer the loss of their ability to interpret novel situations ( Corballis, 2003; Ramachandran et al., 1998). Because of this they can no longer adequately process the reality of their own paralysis, and simply neglect, or fail to realize there is anything wrong with them on the left side of their body. In these patents, when their linguistic left hemisphere remains intact, the patient is able to create excuses for the situation, which has been demonstrated by Ramachandran et al. (1998) follow the Freudian patterns of the psychological

defense mechanisms, suggesting that psychological defense mechanisms are somehow both neurological and developmental structure.

Erik Erikson (1997) saw development as the resolution of internal personal conflicts that occurred at different times over the course of human lifespan. His idea was that an internal crisis triggers a degree of self-learning, which in turn leads to more and more sophisticated cognitive conceptions, and the development of behavior that effectively addresses the conflict. Similar ideas of conflict triggering learning and higher levels of development were identified by Jarvis (2004) as central to adult education. Self-directed learning in adults is generally thought to begin with a difficult encounter, experience or conflict that cannot be easily accommodated or assimilated by the learner (Jarvis, 2004; Merriam, & Caffarella, 2007). Through metacognitive reflection and self-questioning, personal beliefs can be dissociated from, allowing the formation of new more developed beliefs to occur (Iordanou, 2016)

In his book *In Over Our Heads* John Kegan (1996) described the psychological development of consciousness using terms similar to descriptions of metacognitive consciousness put forth by Nelson (1996), and notions of understanding put forth by physicists and mathematician Roger Penrose (1989, 1994). Kegan (1982, 1996) described a shift between subjective consciousness and objective consciousness. Objective consciousness contains objective elements of our knowing that we can reflect on. The subject level of consciousness refers to elements of our knowing we are identified with, or are subjectively embedded within. The interplay of these types of consciousness, one that is able to embody itself in the moment and one that is able to reflect on both the self and the moment, produces a clearer understanding of one's self as a cognitive object and part in the larger system of interactions.

Kegan (1996) identified that the ability to integrate subjective and objective levels of conscious perspective leads to higher order conscious states and healthier, more productive behavior. These findings have further been supported by research into the development of epistemological perspective (Kuhu et al., 2000). However, the development of these more advanced ways of knowing in adulthood do not follow the linear chronological course seen in the cognitive development of children.

Researchers like Kegan (1982, 1996) found that it was relatively uncommon for adults to reach the highest levels of development. These levels are described as *Self-authorship*, where an individual is able to understand and direct their own personal development, and *Self-transformation*, where an individual comes to understand their ability to direct the development of their culture and society. Kuhu et al. (2000) found that the highest levels of epistemological development, which involve advanced evaluative approaches to knowledge, were likewise rare, and may require more than just time or education to attain.

Finally, the psychological field of cognitive-behavioral therapy (CBT) is of particular relevance to the study of metacognition as it focuses on the development of personal-problem solving skills with the goal of directly working to change patterns of thinking and behavior that promote illness and maladaptive behavior. It has been shown to be an effective treatment for numerous psychiatric conditions, from depression to psychosis (Goldapple et al., 2004; Hollon & Beck, 1994). Moreover, neuroimaging investigations have shown that one of the therapeutic effects of CBT is to stimulate neuroplasticity (Paquette et al., 2003; Rotge et al., 2009), meaning that these direct, problem solving forms of psychological therapy produce identifiable positive physical changes in the brain as well as in behavior.

## Neuroplastic Perspectives

Neuroplasticity is the brain's ability to reshape and even heal itself. Neuroplastic phenomena were at one time considered rare, and even negligible phenomena. However, thanks to the pioneering work of researchers like Norman Doidge (2007, 2016) and the introduction of neuroimaging techniques, neuroplasticity has become an area of intense study. The most compelling aspects of this research show there are direct morphological effects on brain regions associated with use (Gaser & Schlaug, 2003; Levitin, 2006; Maguire et.al., 2000; Sluming et al., 2002) that are powerfully related to metacognition.

When it comes to learning, humans are doing more than simple operant conditioning (Skinner, 2011). We demonstrate the ability to regulate our behavior towards learning (Dewey, 2007; Flavell, 1979). This feature of regulation is conscious, effort full and metacognitive in nature. It allows for goal directed executive control and can also produce identifiable morphological changes to the brain. For example, a study of London Cabbies by Maguire, et.al. (2000) demonstrated that as cabbies come to memorize all of the streets and roads in London, as required for their job, measurable anatomical changes in the size of their hippocampus occur. While this study is generally cited as evidence for a hippocampal role in memory formation, it is also evidence of metacognitive self-regulation impacting brain plasticity.

This effect is not limited to memory. There have been demonstrated impacts on the brain's linguistic areas in the middle frontal gyrus as well as the hippocampus during language acquisition (Sluming et.al, 2002). The most widespread neuroplastic effects were found in studies of students learning to play musical instruments (Gaser & Schlaug, 2003; Levitin, 2006). The development of this skill not only demonstrated volumetric increases in the size of

the hippocampus, but also increased synaptic density in motor areas, and improved organization of white matter (Gaser & Schlaug, 2003; Levitin, 2006; Sluming et.al, 2002).

While the neurological relationship between metacognitive regulation, practice, learning and the brain are recent discoveries, a similar kind of metacognitive regulation can be applied to the physical body also. There are presently 131,700,000 (Statistic Brain Research Institute, 2018) people with gym or health club memberships. We can assume that by virtue of their gym membership they intended to directly regulate their behavior to produce changes to their physical being in one way or another; be it to look more fit, lose weight, improve their cardiovascular health, or any of a myriad of reasons. It is clear there is a form of metacognitive self-regulation involved in the act of physical fitness. Efforts may wax and wane, just as in studying, but through a conscious process of metacognitive self-regulation, what is practiced becomes habituated, and physically impacts all areas of the body involved in the process, producing morphological changes to the targeted areas. By virtue of this interaction, humans are able to develop their physical brain in much the same way they can develop their physical body, or any practicable skill.

Neuroplasticity research also suggests that humans can counteract and even stave off the effects of disabilities if they are able to harness their self-regulatory behavior through metacognition. There are many examples of individuals using their personal powers of metacognitive regulation to identify ways to rise above a disability or adversity, but perhaps none is more incredible than the story of John Pepper (Doidge, 2016). In 1968, John Pepper was diagnosed with Parkinson's Disease. However, unlike most people delivered this diagnosis, his response was to learn as much as he could about the illness. Then, from this knowledge, he went on to develop a personalized exercise routine that involved daily focused walking to combat the

disease's progression. By the time he reached his 60's, when most Parkinson's patients lose the ability to walk and begin to succumb to their disease, Mr. Pepper was coming off his medication, walking 5 miles per day and by most evaluative standards moving quite normally (Doidge, 2007, 2016). His story, and others point to the ability of exercise routines, like Pepper's, to trigger the production of brain-derived neurotrophic factor (BDNF) and other growth factors that stimulate neurogenesis (Cotman & Berchtold, 2002). These neurological compounds have been shown to increase resistance to brain insult, improve learning, boost mental performance, and effect conditions that can lead to both muscle and brain impairment (Adami et al., 2018).

The knowledge of BDNF and the beneficial effects of physical fitness on the musculoskeletal nervous system has changed the way surgeons and physical therapists interact with patients. After most modern procedures, surgeons rarely require more than 48-hour bed rest, and most are requiring immediate physical therapy. Along with targeted therapeutic exercise, physical therapists are told "effective exercise instruction is based on knowing a patient's learning style" (Kisner et al., 2017; p.27). Their goal is to expand their patient's metacognitive knowledge about the brain to positively impact self-regulatory adherence to restorative therapeutic routines. Metacognitive regulation plays an important role in the physical and neurological healing made possible by learning and exercise (Cotman & Berchtold, 2002).

### **Social Emotional Perspectives**

Generally, the fields of neurology and psychology approach the subject of human cognition from two different loci. Neurology has historically been the investigation of the physical brain, its physical structures and bio-chemical interactions. Psychology has historically been the investigation of the mind, through psychological processes and behaviors. However,

these fields have been increasingly brought together by research into the domains of social emotional functioning.

Chronic emotional stress has been shown to physically reduce the size of the hippocampus and other areas of the brain involved with memory and learning (Gianaros et al., 2007). Individuals with learning disabilities frequently present with psychiatric disabilities related to emotional regulation. Recent studies (Sanz et al., 2019) of students with ADHD found that over half had a comorbid psychological disorder. Close to 30% of students with ADHD were found to have comorbid anxiety disorder (The MTA Cooperative Group, 1999; Sanz et al., 2019). A study by Koyuncu et al. in 2015 found major depressive disorder (80% lifetime prevalence) was the most common psychiatric comorbidity, followed by anxiety (32.3%), obsessive compulsive disorder (14.6%) specific phobia (14.6%), and panic disorder (4.6%).

However, there is a curious relationship between emotion, cognitive performance and self-regulation. Psychiatric conditions such as bipolar disorder have been shown to be more common in highly intelligent people (Gale et al., 2013). Nettle (2001) identified several relationships between intelligence, creativity and emotionally based psychiatric conditions. The relationship between psychiatric conditions and intelligence is complex, and one cannot be said to cause the other, but findings like these (Gale et al., 2013; Nettle, 2001) suggest a relationship between emotional and intellectual sensitivity in the consideration of intelligence.

The impact of negative emotions on cognition is well documented (Tyng et. al, 2017). Research (Pollack & Herres, 2020) is increasingly demonstrating that sub-clinical experiences of negative emotion can lead to behaviors that are commonly reported as symptomatic of those with learning disabilities. For example, one study showed that negative emotions, such as fear, distress, and guilt, can lead to the behavior of procrastination (Pollack & Herres, 2020).



Recurrent experiences of negative emotion, like those seen in the education of individuals with LD (Nelson & Harwood, 2011), have been shown to have physiological effects that are known to impact learning. For example, it has been shown that students with LDs maintain abnormal levels of the stress hormone cortisol across their day-to-day function when compared to neurotypical peers (Huang et.al, 2020). These findings are leading to emotional distress being seen as a more primary feature of developmental dyslexia (Livingston et al., 2018), and ADHD (Hirsch et al., 2019).

Social conditions are generally the source of emotional distress. The impact of socio-economic status (SES) on educational outcomes is well documented (Perry et al., 2003; Rothstein, 2004). SES has been found to impact reading (Peterson, & Pennington, 2012), and mathematics (DeFlorio et al., 2019) scores of students. Low SES has also been correlated to the development of specific brain regions like the rostral-lateral prefrontal cortex (Leonard et al., 2019), an area of the brain associated with reasoning, self-regulatory abilities and problem solving. It is believed that economic hardships increase conflicts in the home and harsh, inconsistent or uninvolved child-rearing practices (Solantaus, Leinonen, & Punamäki, 2004). The impact of an individual's SES extends beyond schooling, affecting occupational and general life opportunities (Thaning & Hällsten, 2018). This has led some researchers (Boardman & Robert, 2000; Harrison, 2018) to investigate if these difficulties with both school and work are related to self-efficacy (Boardman & Robert, 2000).

How a student perceives their placement in the environment and society has a large impact on regulation and self-efficacy (Boardman & Robert, 2000; Harrison, 2018). Students can negatively interpret experiences, like broken windows and disorganization in a neighborhood, in ways that can affect their self-esteem and general mental health (Haney, 2007; O'Brien et al.,

2018). While it is difficult to separate subjective pessimism about one's neighborhood and mental health (O'Brien et al., 2018), several researchers have shown that negative self-perceptions related to a person's SES strongly affect adolescents (Goodman et al., 2007), and young adults (Finch et al., 2013). These perceptions affect self-regulation and an individual's ability to make effective core self-evaluations, and are strongly related to later career and life satisfaction (Judge, & Bono, 2001; Judge, Erez, Bono & Thoresen, 2003; Judge, Higgins, Thoresen & Barrick, 1999).

Struggling students often experience a level of social isolation that can both exacerbate, and be exacerbated by, poor metacognitive and self-regulatory skills (Siu, Lu, & Spector, 2007). It has been found that many of the students who most struggle with academics lacked even one supportive adult in their life, and 66% of these students stated they would have worked harder if teachers and parents had higher expectations of them (Bridgeland et al., 2006). 69% of the students from the same study claimed that adults did not expect them to perform well (Bridgeland et al., 2006). Lack of support compounds a student's level of isolation and further impacts their metacognitive and regulatory behavior (Bridgeland et al., 2006; Corrigan, & Rao, 2012; Siu et al., 2007).

Socially isolated individuals can more easily come to internalize and accept negative stereotypes about themselves (Corrigan & Rao, 2012). This self-stigmatization can have disastrous impacts on an individual's motivation and ability to think metacognitively, producing a condition called the "why try" effect (Corrigan et al., 2009, p.75) where a student comes to believe that no amount of effort will improve their situation. Self-stigmatizing beliefs disproportionately affect students with low SES, psychiatric illness and learning disabilities (Kieling et al., 2011) However, self-stigmatization develops from an individual's experiences,

and interventions can disrupt the development of self-stigma (Corrigan et al., 2009; Corrigan, & Rao, 2012; Vogel et al., 2013). Four kinds of intervention have been found to disrupt this process (Masi, et al., 2011), and all are related to reducing social isolation. These interventions are: improving social skills, enhancing social support, increasing opportunities for social contact, and addressing maladaptive social cognition (Masi et al., 2011).

Supportive social interactions, particularly those that promote the identification of adaptive and maladaptive behavior have been shown to have a strong impact on an individual's perceived level of social isolation (Cacioppo & Hawkley, 2009). Abramson, Seligman, and Teasdale (1978) demonstrated that students can learn to become helpless based on how they attributed their success or failure. Subtle feelings of inferiority called 'stereotype threat' (Steele & Aronson, 1995) can also elicit a similar negative effect on student performance.

It has been found that one of the best ways to address forms of learned helplessness, like stereotype threat, is to develop a student's leadership abilities (Désert et al., 2009). Plus, simple metacognitive strategies related to self-talk have been shown to help anxious learners (Thomaes et al., 2019). So despite the fact that stress and anxiety seem to have morphological impacts on the physical brain as demonstrated by neurological studies (Gianaros et al., 2007), neuroplasticity researchers are demonstrating the capacity of certain psychological interventions to address and even reverse these physical changes. Increasingly there is evidence that enriching environments can be created that counteract, and even correct errors in the physical brain (Eggins et al, 2019)

Students tend to choose the kinds of activities they feel they will have a good chance of success doing (Vygotsky, 1934). Negative and traumatic, experiences over a lifetime can greatly distort a student's self-perceptions, particularly if they occur before they have the developmental

maturation needed to comprehend these experiences (Finkelhor et al., 2011; Juster et al., 2010; Sapolsky, 2017). The middle and high school years of a student's life can be particularly traumatic because this age range represents a developmental gate between childhood and adulthood. It is highly likely for a student to experience one of many adult traumas before they are maturationally ready. These environmental insults can range from disheartening failures in school to catastrophic life events. They represent a continuum of trauma that impacts learning, impairs an individual's ability to make accurate metacognitive judgments, and dysregulates their behavior (Finkelhor et al., 2011; Sapolsky, 2017).

The impact of trauma on metacognition, self-regulation, and general performance is well established. Trauma has been shown to impact academic skills like reading (Duplechain, Reigner & Packard, 2008), math (Delaney-Black et al., 2002; Grégoire et al., 2019), as well as neurological skills like memory (Grégoire et al., 2019; Sapolsky, 2017) and executive function (van der Kolk, 2003). Trauma is often the source of psychological dysfunction (Sapolsky, 2017; Schilling et al., 2007). Even purely physical trauma inflicts a psychological cost, impacting the student's subjective perception, definition and judgment (Duplechain et al., 2008).

Trauma, however, does not inevitably lead to impairment (Denham, 2008; Sapolsky, 2017). Some students are able to reframe their trauma as a test of their fortitude, or a challenge to overcome, and are able to use this interpretation as a source of self-regulatory strength and resilience. The impact of a supportive relationship with a teacher or therapist who understands learning in a way that can be communicated to students has been found by Vandenbroucke et al., (2018) to support MR, MK and the ability to regulate academic demands.

### **Dialectic and Internal Dialogue Perspectives**

Historically, investigations into subjective experience have been considered the domain of philosophers. One of the earliest and best-known philosophers to promote this kind of introspection was Socrates, who was also known for his educational pedagogy of dialectic discussions (Hamilton, 1961). Dialectic discussions involve questioning a person about what they know, or think they know, to arrive at a deeper and more essential understanding about a subject being discussed. A dialectic format described as the learning conversation was the primary format of the student teacher interaction in the PAL program (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006).

A common theme of these kinds of self-reflective practices is that they support individuals in observing their thoughts more accurately and orienting them toward a mindset of problem solving and discovery. Practices like dialectic dialogue frequently use the metacognitive construct of identifying the conscious and unconscious forces directing and fueling our behavior. Such personal investigations into the self require methods of investigation that may be considered less restrictive or scientific because they are so narrowly focused on subjective experiences (Orbe, 2009). Another common aspect of this kind of investigation is the finding that opening a dialectic conversation within oneself can lead to better self-organization (Harri-Augstein & Thomas, 1991).

A student's internal monologue often defines their mindset and turns out to be a critical feature of their academic success (Dweck 2013, 2017; Whyte, 1978). Cassandra Whyte (1978) was one of the first educational researchers to uncover that self-regulation was more guided by internal dialogue and belief systems than other environmental or biological forces. Whyte (1979) found that students with an internal locus, who believed they had the power to control their

performance, did better academically than those students with an external locus, who believed their performance was merely a product of luck. It was found that students with an internal locus of control put in more self-directed effort and worked more flexibly than students with an external locus of control, who generally worked only for external rewards and were not very flexible in their thinking (Whyte, 1978). Later work by Carol Dweck (2017) found that students who attributed their success or failure on a given task to immutable qualities about themselves, such as a natural talent or biological disability, showed a long-term decline in academic performance, and students who felt their success or failure was due to variable qualities, such as how long they studied and prepared, had better academic outcomes.

Dweck (2013, 2017) also found that not only the words students were saying to themselves mattered, but that the words teachers chose for encouragement and motivational purposes were also important. It was discovered that when teachers or parents identify intrinsic qualities to praise, using phrases like, “you are so smart” or “talented” that these forms of praise actually lead students to become more likely to attribute their success to immutable intrinsic qualities about themselves, and in turn perform worse over time. Whereas praise that focused on self-regulatory qualities of the student’s success, like, “you really put a lot of time into that,” or “I like how you organized,” led to more resilient behavior after a failure and better performance over time (Dweck, 2013).

The relationship of self-talk or personal belief and then later performance has been demonstrated in non-academic areas also. Boroujeni & Shahbazi (2011), demonstrated the power of self-talk on self-regulation with basketball players. It was found that when subjects talked about themselves in the second or third person, using phrases like, “You can do this” or “Jim can do this” instead of “I can do this” reduced their anxiety while performing, and led to their

performances being rated better by their peers. Boroujeni & Shahbazi (2011) suggested that by distancing one's perception of the self by using a third person stance one can better regulate their anxiety. Such demonstrations are significant to the study of metacognition as they represent a purely cognitive intervention that improves the regulation of behavior and aligns with Nelson's (1996) objective and meta levels of conscious function. However, there are other, purely cognitive interventions that improve self-regulation, and some of these are far older and more nuanced.

### **Meditative Perspectives**

One of the hallmarks of a sound scientific theory is not simply what it explains, but what it predicts and enables us to produce. Traditional practices like meditation, have endured many accusations of being unscientific practices. However, it is clear that scientific investigations into meditation have been stymied because of racial bias. Objectivists cite the fallibility of subjective information, and the ease with which humans can bias or delude themselves as the reasons why wholly subjective practices like meditation should be placed outside the objective preview of science and because accusation that these practices do not produce scientific predictions. However, the personal and subjective practice of monitoring one's thoughts, and then consciously regulating one's behavior is a subjective activity that actually does make predictions in the form of the personal goals through which many products are produced. In fact, at this personal level, the phenomena of metacognition becomes most practical and important. Having self-control over life's waves of frustration and emotional annoyance, or having the ability to bring up a memory to be reviewed and applied to a new situation, are hallmarks of metacognition, and a kind of personal science that you do by yourself to improve yourself.

Our understanding of meditation has been greatly bolstered by fMRI and imaging technologies. The use of imaging technologies to investigate contemplative practices have led to a wave of neurological findings about the neurotherapeutic effects of meditation that are removing the stigma of scientific investigation into these historically religious practices (Purser & Loy, 2013). Meditation encompasses a diverse set of ancient introspective practices that seek to develop an individual's self-knowledge and regulation. While there are many forms of meditation, all require introspection into the mind's conscious attention (Cahn & Polich, 2013). Some require the ability to maintain focus on a particular object (Kozasa, et.al., 2012) known as concentrative practices (Cahn & Polich, 2013). Other forms, known as mindfulness practices, involve allowing thoughts, feelings, or sensations to arise, while paying close attention (Kabat-Zinn, 2003). Also, different approaches have been correlated with different cognitive impacts. For example, Transcendental Meditation, a concentrative practice, has demonstrated a marked improvement in creativity ( $p < .0001$ ), practical intelligence ( $p < .0003$ ) and fluid intelligence ( $p < .001$ ) (Hagelin, 2014) whereas mindfulness meditation has been associated with improvements with self-control, objectivity, flexibility, concentration and both emotional tolerance and intelligence (Davis & Hayes, 2011).

What was at one time considered a fringe religious practice in Western society, modern scientific investigation into meditation has been quietly demonstrating that these introspective practices do indeed provide identifiable and measurable benefits that have been historically overlooked by western scientists. By using modern imaging technologies, meditation has been shown to affect the size and conductivity of frontal brain regions (Luders et al., 2011). Through the use of electroencephalographic measurements meditation has demonstrated impact on theta and alpha brainwave activation (Cahn & Polich, 2013). Meditation has demonstrated a unique



impact on the efficiency of neural processing (Kozasa et al., 2012). Meditative practices also impart documented therapeutic effects including alleviating the symptoms of a variety of mental and physical disorders (Gotink et al., 2015), such as personality disorders, behavior disorders (Swart & Apsche 2014) ADHD (Harrison et al., 2004) and even anxiety in children (Napoli et al., 2005). The demonstrable neurotherapeutic effects of meditation has led to its inclusion in many newer psycho-cognitive interventions and treatment regiments (Gotink et.al, 2015)

In the United States, the study of the possible medical applications of mindfulness were developed initially by Dr. Jon Kabat-Zinn (2003), at the University of Massachusetts Medical Center. Over the years, mindfulness has become a more accepted practice in mainstream medicine, psychology, corporate environments, and education. New techniques like mindfulness-based cognitive therapy use traditional cognitive behavioral therapy (CBT) and mindfulness strategies to treat depression. Other treatments like Dialectical behavior therapy (DBT) and Mode Deactivation Therapy (MDT), utilize cognitive behavioral therapy, dialectical, and mindfulness techniques, and have shown promising results with individuals with personality disorders and adolescents with behavior disorders (Swart & Apsche 2014). According to a 2015 meta-analysis of systematic reviews, evidence supports the use of mindfulness programs to alleviate symptoms of a variety of mental and physical disorders (Gotink et al., 2015).

Phenomenological and meditative inquiry into one's personal cognitive experience occupies a growing space of investigation. How an individual experiences and responds to internal states is of great personal and practical importance, as it is these internal experiences that most impact our ability to regulate our behavior effectively.

### **Information and Computational Processing Perspectives**

The integration of neurological and psychological perspectives requires a third, and very important perspective, which will represent the final perspective presented in this review of the literature. This element is, perhaps, even more relevant to the study of metacognition than understanding the underlying biological connections that make metacognition possible for the human mind. This element is the information processing perspective. A perspective that attempts to explain how the physical organ of the brain takes in information and turns it into the comprehensible knowledge and the levels of understanding that are taken for granted as thought.

One aspect of metacognition that is of particular interest when considering how information is processed has to do with the level of conscious awareness that a person approaches their understanding of their learning or behavior. For some researchers (Veenman et al., 2002), the concept of metacognition must include both conscious and subconscious processes. Metacognition by this conception would include less than conscious constructs, such as one's neurological make-up, or environmental factors (Bandura, 1989), that have served to regulate behavior. Other researchers like Nelson (1996) have maintained the more narrow view that metacognition represents a uniquely conscious activity, and that it is the conscious nature of metacognition that leads to higher order processing. Presently, this lack of clarity around the essential nature of consciousness, impacts the ability to clearly define what constitutes a metacognitive skill, strategy or behavior (Veenman et al., 2006) and how one would utilize metacognition in a pedagogical sense.

Generally, the practice of metacognition utilizes a process of bringing otherwise unconscious elements of an individual's learning into a state of conscious awareness for active conscious investigation. It has been suggested that it is the simple process of self-reflection itself

that produces more effective modes of processing through recursion (Hofstadter, 1979). Such an insight runs parallel with educational pedagogy in very practical ways. It has been found that educational routines that promote self-reflection are highly functional (Dunlosky 2013, Hattie, 2012). A potential reason for this could be because they are modeled around an underlying, fundamental quality of information processing. If true, then educational programs that can better support this style of information processing will be most successful as they would be most in line with the brain's natural process.

Presently, there is reason to believe that there could be what has been described as a master algorithm (Domingos, 2015) at work behind human cognition. The best evidence for this theory has been the tremendous developments made in the field of computation and specifically artificial intelligence (AI). These computational models are supported by neuroimaging studies that seem to indicate an emergent consciousness, ending in the neurons of the frontal lobe. Of particular interest, AI researchers have found that self-referential programs based on simple heuristics, rather than complex linear programs, produce more stable and flexibly functioning computer interfaces and robotics (Domingos, 2015; Kelly, 1995, Hofstadter, 1979). This emergent, computational view would impact the conception of metacognition and learning more generally because it would suggest that human level conscious behavior is the result of a coalescence of vast stores of information being integrated from moment to moment by the brain. By this line of thinking higher levels of conscious behavior are the result of larger stores of knowledge and experience.

However, programming a computer that is able to execute metacognition, even in a rudimentary way, has proven to be exceedingly difficult to do. The chief problem is the ability of the mind to formulate a new, and conceptually more abstract representation of phenomena that

appear unrelated at a low level of understanding (Hulbig, 2018). This is an expansion of a perceptual problem known as the binding problem (Revonsuo & Newman, 1999), and it poses a considerable problem to the computational study of metacognition as it is through this abstracting process that new understandings are generated. These understandings are more abstract than the constituent parts and enable more advanced, planned behavior.

Moreover, our chief way of conceptualizing information processing is through computation, which is a linear process. While computational processes are capable of connecting or categorizing information, presently the capacity and flexibility of computation is limited by the computers very linear, “word at a time”, (Backus, 2007, p. 613) processing architecture that limits its ability to access stored processing instructions and the stored data needed for processing simultaneously, a problem called Von Neumann’s bottleneck (Backus, 2007). It may be that what is described as a bottleneck is a functional and fundamental limitation of computation.

This has led to the claim that computation, as presently constituted, will never be able to abstract or forge new novel connections, categorizations, and symbolic representations necessary to produce novel understandings (Penrose, 1989, 1994). Computers presently lack an algorithm capable of making metacognitive, inquisitive, creative and spontaneous understandings. Similarly, seemingly automatic functions of human cognition such as the ability to make analogies and metaphors are far from automatic in computation systems. They seem to require humans to interpret the data and apply human understanding to the production of new algorithms to support the computational process (Domingos, 2015).

Metaphorically, the difference between human and AI information processing, as presently constructed, is akin to the difference between being able to follow a list of instructions

and being able to generate a list of instructions. Though there have been several examples of modern convolutional neural networking style computation systems that have been capable of producing computer programs (Basin et al., 2004; Domingos, 2015). and even articles for major publications (Keohane, 2017) these programs are all based on relationships discovered by humans and added into the system as a list of instructions for organizing the data they have access to, and not the result of any genuine understanding.

Interestingly, this problem is analogous to an age old debate in education between teaching discipline and the skills that follow from direction, versus fostering critical thinking and the skills that follow from creativity. While human beings are able to do both reasonably well, computers are only able to follow directions, albeit in an exceptionally fast and accurate way when compared to humans. It may be that the human brain utilizes two systems of information processing (Hameroff, & Penrose, 2014; Kahneman, 2011), as there are numerous examples of such mode dualities at work in the human mind.

For example, Kahneman (2011) identified two mode dualities in his book *Thinking, fast and slow*. One mode was fast, instinctive and emotional thinking and the other was a slower, more deliberative, and logical mode of processing. Perhaps the most well known mode duality is the seminal conscious versus unconscious modes described by Freud (1992), and Jung (2014). More recently there has been increasing speculation that these two modes may differ in their ability to process subjective qualia and objective cognition (Chalmers, 1996, Hameroff & Penrose, 2014). It has been suggested that at present we do not really understand subjective qualia, because the form of information processing used to generate these experiences are non-computational (Penrose, 1989) this may be why we have been able to produce advanced

computational devices, but not a generalized artificial intelligence that thinks and problem solves in a manner that is seen in humans (Penrose, 1994).

One of the potential solutions to this algorithmic problem could be found in quantum computation. David Deutsch (2011), one of the founding fathers of quantum computing, famous for formulating a description of the Universal Quantum Computer, has presented a theory that human intelligence represents a special kind of computer, a Universal Problem Solving System. His descriptions of a computer that is able to flexibly identify and solve problems would, also, certainly possess a level of metacognitive insight. It may be that as this technology is developed, new insights into how our brains process information will be gained. Presently, this technology is at the beginning stages of development, but development is increasing at a breakneck pace. In 2018, the United States passed the National Quantum Initiative Act, establishing priorities for a 10-year plan to accelerate the development of quantum computer systems (Giles, 2018). This research holds great potential and could reveal new ways that computation could inform our understanding of human cognition.

However, computation may not lead to greater discoveries if there truly is an underlying dualism, sometimes called the mind body problem, where there are simply divisions between the physical and psychic world that cannot be breached. If this philosophical view turns out to be true, then looking for a computational answer to what consciousness is will always remain a scientific dead end. However, there are philosophies that conjecture that there is no mind-matter duality. Many Eastern cultures approach the idea of consciousness this way. Mathematician Alfred North Whitehead (1957) proposed in *Process and Reality* that consciousness is an abstraction produced by what he called, an occasion of experience. These occasions of

experience have both mental and material aspects making conscious abstractions drawn from experience.

Whiteheads (1957) conceptions support an alternative view that consciousness represents a multifaceted and unique type of neural processing that promotes problem solving (Block, 1994), which rather than emergent is, in fact, fundamental to matter and the fine grain structure of the universe (Hameroff & Penrose, 2014). Rather than utilizing the classical computing approach of binary bits of information regulated in the synapse, they propose that consciousness is the result of parallel quantum computing occurring in subcellular structures called microtubules in nerve cells (Hameroff & Penrose, 2014). The implications of this theory is that quantum phenomena such as entanglement and the collapse of the wave function may play a fundamental role in learning. This line of thinking would place higher levels of conscious behavior as the result of an individual's larger resonance and conscious awareness within their environment. Practically speaking this theory would suggest learners and teachers work to forge a deeper relationship between the environment and their understanding, developing their ability to both identify, and connect perceptions (Hulbig, 2018).

The impact of this conflict on educational pedagogy is subtle but real. If metacognition is a wholly conscious phenomena then educational practices like gaining attention, making connections, and individual motivation become critical to practice. Inversely, if metacognition is an emergent phenomena, one which brings together conscious, subconscious and environmental components, then educational practices like routine, exposure and the manner of presentation become most important. In this study distinctions were attempted to be drawn between these two conceptions pertaining to theory and pedagogy.

### **General PAL Practices**

PAL professors meet with their students, one on one or in small groups, to have dialectic discussions about learning, organization, planning, studying and the science of the brain. PAL professors use these discussions to focus their students' attention on potential areas of difficulty to promote problem solving. These personal conversations between the student and the teacher evolve over time with the learners developing a level of self-understanding and self-regulation. These are interactions that engage in supporting a student's understanding of the complexity of their own learning and development of self-sufficiency.

The professor's responsibility in this process is to teach students about their learning and guide them through the demands of their lives in college; supporting the student in their development of the skills and strategies needed to meet these demands. Frequently, living with a SLD leads to a level of cognitive rigidity and pessimism, the PAL approach is to be supportive and help the student to develop a personal practice of strategic thinking, planning and organization that are needed to be successful as college students. Conversations about metacognition encourage, illustrate and educate students about patterns of thought and behavior that can be utilized to address their unique learning profiles. These conversations were initially identified by Diane Goss Learning Conversation and elaborated by Sue Peninni (2006).

Such a conversational structure has considerable historic roots, as does the practice of identifying the student's strength and weakness for the purpose of using one's strengths to overcome their weaknesses. Nietzsche (1974) believed people should "survey all the strengths and weaknesses of their nature and then fit them into an artistic plan until every one of them appears as art and reason and even weaknesses delight the eye," (Nietzsche, 1974, pp. 232-233). Dr. Gertrude Webb also understood this and made understanding personal strengths and



weaknesses a foundational wisdom of the PAL technique. With the support of a professor, students learn to self-examine their strengths and weaknesses of their learning to break down the fear and helplessness associated with their neurological conditions.

PAL is very much a college class in the classic sense of the word. However, a PAL class is highly specialized and individualized to study learning. A learning conversation is used to convey and connect a professor's depth of research and experiential knowledge with the real and everyday learning experiences of their students. Students learn both what the research has to say about learning, as an abstract subject of human inquiry, but also how to connect knowledge to a real time personal investigation of their own learning as they respond to the demands of their life.

In the preface of the book *A Closer Look* (Adelizzi & Goss, 1995), Dr. Webb identified the following features of PAL pedagogy:

1. Just about all students start school wanting to learn.
2. Learning is synonymous with growth.
3. Those who do not learn in our schools fail to do so because they have not found their way.
4. Good teachers serve as "coaches" to both those successful at school learning and to those who have not found their way through the conventional system; they understand that the latter think differently.
5. Teacher/ coaches are excellent observers; they focus on the uniqueness of their learners.
6. Teacher/ coaches are good questioners, encouraging students to "talk," to discuss developing concepts as they clarify their thinking while

identifying their preferred learning styles.

7. Teacher/coaches are deep listeners-they search for the meaning behind what they hear, adding that insight to their observations, putting the pieces of the learning puzzle together.
8. Believing that a student's understanding of his/her learning style preferences is foundational to metacognition, teacher/coaches facilitate this understanding in their learners, suggesting how their preferences might be used to bring success.
9. Teacher/coaches do reality checks, encouraging students to evaluate the usefulness of the application of their newly acquired metacognitive knowledge.
10. Teacher/coaches respect their students' potential for success, coaching them as they strive to become independent, competent, and effective learners, able to take charge of their own learning while working collaboratively in a very competitive society. (Adelizzi & Goss, 1995 pg. 1-2).

What a PAL professor does is a process of identifying their student's strengths and weaknesses, particularly hidden weaknesses and strengths. A secondary goal is to help their students embrace their own individuality and discover how to live a whole and satisfying life. Through dialectic conversations a student's understanding of their disability is made conscious, providing the student with a conceptual framework to overcome and address it. A high level of self-examination is cultivated and practiced through honest self-reflection with an eye for behavioral patterns and habits of mind.

### **Chapter Summary**

This chapter reviewed the literature on metacognition. It brought together several domains of understanding and perspectives on metacognition. These domains were evolutionary

biological, historical, pedagogical, neurological, psychological, neuroplastic, social emotional, philosophical, dialectical, meditative, information processing and computational. This chapter also reviewed the general practice of a PAL professor. The intent of this chapter was to provide the reader with an adequate understanding of the complex subject of metacognition and the educational role of the PAL professor in developing it in their students.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **Overview of Chapter**

Chapter three reviews the methodology of this study. It will present the theoretical approaches that were integrated to produce the methodological design. The approaches that were integrated were case study, reflective narrative, and grounded theory. Along with a description of the theoretical approaches are descriptions of how and why each were applied to this study. This chapter will also identify the role of the researcher, and the steps taken to identify and avoid potential bias. This will be followed by discussions of the sample population interviewed. This chapter will also cover the methods and phases of data collection as well as the methods and procedures of data analysis. Near the end of the chapter, limitations of the study are discussed as are specific ethical considerations. Finally, this chapter will cover the issues of validity and reliability related to the methods of this study.

#### **Introduction to Research Approach**

This study investigates the perceptions and the practices of professors in the PAL program around the subject of metacognition and how it is taught. Metacognition has been shown to have tremendous educational benefits (Dunlosky, 2013; Dunlosky & Metcalfe, 2009; Quigley et al., 2019; Simmons, 2019). There is a need to record how the theoretical construct of

metacognition is practiced by educators. This study has approached the subject in three ways, utilizing case study, reflective narrative, and grounded theory coding schemes.

The perspectives and experiences of educators like these PAL professors, who have made the development and teaching of metacognition their lives' work, can provide valuable pedagogical insight. My unique contribution is to provide a personal narrative of my experience learning metacognition and the transformation that resulted from the programs' techniques and approaches, a transformation that moved me from a student struggling with a learning disability to an educator specializing in a high need and neurologically diverse student population. The varied perspectives of these interview subjects were analyzed utilizing an inductive/deductive multi-level coding scheme.

### ***Case Study Research***

The methodology of case study is an in-depth approach that seeks to unveil multifaceted and complex issues in their real-life settings. According to Stake (1995), the three primary kinds of case study are intrinsic, instrumental, and collective. This study adhered primarily to the format of an intrinsic case study, because of its focus on the unique phenomenon of metacognitive education. Intrinsic case studies seek to explain, describe and explore a given phenomenon in the contexts in which it occurs (Yin, 2014). The rationale for using this methodological approach is to understand the individual and shared social meanings of these PAL professors around the subject of metacognition and its pedagogy.

### ***Narrative Research***

Narrative research is an approach that relies on the lived experiential representation of an individual's life. This approach focuses on the lives of individuals as told through their own stories. It attempts to capture the personal and human dimensions of experience over time, while

accounting relationships between the individual's experience and cultural context (Clandinin & Connelly 2000). Narrative research is often used to investigate ambiguous and complex aspects of human life (Clandinin & Connelly 2000; Connelly & Clandinin, 1990).

Narrative research has become an important methodology in the study of educational practice because the complexity of the lived experiences of teachers are frequently most easily understood through their individual stories (Connelly & Clandinin, 1990). Heikkinen (2002) identified narrative approaches as more being a frame of reference than a methodology. For this reason narrative may be the most natural way to investigate metacognition because it allows for the most fluid movement between perspective and representation. Narrative approaches can be seen as a form of investigation that allows researchers to reflect during the entire inquiry process, making it both a research method, and a mode for representing the research of the study (Moen, 2006).

This study specifically utilized a narrative autobiographical reflection of this writer's introduction to the concept of metacognition and experiences utilizing metacognition collected before the interviews and analysis of the data. This methodological approach bridges several very important concepts. First, the narrative investigation seeks to bridge the metaphorical chasm between educator practices and the experiences of the student. It provides a valuable bridge of insight over another metaphorical chasm that exists between the research subject and the researcher, which has historically been identified as impacting the practice and progress of research projects (Pringle et al., 2011) and can be a source of study bias (Roulston & Shelton, 2015). This narrative approach provides the reader with an opportunity to enter into the thinking of the researcher. The hope is that it will connect the case study and grounded data analysis in a

way that will clarify research judgments and offer insight into the developmental process of metacognition that would otherwise not be possible to represent to the reader.

### ***Grounded Theory Research***

Grounded theory is a research methodology that is employed to enhance the capabilities of data analysis (Strauss & Corbin, 1990). Theories are constructed based on a synthesis of the data that has been collected. This dissertation was conducted using case studies of PAL professors and the personal reflective narrative of the researcher. The data analysis process is centered around essential questions that seek to identify the process, the influences and the actions of metacognitive instruction and development.

After transcribing interviews, the data was compared and analyzed in order to produce a theoretical hypothesis capable of informing the direction of more targeted research in the future, such as cohort studies or randomized controlled trials (Greenhalgh, 2014). This systematic approach grounds the theory in the data (Strauss & Corbin, 1990). A grounded theory is sensitive to the ideas of individuals, their actions, interactions and the events pertaining to a particular topic (Creswell, 2005). The steps for data analysis in grounded theory are: open, axial, and selective coding (Creswell, 2005; Strauss & Corbin, 1990). In open coding, initial categories are identified based on all data collected from interviews, observations, and documents (Strauss & Corbin, 1990). Axial coding is derived from the open coding categories. This is followed by selective coding, where a theoretical hypothesis is isolated from the interrelationships of the categories of the coding model developed (Strauss & Corbin, 1990).

### **The Role of the Researcher**

My role as the researcher in this project has many facets. The nature of the subject of metacognition, its pedagogy and practices, requires a high degree of self-awareness and

self-reflection. Because self-reflection is a key component of the subject matter, I have attempted to bring those elements forward for the reader. One way this was achieved was by choosing research methodologies and procedural approaches to analysis that make reflection on the data visible from many perspectives.

Metacognition also integrates dualistic subjective and objective qualities of mind. For this reason, I have purposefully used first person narrative to express, and help the reader identify information that is most informatively expressed subjectively. Likewise, I have utilized third person narrative when it most informatively expressed the information objectively. These shifting narrative styles are analogous to the metacognitive perceptual shifts utilized by the mind to optimize its cognitive capacity relative to the task at hand. The first-person nature of this section of the dissertation is a textual example of my aim to bring forward the functional shifts in perceptual understanding metacognition makes possible through both form and format.

As a researcher utilizing a mixed method approach to investigate metacognition, I committed myself to critically evaluating my thinking by actively identifying my underlying assumptions and actively searching for counterpoints to those assumptions. For example, at the beginning of my doctoral work I was initially fascinated with the self-referencing informational systems being produced by computer programmers working on artificial intelligence (Hofstadter, 1979; Minsky, 1988) and I still believe there is tremendously important work being done in this field that could deeply inform the study of metacognition. However, purposeful research into critics of computational theories led me to critiques (Gödel, 1992; Penrose, 1989) of computational analogs of metacognition and clarified relationships between understanding (Penrose, 1989), metacognitive consciousness (Nelson, 1996) and human development (Keegan, 1982) that became important in my final analysis. This approach has led to a tremendous amount

of research, from a wide spectrum of fields and disciplines.

First, and most practically, my role as a researcher was to be an effective interviewer. In this context my role was to draw out of my interview subjects their insights, and the full range of their thoughts on metacognition, and its practical practice. To do this a core structured list of questions was developed. I employed my intuition as a researcher, to seize upon opportunities to ask follow up questions when potential points of interest arose. In my role as an interviewer, I attempted to evoke insights through follow up questioning, and by inviting interview subjects to share their insights.

The next important facet of my role as a researcher was to detail my embodied, personal account of my experiences with metacognition. This required a deeply personal analysis of how my ideas of metacognition came to be developed through personal experience and reflection. For this I attempted to write a compelling, thoughtful, and exhaustive narrative, thick with a description of these experiences and ideas. In this narrative context I strove to be as honest and as detailed as possible to provide the reader with a strong point of reference with which to evaluate the work and its conclusions.

Finally, and most importantly, my role as a researcher was to analyze the data deeply and thoroughly. To identify patterns and common themes of conceptualization in the data a systematic approach of multi-leveled, organized coding was used. The applied multilevel coding scheme included open, axial and selective coding phases, which was further broken into a phase of contrasting coding and served to make subtle patterns in the data visible. Through this analytic procedure valuable insights into a broad theory of metacognition and its pedagogy were developed that are both insightful and actionable for future research.

In all facets of this research, I attempted to remain aware of my standing point, and the



lenses through which I viewed and described the data. Careful self-reflection and analysis of my thinking, in conjecture with the support and insight of the professionals on my doctoral committee provided crucial perspective needed. Research into implicit bias (Brownstein, 2019) demonstrates that it is not possible to fully eliminate the shortcomings of my neurological system or the influential lens of my past experience. However, by utilizing the guidance and insight of the professionals on my committee, as well as the tools of reflection built into the study, I have striven to address the existence of biases that may distort perceptions or interpretations of the data.

I do not believe I can be more honest about PAL or the impact the program's approach to metacognitive teaching and learning has had on my individual development. I have had a transformative learning experience. As a result, I have dedicated myself to investigating and identifying metacognition in all of its components. This learning experience has, no doubt, impacted my thinking. However, I also believe this experience is the source of valuable points of data. I have tried to present these experiences as plainly and honestly as I can. It is why I have chosen to integrate them into the methodological framework of this study for you to examine and bring into your research.

Jack Mezirow (1975) was the first researcher to identify the central features of transformative learning. Mezirow felt such transformations were most often experienced as the result of a crisis or a major life transition. My experiences with failure in high school fits this formulation. However, I also benefited from a third factor that Mezirow came to believe was most important. This third factor would be educational experiences induced by a skilled teacher (Mezirow, 1991). His descriptions of the changes in an individual's psychological understanding of the self and how they trigger changes in one's convictions, beliefs, and lifestyle rings very true

for me (Mezirow, 1991, 1975).

I have resigned myself to the fact that I am part of this research. This aspect of my role as a researcher was to collect and present the data related to my personal experience with metacognition, and how those experiences provoked an educational transformation within me. Care was taken to closely describe the first-person experiential elements of the educational transformation metacognitive education provokes. This insight also provided several unique layers of insight to this work: a visceral lived component of the education provided by the PAL program; a historical perspective on the evolution of the program; and the perspective of someone who was both a student and a professor for this program. However, these experiences color my impressions of the data. My hope is that through thick description and open discussion any bias that creeps into this study will not go unnoticed and will be addressable in a way that does not detract from the main insights.

My ultimate role as a researcher is to present what I have learned about metacognition and the pedagogical insights of these PAL professors, as well as integrate my years of research into the subject. Through this process I have been able to penetrate the subject deeply. My personal experiences as a PAL student, a teacher and a researcher developing and using metacognitive educational techniques has informed my understanding of educational transformation and produced important data to inform the domain of future metacognitive research.

### **Sample Population**

The study consisted of eight interview subjects. All were senior professors from Curry College's Program for the Advancement of Learning (PAL). Some were moving into retirement, but all were working as PAL professors at the time of their interviews. One was familiar with me

from my time as a Curry student. All subjects were female as there were no senior level male PAL professors still in the program at this time. These subjects were chosen because they were among the most experienced instructors at PAL. Their years of experience specifically utilizing metacognition in their practice at a time when there was little agreed upon common knowledge on how metacognitive education should be practiced makes their wisdom an important contribution to the field of learning and teaching. The participants received a consent form and pre-interview explanation of their rights as a test subject. Their names were removed from data collection and replaced with alphanumeric identifications. Data was stored on a password protected file on a computer requiring two points of verification to access.

### **Data Collection**

This study conducted four phases of data collection. Two phases of narrative data collection and two interview phases of data collection with faculty at the PAL program. The first phase involved writing a personal narrative related to my formative experiences with metacognition. The next phase of narrative data collection involved writing directly about my pre-analysis thoughts about metacognition. This analysis more directly addressed the questions asked of the interview subjects and my pre-analysis perspective on the subject.

A third and fourth phase of data was collected from the interviews of eight PAL professors. The initial interviews were roughly sixty minutes long and semi-structured around 11 questions that were developed as the result of a pilot study (Hulbig, 2016). During the final phase of interview data collection, participants were asked to read the qualifying paper *Toward a Neurological Understanding of Metacognition* (Hulbig, 2018) and attend a workshop that reviewed the information. They were then again interviewed utilizing a semi-structured questioning format regarding neurological perspectives on metacognition, and how they integrate

new scientific knowledge into their practice. A copy of the core protocol questions for each phase of the study are included in the appendix. The following is a review of the four phases of data collection.

### ***Phase I***

The first phase of the study occurred before the development of the interview questions. This phase involved developing a personal narrative of my introduction to metacognition and its transformative effects. This transformation was part of my initial rationale for pursuing this doctoral study. It was written over a two-year period before entering Lesley University's individually designed doctoral program, and was used as the self-reflective essay required for entrance into the program.

Since this time this piece has been reviewed and edited many times to ensure that it is factually correct and clear. This piece details my experiences growing up as a child with learning disabilities, and how I came to be a student in Curry College's PAL program. This first self-reflective narrative has been placed in chapter one of this dissertation because it provides perspective and a level of first-person insight that is intended to complement the review of the pertinent literature on metacognition. This narrative reflection was intended to provide the reader with baseline data about the researcher, PAL's educational approach, and my formative experiences with the concept of metacognition.

### ***Phase II***

The final narrative phase of data collection included data collected from my personal experience and development that was related to the core questions of the study. During the course of this research it became apparent that my experience as a researcher, a lecturer in the PAL program, a special education teacher running sub-separate classrooms in the public schools,

and a learning disabled student educated in these same systems provided a unique depth of perspective on the subject being investigated. This second narrative reflection was completed before all the interviews with PAL professors and was included in the appendix after the interview summaries.

The nature of research dictates a separation of the researcher from the subject in the effort to preserve the researcher's objectivity. A researcher can become biased by their subjective experiences losing both objectivity, and perspective (Roulston & Shelton, 2015). However, the very nature of the concept of metacognition spans both subjective and objective elements of investigation. By necessity this interplay between subjective and objective elements is part of metacognition, but this interplay does exist as an element of every researcher's process of data analysis (Pringle et al., 2011) However, more than other subjects of inquiry, metacognition can simultaneously be criticized for being too objective, and ignoring the internal conscious cognitions that produce the experienced phenomena, or too subjective, being so highly individualized the findings cannot be widely applicable.

Metacognition seems to exist at the nexus between subjective and objective cognitive stances (Nelson, 1996). Through my course of studies, I came to realize that I could try to address this explanatory gap in the research by adding my own reflections as data points. These data points could in turn be used to address concerns of personal bias by making my background and preconceptions visible before I began my analysis. These data points also helped to more clearly explain the educational approaches of PAL that produce transformative educational experiences. Finally, by including this data I also was able to identify growth in my thinking over the research process that may have otherwise remained obscured.

### ***Phase III***

The third phase of data collection involved interviewing eight PAL professors about metacognition and their practice. Interview questions were developed out of pilot study work done during an independent study titled, *Metacognition at the Program for the Advancement of Learning* (Hulbig, 2016). The questions of this pilot informed the creation of the first phase of questions in this study. Along with updated versions of the questions used in the pilot, additional, more direct questions on how metacognition is evaluated were added.

Earlier research into theoretical perspectives on metacognition (Hulbig, 2016) led to the identification of three conceptual stances that can be taken when discussing the subject. These three conceptual stances are intrapersonal, interpersonal, and socially constructed. Intrapersonal stances were defined as personal approaches to metacognition, or as references to the respondents own internal processes. Interpersonal stances were defined as interactive approaches to metacognition centered around discussion with another person. Socially constructed stances were defined as references to metacognition that were derived from research, the media or formal institutional education. The protocol questions were formulated to allow the professors to define the terms of the questions for themselves and provoke the identification of subtle interpretive differences in their stances, as well as identifying if the subjects were inclined to one conceptual stance over another.

Interviews were largely conducted in the professors' offices at PAL, with the exception of one that was conducted in an office space at Lesley University. Professors were provided with the core protocol questions before the interview to allow them the opportunity to more deeply contemplate their answers. A few subjects drafted answers to these questions that they presented alongside their interview answers, and were integrated into the collected data. One subject shared

a letter written by a former student that they had, who unfortunately ended up dropping out of Curry, but attributed their later success in life to the skills they learned from attending the PAL program.

#### ***Phase IV***

The final phase of data collection began by presenting subjects with a copy of the paper *Toward a Neurological Understanding of Metacognition* (Hulbig, 2018), which covered research into metacognition drawn from the field of neurology. This was followed by having them attend a one-hour workshop on the information contained in the paper. The intent of this phase of investigation was to determine how these professors utilized developing scientific information related to the process of metacognition to help neurologically atypical student's function. It was hoped that the introduction of this component would reveal how these professionals integrated new information into their thinking and practice. It was also hoped this course of investigation would reveal unique data into the metacognitive perspective of learning.

This phase of data collection presented interesting challenges. Workshops were scheduled to be as convenient, informal and informational as possible. Even with flexible scheduling, one participant was unable to attend the workshop, but agreed to read the paper *Toward a Neurological Understanding of Metacognition* (Hulbig, 2016) and be subjected to the second phase of questioning. One subject agreed to attend the workshop, but declined participating in the phase two interview providing written answers to the questions instead.

The workshops were conducted in small sessions, with three or less subjects per session. One concern was that this model did reveal the identity of some of the subjects to each other. Though no session contained all the study subjects, it was a concern that this would impact the desire of participants to be part of the study. Subjects were informed of this concern, and

encouraged to withdraw from the study if they were uncomfortable. Despite the airing of this concern all professors agreed to continue to participate.

This phase of interviews was conducted after each workshop. Interviews were, on average, 40 minutes long and conducted with individual professors in their offices at PAL. Professors were provided with the protocol questions before the interview. For this round of questioning none chose to supplement their interviews with written responses. Both interview sessions were transcribed utilizing a transcription service, and then re-transcribed by the author.

The data collection of one interview subject was disrupted due in part to their busy schedule that prevented their participation in the workshop. After consulting with my committee, a final question was added to the data collection regarding the subject's formative learning experiences with metacognition. This question was presented to the subjects via email. Each subject was given the option to respond in writing or in person in a follow up interview.

### **Procedures for Data Analysis**

Coding procedures for data analysis were adapted from Strauss & Corbin's (1990) grounded theory approach and the earlier inductive–deductive analysis approach of Schutz (1967). Through this approach, I recorded what these researchers said, both at a practical level and deeper contextual level. Through this approach to analysis (Schutz, 1967; Strauss & Corbin, 1990) the first order processes used to make sense of the phenomena of metacognition were identified, as well as its role in their pedagogical practice. A second order understanding was developed through refined coding. This second order understanding identified several pieces of a widely generalizable form of metacognitive practice. Coding drawn from these interviews produced a description of a metacognitive teaching strategy that could be applied widely across educational settings.



A third order of analysis was identified by integrating the second order finding of a generalizable metacognitive practice with broader interdisciplinary practices and neuropsychological research. From this third order analysis contrasting categories of information were identified. A fourth order analysis of the data was drawn from these contrasting categories. These layers of analysis were applied to the narrative and integrated with the research data to produce a theory of the phenomena of metacognition that identifies it as foundational to the processes of learning. Careful and systematic analysis of the coding of the data led to the identification of themes, categories, and relationships, which in turn enabled the isolation of higher order relationships.

Data analysis began with open coding of the collected interviews. This first round of coding sought to isolate concise answers to the questions, and statements that were initially considered powerful or strongly insightful. Many of these statements became jumping off points for future coding. These initial codes were used to create individual summaries of the subject interviews using their own words.

The initial open coding was followed by axial coding. Axial coding uses an intrapersonal, interpersonal and social construction categorical lens. These categories of analysis were identified during the pilot study as a formidable way to draw abstract relationships out of the data. This data provided insight into subtle differences between how these professors both conceptualized and utilized metacognition in personal, interpersonal and social contexts.

Statements coded intrapersonal were defined as statements that referred to the subjects' personal subjective practice. Statements coded under this scheme included personal practices of reflection and self-regulation. Spiritual and private meditative practices were included in this category when they were made outside of a broader social reference to a religion or school of

thought. Intrapersonal codes sought to identify those metacognitive practices that developed largely from within the individual themselves.

Interpersonally coded statements included those that involved discussion and dialectic interactions between teacher and student. These would include co-created skills and the process of metacognition that occur between two individuals directly interacting. Coding included statements about interpersonal relationships. Statements coded as belonging in the category of social construction were those that referred to research, media, formal definitions or educational sources. These would be sources of knowledge about the brain and learning that come from institutions of learning or mass media.

Another dimension of coding involved the identification of recurring patterns found in the data between interview subjects. Two rounds of distinct coding procedures were used. First, codes identified using traditional, by hand and paper organization techniques during this coding routine, statements were highlighted with color codes and placed into a visual web using a computer-based mapping program called Popple. Then, the transcripts were moved onto a computer based qualitative analytical program called Delve. This software allowed data to again be arranged, color coded and thematically organized. Patterns in the data derived by this computational procedure were compared with the patterns identified during the hand coding procedure. This dual process allowed for deeper analysis of the coding and an added check on validity. Common themes and conceptualizing categories such as relationship, questioning, modeling, and evaluation were identified as significant during both evaluations of the data. The computer program was able to bring to bear an increased level of organization of the data that produced the conceptualizing categories used to identify the contrasting expressions in the data and specific coding.

The first contrasting codes were related to teaching practices that either represented an organized planned teaching defined as pedagogy, or those that represented an individualized and situational teaching defined as praxis. Other contrasting codes related to the conscious versus unconscious description of metacognition, the use of neurological versus psychological data, and traditional versus non-traditional definitions of metacognition. Finally, each interview was coded one last time for statements of deep insight that were missed or under-appreciated during the first round of open coding. This information was analyzed, organized and written before going into the narrative analysis.

A full data analysis using the open, axial and selective coding schemes detailed above, was then applied to the data from the narrative phase of investigation. The same systematic approach that was used with the data collected from the interviews, was also applied to my own narrative reflections. The multilevel systems of analysis employed for the interviews of the PAL professors provided the structure for the narrative analysis.

The narrative was initially coded for answers to the protocol questions or strong statements, then axial coded for intrapersonal, interpersonal and socially constructed statements. The last round of coding focused on the themes of selective coding relating to relationship, questioning, modeling, and evaluation. A final level of contrasting codes were identified utilizing the Delve qualitative research tool. These contrasting codes included pedagogy versus praxis, conscious versus unconscious descriptions of metacognition, the use of neurological versus psychological data, and traditional versus nontraditional definitions of metacognition.

The final stage of narrative analysis identified insights that were missed, underappreciated during earlier rounds of coding, or unique to the narrative analysis. These codes were then organized with the codes taken from the professor interviews and analyzed

together using Delve to produce the third order insights. These insights are presented in the following discussion section of the dissertation.

### **Limitations**

Qualitative study is subject to certain limitations. The relatively small study size and highly targeted sample are limitations of this study. While the sample population was chosen due to their high level of experience with the subject matter, they do not represent the full diversity of educators who utilize metacognition in their practice. Future research would benefit from interviewing a wider range of practitioners. There may also be benefits to investigating the insights of educators who do not specifically teach a metacognitive curriculum or who work with students who are not learning disabled. It may be instructive to investigate the views of professionals who utilize metacognition with students who demonstrate either very high or very low educational attainment.

The sample was largely drawn from a female perspective, with the exception of my narrative input. The sample also lacked minority representation. Having collected data from a narrowly chosen cohort of PAL professors may limit how generalizable the results are to other populations. Though it may not be possible to compare the metacognitive experiences across populations, this could be a fruitful area for further investigation. It is also possible that people with other learning disabilities may have a different experience with metacognition. It may be that individuals with other health issues or chronic illnesses may experience metacognition differently.

The depth and complexity of this kind of qualitative study is constrained by limitations of time and resources. For example, it became necessary to limit the study to eight interview subjects due to constraints of time. These time constraints were a difficult impediment for many

of the interview subjects who were asked to volunteer two hours for interviews, attend a one-hour workshop and thoughtfully read a long research paper on the neurology of metacognition. These constraints will also make study replication difficult. Also, the subject matter being limited to participant's beliefs about metacognition and pedagogical practices, while potentially of high importance to certain targeted fields of research like metacognitive pedagogy, could also be necessarily difficult to generalize. Despite these limitations, the data presented displays a level of authenticity and range of perspective, capable of providing a sophisticated understanding of the phenomena that suggest practical actions that can be taken.

### **Ethical Considerations**

Through this research project many steps were taken to maintain ethical integrity. First, a consent form was presented, which informed participants of the purpose of the project and how they would be protected if they chose to participate. Participants were informed, both through the consent form and a brief discussion at the beginning of each interview in the process that participation was voluntary and that they could withdraw at any time. The consent form detailed how participants' names would not be used in data collection nor in the written dissertation.

Each interview was assigned an alphanumeric code that was used on all transcripts and analysis documents in order to guarantee anonymity. Only the researcher, and briefly the transcriber would have access to the transcripts, which were stored on a password protected file requiring two-point verification to access. Several times throughout the study respondents were informed of the process. They were also explicitly given the option to withdraw from the study if they felt uncomfortable about attending the workshop, or any part of the study for any reason. While no participants chose to completely drop out of the study, as stated earlier one respondent did request not to participate in the second phase interview, and one participated in the interview

and not the workshop.

### *Validity*

Validity in qualitative research is a measure of trustworthiness. Several strategies were used to promote the validity of the study. A key strategy was to build an honest and supportive relationship with the interview subjects, so they felt comfortable sharing their deep insights into the teaching practices of metacognition. Questions were carefully crafted to capture specific traits about metacognition and subtle differences in the way interview subjects framed their understanding of the subject. The multi leveled grounded theoretical approach to data analysis created insightful analytical routines through a process of open, axial, and selective coding of the transcripts. Finally, the decision to collect narrative data at points before the interviews and analysis portions of the process, as well as the use of a consistent analytic coding strategy for both the interviews and narrative was done to ensure validity.

Written notes and artifacts from the participants and their practice were also collected. These artifacts consisted of letters from students, research suggestions and protocols from assignments. The tapes and transcripts of the interviews were reviewed multiple times, as were the codes developed through these observations. Along with actively looking for contradictory data, my progress was regularly reviewed with my senior advisor and committee. I was also greatly supported by the Executive Director of Disability Support Services at Lesley University. Concerns of clarity and validity were addressed regularly through meetings, conference calls and emails with these individuals.

The largest threats to the internal validity of this study were the small sample size and partial attrition of one subject who was unable to participate in the workshop phase of the study. There also could have been some interaction between interview subjects as a result of the

workshop format. Because of concern for this impacting subject confidentiality and validity, care was taken to contact all the participants and inform them of their option to withdraw from the study if they felt this would impact them. No professors opted to withdraw, but there could have been some communication between professors about the study that could possibly impact validity.

Finally, methodical triangulation between the interviews, personal narrative and theoretical research was utilized to present a balanced evaluation of the data to the reader. The open, axial and selective coding employed during data analysis was an example of the triangulation used to ensure analytical validity. The application of the same coding scheme to both interviews and narrative data also ensured that both data sets were similarly analyzed. Plus, several theoretical schemes were utilized in the final interpretation of the Metacognitive phenomenon including perspectives drawn from educational, neuropsychological, information/sensory processing, ontology, epistemology, mathematics and physics to ensure the produced theories were widely grounded in data from various fields of inquiry.

### ***Reliability***

Reliability in a qualitative research project means identifying whether findings are dependable and consistent within the data collected (Lincoln & Guba, 1985). One strategy that was used to maintain reliability was the use of a consistent coding scheme across both case studies and narrative investigations. This was done to ensure that the same categorical features were examined across the various forms of data collected in the study.

The central strategy used to maintain reliability and external validity was to document the reasons and potential influences on the choices made through the course of this investigation. To this end, each professor interviewed was asked to read their transcripts and give feedback as to

whether they felt the paper properly represented their thinking on the data. Participants were also invited to read and comment on an early draft of the final dissertation to be sure they felt they were properly represented. Finally, to address the potential impact of unintended bias a detailed expression of my history and personal perspective was provided and built into the study as a perspective data point.

### **Chapter Summary**

Chapter three has reviewed the methodology of this study. It presented the rationale for the integration of case study, reflective narrative and grounded theory approaches and reviewed the general qualities of each method. It also identified my role as the researcher, and the steps I have taken to avoid bias and increase both validity and reliability. It described the approach of the various aspects of the interview process, ranging from the execution of the interviews to the presentation of the workshop and its supporting document, *Toward a Neurology of Metacognition*. This chapter also described the study participants. This chapter provided the reader with an explanation of the various phases of data collection and analysis, as well as covering the measures taken to promote validity and reliability while identifying ethical considerations and limitations of the study.

## **CHAPTER 4**

### **ANALYSIS AND FINDINGS**

#### **Overview of Chapter**

This chapter outlines the analysis of the data and the findings of the process. Each stage of data analysis is identified by the type of coding with subsections delineating the chief findings at each stage. A summary of the main findings is delineated at the end of the chapter.



## Open Coding

During the initial open coding of the interviews, statements were identified for their relevance regarding the questions asked, because they seemed interesting, or were identified by the interview subject, themselves, as important. This coding was also turned into concise overviews in each subject's own words, expressing their perspectives and what was discussed in the interviews.

Despite all professors in the PAL program ostensibly teaching toward the same goals, approaches were highly individualized. Professors invited the opportunity to express their knowledge about what they did. Some even expressed an interest in having an opportunity to hear how other professors approached the subject of metacognition. Subject A, identified wanting to hear specific strategies relative to individual student needs. Subject A:

...to really hear some of the more interesting things that people have tried and found to be effective in each of the metacognitive areas, executive functioning, all of that. (I'd) be really interested in hearing very specific things, like I had this kid once and ... Just something just to spur the creativity that lets us, I think, create innovative ways of working with students. It kind of sparks things that gets more ideas rolling.

Some even expressed an interest that they appreciated opportunities to share professionally.

Subject B noted:

I think this department used to take time to have collegial conversations of

student concerns. There was an effort to kind of put that back together. But we still don't have the time to talk about practice and how we're all using metacognition, or what are we calling metacognition these days.

This idea was corroborated by interview subject G: "I think we don't have enough time to play with ideas like this and then relate them back to our practice."

This need for opportunities for professors to share ideas and experiences pointed to a twofold issue. First, practical research into teaching approaches to metacognitive and self-regulatory skills have been lacking generally (Tryggvason, 2009), and often focus on classroom procedures not the individual interactions between teacher and student seen between PAL professors and their students. There would be educational benefits to identifying specific situational techniques favored by these professors that are aggregated and distributed in a way that makes them more accessible to teachers generally.

Secondly, the highly interpersonal and individualized nature of the metacognitive education practiced at PAL does not lend itself to easy standardization. Subject C hinted at the difficulty standardizing an approach to what she did:

It's going to be really hard to translate something like this into a curriculum, it's going to be hard to translate something like this into a program. We have a program here that is staffed by 22 very different, individually different, and high achieving faculty members, and they're each going to do it in a different way.

The highly individualized nature of the program and shifting nature of the subject matter presents unique professional development needs for these professors. This itself could be a line of

research that would be of interest to both present members of the PAL faculty, and those in the future interested in studying the development of this program's pedagogical practices.

### **Initial Findings of Similarities**

Despite the lack of a strictly standardized teaching approach, many broad similarities were identified between the PAL professors and their practice. All agreed with Flavell's (1979) basic definition of metacognition as learning about learning. However, some identified a feeling that metacognition encompassed more than what is simply inferred by this definition. For example, Subject D noted: "It's not about just thinking about thinking. It's got to be more than that." Subject B described metacognition this way: "It's a very seemingly simple, elegant if you will, phrase." Some like, Subject G, insinuated a desire to expand the definition of metacognition: "I used to define it as thinking about thinking. But now I define it more as being aware of one's thought processes, which includes implicit attitudes, explicit attitudes, emotions... I really think about thinking as a broader concept than just language." Others, like Subject B, identified a quote by Flavell used during the workshop as an example of the potential to expand the definition of metacognition beyond a point of usefulness: "that definition of metacognition kept growing and growing and being more and more and more encompassing...I thought metacognition is sort of like it's becoming god-like<sup>5</sup>." This quote highlights the importance of using proper conceptual constraint when discussing metacognition to avoid a recursive conceptual expansion of the definition.

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<sup>5</sup> The Flavell quote: Flavell (1979)- "metacognition plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and, various types of self-control and self-instruction; there are also clear indications that ideas about metacognition are beginning to make contact with similar ideas in the areas of social learning theory, cognitive behavior modification, personality development, and education."

All identified metacognition as important to their practice. All interview subjects directly identified metacognition as a core educational concept, and expressed feelings similar to Subject C, who said: “I think metacognition as a statement... is what education is all about.” Outside of a general agreement of the importance of metacognition and the general definition of thinking about thinking, there were surprising differences. Some saw the word itself as problematic, “I don't like the word metacognition. I think it sounds like... it's making something sound more intimidating than it is” (Subject E). This was identified as a particular problem with parents by Subject D: “(In) My experience... a lot of parents (do) not get it. And I want them to get it because it's important for them to understand.” One way to bridge this gap was offered by Subject E: “I really do see metacognition as self-awareness and in some ways would be more comfortable thinking of it, as aware(ness) of... who you are.”

All of the subjects talked about emotion as a confounding factor in the development of metacognitive understanding and thinking. Over half of the subjects, A, B, D, E, G and H, specifically identified an underlying emotional component that needed to be addressed before being able to get into the work of self-regulation and self-monitoring. “The problem when you work with adults with learning disabilities and attention deficits is that (they) have had their needs inconsistently addressed” (Subject B). Students with emotional issues were identified by Subject C as having the most difficulty: “Students who have some other difficulty with self-regulation... stemming from a psychiatric/psychological challenge with depression, anxiety, obsessive-compulsive. Those students are having a very difficult time.”

### **Axial Coding**

The abstract features of metacognition identified during axial coding were intrapersonal, interpersonal, or societally constructed. Intrapersonal statements were statements pertaining to an individual's subjective practice of metacognition, self-awareness and self-control. Interpersonal codes pertained to dialectic discussions or small group interactions between a teacher, or other individuals, that support metacognition and self-regulation. Societally constructed statements were those that referred to metacognition through the lens of a theorist or institution. These codes represented wider social and institutional perspectives on metacognition.

The coding scheme of intrapersonal, interpersonal, and societally constructed were identified during the earlier pilot study (Hulbig, 2016) and from differences in practice identified in the broader literature related to metacognition (Artino, 2008; Darabi, Nelson & Paas, 2007; Downing et al., 2009; Dweck, 2013; Pennini, 2006; Schwarz, 2015). The questions developed for this interview were purposefully designed to allow the interview subjects to choose their definitional perspective without being guided by the frame of the question. Analysis showed deep relationships and made visible abstract interconnections that transcended these three dimensions, demonstrated by responses that overlapped or blended perspectives.

Through this coding system it became possible to analyze a subject's descriptions of metacognition to reveal aspects of their underlying stance toward the subject. For example, individuals with very personal and individualized conceptions of metacognition were identified by the number of intrapersonal statements that they made during the interview. Similarly, many interactions between student and teacher were identified as intrapersonal, revealing further subcategories related to these professors' pedagogical approach to metacognition. The social

construction codes helped identify the professors' reliance on research, institutional or prescribed learning structures, as well as the limitations these structures imposed.

Axial coding revealed a pattern that allowed subjects to be identified by two qualities. First, the unique nature of the metacognitive relationship the interviewees aimed to establish with their students. Second, was the transformational quality of their metacognitive educational practices. This practice was perhaps best encapsulated by interview Subject H's description:

The learning conversation is a deeper conversation about their hopes and dreams, passions, their fears, their frustrations, their successes, their social life, the way they think, what I'm noticing that day, what they're noticing that day. I engage in deep listening, so I can be fully present in their discoveries, their tears, their joy.

These conversations between student and professor, evolve over time supporting the learner's development and self-regulation.

The interpersonal quality of these learning conversations would frequently be paired with the development of intrapersonal insights from the professor's personal practice or social insights from the literature. These conversations highlighted an interactive process of elevating the students' powers of reflection and self-assessment that seemed to transcend the intra-, inter- and social framework of this axial coding scheme. There was a clear connection between these interpersonal learning conversations and increased intrapersonal self-regulation, both for the student and the professors themselves. This support aided in the development of new skills and self-regulatory behaviors.

Axial coding revealed that metacognitive teaching was more than just a step by step pedagogical approach, but rather a perceived responsibility to engage in a process focused on guiding students through the transitional gates between the personal, interpersonal, and social demands of their lives in college. These professors saw their role as supporting their students to develop strategies to meet the demands of college and life. Sometimes the process was simply letting the student know something they did not know before or, as Subject G put it: “you should model the process of metacognition for your students.”

Subjects A, C, G, and H described how they utilized their personal practice of metacognition to confront their cognitive biases, which in turn enabled them to provide a supportive practice to their students. “I’m constantly using metacognition while I’m teaching, and on myself, thinking about my thinking and my approach and my responses to my students (Subject G).” Metacognition was conceived of as a cognitive tool from this frame of reference, one that guided a professor’s modeling behavior, and the way they addressed their students’ fears and anxieties. By drawing from their own personal metacognitive practice, these professors have become more adept at addressing cognitive rigidity both in themselves and their students. This was most eloquently expressed by Subject G: “It’s a tool that I use to become more aware of my ability to be open and accepting and kind and loving to people.” In reference to their pedagogical practice, Subject B used the metaphor of metacognition as a vehicle to educate students about patterns of thought and behaviors that can be utilized to address their unique learning. “It’s a vehicle for getting some things done.”

The system of axial coding also identified a professor’s frequency to draw upon standardized researched practices, as opposed to personally developed approaches, and when they integrated both into the work they were doing with students. Interestingly, it was found that

the majority of statements correlated to a direct individualized interaction between the professor and their students. This suggested that these professors employed a kind of embodied educational practice, or praxis, that was highly individualized from moment to moment. The identification of this relationship led to a deeper selective coding, one that was able to identify practical differences between practices of pedagogy and practices of praxis.

Axial coding identified several abstract relationships in the data that were more deeply investigated during the selective coding phase. These abstract categories revealed a strongly interactive teaching style. This teaching style drew upon connections between the professor's personal practices of metacognitive self-discovery, research based practices from psychology and neurology, and a strong relationship between student and professor. Investigation into these themes, and others, occurred during selective coding.

### **Selective Coding**

Selective coding was used to identify relevant themes represented across interview subjects. It was used to make visible abstract relationships and patterns uncovered in the data. Selective coding consisted of two types of coding: single theme and contrasting. Single theme codes were targeted due to their identified significance during open and axial coding. Single theme codes were related to statements about definition, relationship, modeling, institutional problems, and questions. Contrasting codes were themes that could be broken into contrasting stances, such as pedagogy vs. praxis, psychological vs. neurological, and conscious vs. unconscious.



### *Relationship*

Relationship was mentioned several times as one of the most important elements of teaching metacognition. Subject F reported it was: “very important to build a positive relationship with them so they want to grow.” Subject D observed: “I often think that some of the magic at PAL is that we take the time and have the relationship to go there.” The place where their relationship allowed these professors to go with their students was a zone where emotion, action, and learning was integrated with a student’s self concept. These codes often blended or overlapped with other codes identifying them as statements of unique importance to the practice of metacognition. As Subject A noted:

I think in order to teach anything, including metacognitive strategies, relationship is key...From the relationship we relax enough to show what we don't have a real good grasp of. That lets whoever is kind of scaffolding in that interaction, allows them to see enough of what's going on inside of you to create something to help you figure out how you move forward.

This learning relationship was succinctly described by Subject B through a story about a student who was having academic problems and needed to have a difficult conversation with a professor: “It was a very mindful kind of thing that we worked through in that moment using that conversation that he was dreading to have with the professor.”

There were many descriptions of professors creating an emotionally safe space for their students, as described by Subject E: “It is my relationship with students that allows metacognition to happen, the non-judgmental, and the acceptance, so that it's okay to be honest,

even about things that you don't want to be honest about.” Subject E also identified this relationship as being one where power between teacher and student was integrated into the relationship:

I think it's really important to feel some connection before you progress into conversations with metacognition. I also think there has to be some kind of equality before that can happen.

Subject F described the subtle way she used her relationship with students to influence them to grow:

I try not to make a lot of negative judgments about it because then he won't want to do anything about it. But if I tease him about it, and cajole him a little bit about it, he's more ... because I have an excellent relationship with this kid he's more willing to address that behavior in a different way.

Another reason for this relationship was identified by Subject B: “I have students be in the relationship equal in power because I want them to practice their agency.” Statements like these suggest that metacognitive education requires a level of equality between teacher and student that is not only quite different from the traditional teaching model but is done for the practical reason of enhancing a deepening of the learning experience itself.

Metacognition seems to integrate abstract cognitions and visceral concrete cognitions in ways that produce new understandings. Several comments suggested that metacognitive learning leads to a general awareness that is qualitatively different and encompassing of multiple data points:

... a lot of people are completely blind to (it). They don't even believe that it's happening. Like you could be in a group, and you could know, boy this is not working. And someone else could think that it's moving along beautifully because the language is the cohesive element that they're using, and nothing else. No body language, no eyes, you know what I mean? (Subject A).

While this statement from Subject A seems to identify a perhaps missing intuitive or nonverbal element, others indicated that there was a very temporal and embodied element also: "There's a person in the room and there's the past, and somehow we have to get there. We have to bring those two together (Subject D)."

Subject E also connected curiosity with the need for a safe secure learning relationship: "I think curiosity adds a little lightness to it also, so it's not so heavy and scary. It's interesting, it's going to be interesting." Through curiosity she was able to change the emotional energy of the learning. This ability to change the emotional energy of the learning through language was also described by Subject F:

If you have a relationship with someone and you can go, "I'm doing it again."

It's so much more effective than if (you) just say it to yourself."

The simple phrase, "I'm doing it again" represents a specific constellation of issues and repeated behavior patterns that impacted this student's progress. It is a simple phrase that serves to define, identify, and emotionally frame these issues as a curious problem to solve.

There were also several components that were identified as necessary to build this relationship. One was vulnerability:

Part of building of the relationship is building a rapport and part of building a rapport is being vulnerable, a little bit vulnerable...You don't want to make it too heavy (Subject F).

Subject E described it as:

One reason I feel like I get along well with my students is that I acknowledge that we're both... We're all just humans, which means we're all imperfect, and we're all working on doing better. I think that that acknowledgement goes a long way in my connection with students.

Subject A identified what they saw as a common block that impaired a teacher's ability to build this kind of relationship:

People kind of slip into something, like a role or authoritarian gig or something. I think there's less vulnerability in that, and so less of an authentic relationship.

Subject F indicated that a teacher: “must care and not just teach metacognition.”

Another necessary component expressed was a high level of authenticity. “I think you have to be brave, and you have to have some level of confidence, at least with the people you're with, in order to be authentic (Subject A)”. Some professors described what seemed to be an almost heroic level of courage in their students:

They come into the program...managing issues like depression, all kinds of depression, anxiety, certainly attention and focus issues, all kinds of language

processing difficulties and yet, courageously, they're still here (Subject, B).

Understanding the impact of their student's personal history was considered important across interviews. Subject H described the need for this sensitivity as: "Sometimes people struggle so hard that they get disconnected, and not only from themselves but from other people." Subject E described how she would like to deeply understand: "how anxiety impacts (them), I want to learn how to undo it so that students can have some way of dealing with that."

Frequent statements by these professors demonstrated a deep respect and admiration for these students and their understanding capabilities. Subject C described her work with a student as:

There's like this implicit curriculum that we're making explicit for him before he even gets to his content that he's studying. And that he sees his learning as collaborative...To me (it) is remarkable that he can imagine that...his cognitive space is amenable to change and he wants people in it.

However, despite common components of honesty, vulnerability and authenticity it was still difficult for professors to describe what was happening.

I don't know how I do it to be honest with you. It's funny, because part of what happens is that a student will walk into my office and they'll sit down and then it just starts to happen, where there's this sort of give and take (Subject E).

Subject F also acknowledged a difficulty pinpointing exactly what the necessary components were for this learning relationship to develop:

Sometimes I don't really know why because I don't feel like I'm the most attentive teacher or the best teacher or the perfect teacher. But it is about relationship and there is something that I do, and it has maybe to do with being

informal rather than formal.

Subject H used the stronger word, 'connection', to describe metacognition itself:

What I see about metacognition is... It's about connection. Not only just a connection to yourself, but connection between the two of us. Connection to the classes. How it connects deeply to your life.

Statements like this suggest a deep and powerful role of relationship in metacognition education that perhaps transcends the simple roles of teacher and student and encompasses both the student's academic demands and emotional experience. Regardless, the relationship between student and teacher achieved by metacognitive learning seems to powerfully impact both the student and the professors as evidenced by this statement by Subject C: "I'm just so honored to be invited into their thinking process and be able to be with them."

### ***Modeling***

Modeling was a universal theme across interviews. For most, it was an important part of their approach, "you should model the process of metacognition for your students. And necessarily use language to give voice to your awareness (Subject G)." Some described their modeling approach as, "I'm honest with them. I'm authentic with them. I share my own personal experiences (Subject F)." Others specifically identified that they: "model ways to remember, retrieve, and apply the information (Subject D)." A common modeling intervention expressed by Subject D was to use metacognitive questions because: "They're easy to remember," and were easy to make, "a normal part of what they do on a daily basis." Many described this kind of metacognitive modeling as: "just how you operate, I just automatically do it in my practice with students and in my own life (Subject G)."

The modeling of metacognition was a formative experience for at least one professor who described:

I had really good models in my home... I remember... the modeling that my mom had done and how critical that was for me for problem solving. Even her voice would change as she tried the new approach, and I would sit there and do my homework and I could hear her be like, "Well what about if," and she'd re-engage with her thoughts in a totally different voice, and I'd be like, "Oh she's got a new idea. I wonder what that one is," and I'd listen and do my homework... after she had died, 10 years after her death, realizing that she had modeled how to mull over thinking, like how to actively engage in thinking and revise it and flip it on its head and do it again and what a gift that was (Subject C).

This description described the metacognitive modeling observed being employed by other professors during their interviews. It was noted that all professors slipped into moments where they described their practice through a reenactment of the dialogue, likewise, using differing tones of voice to indicate different individuals speaking or differing lines of thought. Some of the richest and most interesting data came through these presentations of discussions professors had with their students. Closer examination revealed that what these professors portrayed was not simply what was said, but also the thinking involved in the exchanges. This example by Subject B demonstrates:

Initially, I said, "Well, that seems like you're going to have brain freeze. That's a worry, by the way you're talking, it seems like you're going to have brain freeze." Then ultimately, it really was, "I'm scared, I'm anxious and when that happens, I

get angry and it comes out as a bad temper, and I flare." He was thinking through his process. "I'm anxious and worried, I'm embarrassed and where this was all headed, this actually is my ... If I start with this, then this happens and then this happens and then I get mad." Before it was sort of free floating, not nailed down at all and then there was this look of recognition, "It's a problem to solve, so I could compartmentalize those feelings and put them somewhere. It's a problem to solve, something I can repeat to myself so I can keep my emotions in check and how I fly off the handle is this is the progression for that."

This example by Subject B also demonstrates the previously mentioned learning technique of compacting many of the students' problematic behaviors and feelings into a phrase. Here Subject B's use of the phrase, "its a problem to solve" is similar to Subject F's use of the phrase "you are doing it again" with her student. Both serve to take, what would seem a wide field of issues, and turn them into a single actionable phrase.

This propensity for modeling behavior was deeply integrated into their practice and came out organically as they described their educational practices. The modeling done by these professors was purposeful, and intent on revealing a process to better control self-regulation. Interview Subject A identified that teaching metacognition this way allows you: "to see enough of what's going on inside of you to create something to help you figure out how you move forward." This appears to suggest that these professors are using modeling at PAL in a unique way. They are modeling a cognitive interaction, representing not only thoughts and actions, but also a process of bringing understanding to multiple perspectives and modes of action in the service of improving one's own actions.



*Institutional and Social Barriers*

Recurring themes of conflict between the way metacognition was practiced at PAL and broader social/institutional conceptions of learning was found in the data. Subject H succinctly identified this as: “The biggest problem I have with metacognition is academia and the way they misperceive what we do.” Subject C described the problem through a conversation with a non-PAL professor who was described as saying:

I just want to give them things to do and tell them to do it, that's what I want to do.” And I said, “I don't want to give them things to do and tell them to do it... I want to teach them what they could do, and how they could do it.” So that when they come to a new situation they can say to themselves, “what could I do and how would I do it?”

Interview Subject C described the reason for this divide in approaches: “It is so much harder, on the teacher, I believe, to do the metacognitive work.” The source of this problem for Subject C was the difficulty for teachers: “To take the time to teach the students to understand what metacognition is.” Others, like Subject D, identified an over reliance on reaching curriculum standards: “You know why it's not done all the time? Because we worry so much about covering content.” Subject G identified a common implicit bias that she believed greatly impacted a professor's ability to develop metacognitive thinking in their students: “If professors believe motivation is a personality choice or personal choice, then when the students aren't motivated, they get to blame the student.”

For Subject H this problem was also exacerbated by a lack of neurodiversity in the teaching profession, “We need a better balance in education. You know, I mean, we need more

people to think out of the box because there are more and more students who are outside of the box.” This lack of neurodiversity negatively impacted students with specific learning disabilities (SLD) because:

They need to see that there are people who think outside of the box. The need to see that there are people who, who don't think linearly...it is sort of like, having a bunch of black students and white teachers. If we do not have mixed teachers, students don't have somebody they can look at and say, ahh, I know this person (Subject H).

A number of statements indicated professors were noticing a broad increase in social conditions that negatively impact metacognitive development. “This is a very challenging time, but it will probably become challenging in other ways down the road. I just feel like everybody's being pierced and interrupted. It's very hard to set the sort of boundaries needed for reflection and thought, real thought (Subject A).” Three areas of social disruption were identified by Subject C. The first was, “They can use the computer and they can use the internet to access information faster than I will be able to simply because they're native about the process, but then when I watched them access that information, I realize they're not being critical consumers of the information.” The second was, “We're seeing students who have been parented in a different way than they were parented 15 years ago, 20 years ago, 30 years ago, and that type of parenting could be influencing the type of development we see.” And the third was, “The whole purpose of learning has shifted in a way that I think also impacts the way that they're developing.”

There was broad acceptance that metacognition was not only developmental, but that development could be impacted by learning experience. However, the lack of a curriculum or

formal process of intervention was identified by interview Subject C who said: “I don't know that there is an intentional curriculum that is woven through the developmental stages that we teach across the academic lifespan.” In terms of professional development Subject G felt: “including it in teacher education is super important.” Subject H saw metacognition transcending curriculum, indicating that teaching metacognitive thinking should be a core principle of education.

“Learning how you learn and learning how to connect with your work is what education should be about... Connection, metacognition and engagement (need) to be at the top of everybody's list in education. Not the bottom, the top.”

### ***Evaluation***

The question of whether metacognition should be graded initially appeared to reveal a real split between practices. Some professors, like Subject F, believed strongly that metacognition should be evaluated. For her this was done through a writing assignment on a student's metacognition, stating, “papers will be graded. There will be a rubric and there will be expectations, and they'll be graded on what they write.” She cited the needs of the teacher saying, “if you're just teaching about metacognition, you have no way of knowing if they get it, do they really get it? It's an abstract concept so it's nothing they can touch so we have to make it touchable, experienceable (Subject F).” Others, like Subject C, also felt: “Don't you want students to know where they stand.” However, she struggled over the idea of who should be giving the grade:

Is it my grade or is it their evaluation of their metacognition with an expert guide? Can you fail at metacognition? Is it a direct assessment or an indirect assessment? Because my research and training would say it has to be both.

Other professors took the opposite stance, like Subject E: “I don't think you can take a test on metacognition.” However, she did not rule out an informal assessment in a conversation: “I would have a conversation about how students use metacognition, how they use their self-awareness in becoming better students or whatever their goals are.” Subject G stated: “No, I would never grade it...I'm very averse to grading. I think it diminishes whatever's been accomplished.” Subject B described it this way: “Feedback, not evaluate,” sarcastically indicating that she would never say, “Doing a good job there, Sport. I give you an A in metacognition... I would never do that.”

### *Questions*

Questions were also found to be a central component of metacognitive teaching at PAL. Most, like Subject H, identified questioning students as the first step of their process: “The beginning is just kind of simply getting to know a student. Asking them questions.” These questions were identified as being of a highly specific nature. “I think questions are very important. Not questions like, Da-data-da-data. Whatdayahdo? What about this? You know. But really questions (Subject H).” Subject B described herself as being: “very deliberate and intentional about what I say to them, what question I might insert.” Subject C described the questioning process as: “asking the student a question to which he or she already knows the answer...but in asking the question, making the thought process illuminated for the student.” Subject D specifically identified the importance of ‘how’ questions:

The magic word is how. How much do you know about this? How much do you remember about that? How does this apply to your life? How are you going to do this? How are you going to remember that? How effective was it last time you used flashcards? All of those.

Subject D identified that the reason these ‘how’ questions were so effective was that they identified evaluative processes that: “just bring it out there and address it explicitly.” However, Subject D was not the only professor to overtly identify the importance of ‘how’ questions. Subject E also identified ‘how’ questions as significant: “The questions have to do with how do I ... You know, how do I take in information? How do I express information? How do I remember information? How do I react to my professors?”

Coding identified practical, self-reflective questioning occurring as a primary style across subjects. “What do you think about that, and how did you approach that, and why did you choose this over that, and what were your thoughts, what were your feelings, how did that affect you? (Subject G).” These kinds of questions identified by Subject G, highlighted a question strategy that focused on self-understanding and self-discovery. They suggest a deeper functional base to the questioning process than simple information seeking.

Subject H identified that these questions had an emotive and motivational dimension to them: “Just the questioning makes them think. Like, this person is interested in me.” Subject F described: “It’s not about comparing yourself to everybody else, and saying, am I better than them? It’s like, what is the best that I can do?” Subject A described important motivational discussions being developed around the question: “How did you feel?...Everybody wants to feel better or feel good...Let’s look at what you did that led to what made you feel so good, or what you think made you feel so good.” Subject B described how they used questions to encourage problem solving around feelings by asking: “What is in your way? What is gnawing at you today?” We start with that and clear that out of the way and then proceed with whatever work we’re going to work on that day.”

Subject D also identified ‘why’ questions as important: “Because, this is how we become aware of the unconscious patterns, mindsets, assumptions, language and habits drawn from the past that influence processes now.” Using questions to help uncover ideas and realities that the student may not be aware of, or be biased toward, was another identified theme. Subject B described how she used questions to open up a conversation to analyze a student's thinking: “I don't settle for the general statement of, "Well, that was fine.” Instead, she would use questions to draw out details:

What does that mean? What about that did you like? What about that? What exactly did that look like that worked?" Really doing their own task analysis or thought analysis, but (also) showing them how to do that.”

Questioning was identified as an important and multidimensional aspect of these professors' approach to education. Certain questions were common among interview subjects. To deeply analyze the nature of this procedure, a list of questions used by the subjects during their practice with students was compiled.

**Table 2**

*List of Identified Question*

What was it about that task to make it so hard to initiate?	Is it improving the quality of your life and your functioning?	How can we make this interesting so that your affect is engaged?
What's the difference between those two things, (which) one grabs you?	What are you feeling right now? Is there anything making you uncomfortable?	Who were you in the second grade?
What do you think about that?	What are your assumptions? What are you worried about?	How is it that you keep playing out the same thing that you're doing?
Do you notice how you're feeling right now?	What's the worry of the moment?	You have this diagnosis, just what does that mean? How does it play out for you? And in what circumstances? And how are we gonna work with that?
Tell me how you go about finding out this information?	What's going on in that space?	How are you going to remember that?"
Where do I start? How do I start?	How did that work? What worked but didn't work?	

How did that go? What about that worked?	Why do you think you approached it that way?	What's the question we need to ask right now?
What are your thoughts? How is this working for you?	What were you feeling at that time? What do you think might've happened?	What can I help you with here? What should we do today?
What's working, what's not working?	You don't think you can do this? Is that why you were doing the work-around?	What would make you feel better, which task?
What should you be doing? What's the goal?	What does this tell you about yourself as a learner?	Why don't you just submit the assignment the first time?
Why is my stomach in a knot?	What do you think you need to know for this thing that's coming up?	What will make you remember? What triggers something good, or bad?
How did it feel to be on time with your work?	What do you think are the main points? How are you gonna remember them?	How has that influenced my thinking? How was I today?
What did you learn from your class? What do you like about it?	Was I a kind person?	Was I a good person? Was I a loving person?
What are your strengths? What do you like?	Why should people use metacognition?	Why did I make this assumption? Where did that come from?
	What happened? What were you thinking? How did that make you feel?	

*Note.* Table lists questions interview subjects identified using with students.

**Contrasting Codes**

Contrasting codes were the categorical themes identified during selective coding that were then broken into contrasting stances. These codes helped to highlight differences within certain specific themes or categories of information. For example, statements that fell into the categorical theme of metacognitive teaching practices were identified and then contrast coded into the contending categories of pedagogy or a praxis based on even more specific qualities. Other contrast codes were: conscious and unconscious behavior; psychological or neurological perspective; and constrained and unconstrained definitions of metacognition.

***Pedagogy vs Praxis***

Descriptions of teaching practices were contrast coded as statements about pedagogy or statements about praxis. Pedagogical statements referred to more standardized elements of teaching related to procedure, curriculum or elements of practice. Praxis referred to elements of teaching that were related to individualized actions or approaches toward education that were student or situation specific. Praxis related codes were often expressed as stories about the professor's work with individual students or represented in the moment to moment teaching judgments that would not be generally standardized or expressible in a lesson plan or curriculum.

Pedagogy and praxis related statements were found throughout the interviews. For example, a statement like, "I assign them *How to Read a Book You Don't Want to Read*, which is a nine-minute YouTube thing, which is about chopping the book up and all this. Okay, now reflect on that, you know? Tell me about it with regards to you, specifically (Subject F)," would be coded pedagogy. Whereas a statement like, "I use at least that initial easing them in, sports conversation perhaps, to relax. It gives them practice talking to somebody who does not judge them," would be coded praxis as it is more focused on the needs of the student in the moment. This coding scheme helped to add a deeper dimension to participant descriptions about their teaching practices.

Contrast coding in this way revealed a very individualized educational practice at the PAL program. The educational experience of a typical PAL session was highly contingent on personal and situational variables. Learning conversations had a very clear and predictable pedagogical core with replicable goals and practices, which will be discussed in greater length in the coming section on the metacognitive teaching practices of PAL professors. However, coding made it clear that much of what a PAL professor was doing was a response to the real and



immediate needs of the student. Through responses to their student's immediate needs, these professors would aim to improve their student's ability to respond to these challenges in the future.

### ***Psychological vs Neurological***

Another finding of selective coding identified that these educators strongly utilized components of psychology and neurology in their teaching of metacognition. Considering Dr. Webb's approach when founding the program, and the influence of former PAL professors such as Jane Adelizzi, who was credited by interview Subject D as the person who brought the practice of Educational Therapy to the East Coast, it was not surprising that coding identified strong themes related to psychotherapeutic approaches. However, what was surprising was the interesting way these professors utilized neurological findings. My insertion of the paper *Toward a Neurological Understanding of Metacognition* and presentation prompted many revealing statements for me specifically. While analyzing these codes I realized that I was incorrect in some of my initial assumptions about how PAL professors integrated neuro-psychological research into their practice.

While coding revealed a deep respect and understanding of neurology, it also revealed that for most PAL professors neurological understanding was secondary to psychological understanding. Some subjects directly identified their approach as being psychotherapeutic in nature. For most professors their interest in neurological information was strictly focused on how it practically informed their teaching practice. Subject E reacted to the workshop information by

saying: “Some of the brain stuff was just almost too much for me. But once it gets connected to learning, that's what's most interesting to me.”

For me this was quite surprising, because it was the revelation of my neurological profile, as revealed by the Wechsler Adult Intelligence Scale (WAIS), which was administered to me that had made such a profound impact on me personally. This experience led me to believe that knowledge of neurology was essentially the most valuable source of metacognitive knowledge. However, the data caused me to reevaluate and realize that I was slightly biased to the idea of the supremacy of neurological understanding. Analysis of the data revealed that metacognition was much more of an active process than a neurological mental state occurring in a localizable area in the brain.

This realization caused me to reconceptualize metacognition as a cyclical and personal process of integrating an individual's various neurological skills and evaluating them in service of improving their development. This finding suggests that there is a perspective shifting perceptual ability that underlies the process of metacognition that these professors help their students utilize. This ability to shift perspective promotes self-understanding and regulation, but students must be supported to integrate their abstract, non-perceptual cognitive functions like reason, analysis, or logic with their perceptual and experiential knowledge. “It is not just language,” subject D. The role of the teacher in metacognitive work is helping their students to better integrate qualitative perceptions and sensations with the brain's cognitive abstract processes by directing the students' awareness of both.

To expand on Subject D's observation, metacognition is about more than language, it is about more than knowledge, it is about identifying and organizing the qualia of perception and experience with the reason of cognition and logic, thereby improving the individual's response to

challenges in their environment. To help a student engage in this kind of integration, PAL professors attempt to be as respectful, nurturing, attentive and responsive to the internal qualitative experiences of their students as they were to their depth of knowledge about the brain and learning strategies. This finding was most enlightening for me as the researcher. It revealed a personal bias toward neurology that had motivated much of my research up to this point. It revealed that, perhaps, my sensitivity and ability to understand and relate to the qualitative experiences of my students was more behind my effectiveness as a teacher than my depth of knowledge about the neurological underpinnings of brain function.

Neurology was shown to play more of a critical role in addressing problems with learning, i.e. metacognitive regulation, rather than simply explaining learning problems, i.e. metacognitive knowledge. Neurology was used as a tool of discussion by these professors, to educate students about themselves, for the purposes of improving and explaining their self-regulatory strategies and problem behaviors. Similar to earlier stated examples where professors used phrases like, “you are doing it again,” or “that is a problem to solve,” neurological and psychological information were used to identify and label problems for discussion. Once identified in this way, professors were able to develop a student’s understanding of how to address the issue in an abstract way that was less distorted by emotional interference. Rather than a simple explanation about what was negatively affecting the student’s learning, neurological information was used to identify and address problems with learning in a more abstract and objective way, limiting emotional interference. Subject A described it this way: “when kids learn that it's something physiological or neurological or maybe adults too, that it sort of takes a burden off the identity of it.”

However, these professors were also keenly aware that for some students this level of technical discussion does not resonate with them. For this reason, professors utilized neurological understanding as part of a broad constellation of topics identified as important in generating the self-understanding necessary to achieve better self-regulation. Along with identifying a slight preference for psychological over neurological approaches, this investigation identified a preference for presenting information that could be used more in service to building a student's metacognitive regulatory abilities rather than knowledge. Subject G explained it this way:

These are theories. These aren't written in stone. I still think that relating behaviors back to the brain is a really good idea for students. Because it's foundational. It would be like explaining to an athlete how muscles work or explaining to a sick person who needs to improve their health how the body works.”

Clearly, a neurological understanding was considered a very important part of the educational practices of PAL. However, these perspectives were tempered by practical concerns about the actual psychological situation of the student and other competing needs that may impact their self-regulation.

### *Conscious vs unconscious*

Another contrasting code used was related to conscious and unconscious processes of metacognition. This code was generally related to the protocol question asking if the subjects found metacognition to be more conscious or unconscious. However, aspects of conscious and unconscious behavioral observation surfaced throughout the interviews. Again, this coding structure revealed unique patterns and overlapped with other codes. For example, some subjects

felt metacognition was an important conscious activity that helped address implicit bias, “my personal practice of metacognition (is) to be constantly aware of my physical experience of the moment, to include my noticing of assumptions that I’ve made and to really reflect on those (Subject G).” Several subjects identified that over time metacognitive capacity moved from being a conscious activity, to an unconscious activity with practice: “it may become less conscious once the metacognitive user is in the habit of applying it (Subject F).

This coding scheme was often embedded with statements that were identified with the professor’s practice. Professors identified a large part of what they were doing with students was helping to reveal aspects of thinking or behavior that were otherwise subconscious and hidden. Subject F described this as: “Just bringing it to his conscious level of awareness... then we clarify it.” It was found that these professors all generally viewed metacognition as both a conscious and unconscious process. It was also found that helping to identify subconscious thoughts, problem behaviors, or areas of knowledge where a student lacks a complete understanding moved them into consciousness for investigation and discussion was a centrally important component of their job.

### **Definition of Metacognition**

Several subjects referred to a feeling that the concept of metacognition itself was larger than its popular definition of thinking about thinking. Subject D went so far as to say: “it’s not three words. It’s not thinking about thinking. It’s got to be more than that.” It was found that for these professors the concept of metacognition included many facets that transcended traditional conceptions of learning. These facets included: a conscious awareness of thoughts, conversation to clarify feelings and action; a reliance on memory to define and diagnose problems; and an ability to identify, comprehend and evaluate perspectives that are different than our own.

One thing that was made very clear through this coding structure was the dichotomous nature of the concept of metacognition. While the vast majority of statements indicated that these professors identified metacognition as a process that a student actively engages in, a large number of statements were made that also identified metacognition as a feature of cognition, like vision. However, just as frequently, it seemed that professors were describing a process that needed to be practiced to be improved. Frequently, it was difficult to determine if the subject was referring to metacognition as a process to be practiced or a feature of mind that needed to be developed. This finding seems to indicate that terms and conceptual descriptions need to be reorganized to better delineate between the active practices and intrinsic cognitive features of metacognition.

### **Narrative analysis**

After open, axial, selective and contrast coding of interviews was completed, reflected upon, and written up for the professors' interviews, the same coding structure was applied to my personal reflection on metacognition. By applying the same structure of analysis, it became possible to identify similarities and differences between my approach and thinking with those of the various interview subjects. I also identified variations of thematic importance. For example, coding identified that I was highly interested in defining metacognition in a way that was more nuanced than Flavell's (1979) learning about learning statement. However, as a result of the work done through this study, I believe I have gained a deeper appreciation of the descriptive simplicity of Flavell's initial definition.

The investigation not only identified strong similarities between myself and these PAL professors, but also interesting differences. For example, while themes of addressing anxieties with students through metacognition were ubiquitous across interviews, I placed heightened

importance on the impact of trauma in producing these anxieties. This was probably due to my years of specialized work with traumatized students. Similarly, all professors delineated the importance of the metacognitive relationship, but only two, besides myself, identified having significant metacognitive relationships outside of their professional relationships with students. One was Subject C who talked about the relationship they had with their mother. The other was Subject G who identified having such a relationship with their husband, stating:

I will have discussions when he'll say, "Well, I'm doing this and they're not getting it and they're not getting it." I say, "Oh, sounds like you might be overloading them a little bit too much. You should-"...through our conversations about the brain and our arguments about motivation, what causes motivation. I think he's really grown as a teacher."

This quote reminded me of the metacognitive relationship I have with my own wife, and how our metacognitive conversations have helped improve our relationship and ability to support the other. Moreover, my narrative investigation found relationships with others support conversations of metacognitive insight that are important in work environments. Harri-Augstein & Thomas (1991) also recorded positive impacts in work environments using Learning Conversation in the management of employees.

After analysis of my narrative, all of the subjects' interviews were again re-coded for important statements. These were statements, or often parts of statements, that assumed new importance as a result of the prior analysis and further supported the various earlier findings found during the coding process. These insights will be further broken down in the upcoming chapter's discussion of the findings.

**Summary of Findings**

This chapter reviewed the findings drawn from the analysis of interviews of eight PAL professors and my own narrative reflections on metacognitive development and educational transformation. They have been represented in relation to the processes of analysis that drove their discovery. The analysis of data revealed findings in four relevant areas. The first group of findings were relevant to Curry’s PAL program. The second was relevant to the general practice of metacognitive education. The third area of findings were most relevant to wider institutional practices and finally the fourth area of findings were relevant to developing metacognitive theory. The findings for these areas have been organized and grouped together on table 3.

**Table 3**

*Findings*

PAL Specific	Education Practices	Institutional	Metacognitive Theory
<p>There is a need for professors in the PAL program to share strategies and insights about student learning and instruction of metacognition and self-regulation.</p> <p>PAL utilizes a core educational approach identified as the Learning Conversation to instruct metacognition.</p>	<p>A positive student teacher relationship supports a developmental process of understanding and meeting the demands of school and life.</p> <p>Metacognitive teaching brings unconscious or unknown aspects about an individual’s learning/behavior into conscious awareness to be analyzed, including unconscious bias as well as mental and emotional blocks to learning.</p> <p>Modeling metacognitive practices and thinking are essential components of metacognitive education</p> <p>The skilled use of questions is essential in building metacognitive thought.</p> <p>Metacognitive teaching uses personal data to assist students in self-understanding and self-discovery</p>	<p>The development of a student’s metacognitive skills and abilities should be considered a central tenet of education that starts in preschool and runs through adult education with an ultimate goal of self-authorship.</p> <p>The individualized nature of metacognitive instruction requires a different approach to education if it is going to become standardizable, this would require making metacognitive approaches to self-evaluation as primary</p> <p>Creating metacognitive relationships that foster learning conversation supports productivity in work environments</p>	<p>The terms related to metacognition are ambiguous, overlap with those used in other fields and require clarification.</p> <p>Emotion and trauma impact and limit an individual’s ability to reason metacognitively and engage in metacognitive education.</p> <p>Metacognition occurs in ways that are both conscious and unconscious.</p> <p>Metacognition develops deeper connections between an individual’s mental and physical environments.</p> <p>Metacognitive thinking uses language for identifying and defining the conditions driving a person’s behavior.</p> <p>Metacognition drives human development.</p>



## CHAPTER 5

### DISCUSSION OF FINDINGS

#### Overview of Chapter

This chapter discusses the findings of the study. For this purpose the findings are divided into three focal areas:

1. The first area reviews the determined primary element of PAL's metacognitive pedagogy, an approach called the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006). The structure, learning outcomes, evaluation and unique needs of the Learning Conversation (Pennini, 2006) approach are discussed in this first section. Suggestions for the professional development of the unique aspects of this approach are also addressed.
2. The next section extrapolates core principles of metacognitive pedagogy from the data into a general theory of metacognitive instruction. This section covers what is considered the primary elements of a metacognitive education drawn from the study. It starts with a discussion of the primary educational goals of achieving self-authorship, and the ability of the student to engage in self-directed learning. Then it details the core procedures of a metacognitive approach to learning. These cyclical educational procedures include identification, ordering, and interventions that force students to consciously make choices and evaluate the choices they have made. The last topic covered in this section is on the fundamental role of emotion in metacognitive thinking and behavior.
3. The final section grounds the elements of metacognitive instruction to fundamental neuropsychological phenomenon and information processing. It is hypothesized that metacognitive thinking and instruction exploit a phenomenon that binds cognitive processing to perceptual experiential qualia. This phenomenon, identified as 'Metaing',

gives the human mind its universal problem solving capacity, as described by David Deutsch (2011).

The chapter concludes by connecting the findings of this study to a wide and diverse array of interdisciplinary findings in the literature. These findings support the hypothesis that the educational benefits of a metacognitive education can be attributed to its focus on a style of conscious self-reflective learning that promotes and exploits underlying neuropsychological phenomena to produce gains in students' understanding of their own learning process, which in turn enables more complex and self-regulated behavior.

### **Metacognition Overview**

Thinking about thinking, It's a... seemingly simple, elegant... phrase.  
Elegance like you would use in physics. The most simple, the most meaningful kernel of it (Subject B).

The above statement by Subject B about the elegance of metacognition well frames this discussion. The simple definition of “thinking about thinking” (Flavell; 1979) captures an infinite complexity, that is akin to the mathematical expression of relativity in physics, and yet somehow, to this point, has escaped meaningful mathematical expression. It is a statement that carries with it far reaching practical implications for our understanding of learning. Much like the way relativity explains the motions produced by gravity, imbuing those who understand it with an unprecedented ability to influence and control the physical world, it is believed that metacognition unveils the features of learning in such a way that it imbues those that understand it with an unprecedented ability to control their mental world.

Metacognition describes a form of personal mindfulness that opens a learner up to higher

levels of understanding and more complex behavioral choice. It enables learners to discover their own implicit mental traps, and the implicit bias created and reinforced repeatedly through interactions with others around them. Knowledge of metacognition also informs teacher understanding. Providing insight into which educational techniques will enable the student to develop a skill. By exploiting the brain's ability to identify its own neurocognitive features of learning metacognitive education approaches capitalize on the infinite human capacity to problem solve (Deutsch, 2011) and self-direct their own learning.

### **The PAL Approach**

The PAL program's approach to metacognition is important because of its unique history. Over 50 years of history helping a demographic of college students that were at one time barred from participation because of the common belief that their learning disabilities made success in college unattainable. In many ways PAL's approach is better designed to address the complex educational issues faced in the present age because it is focused on helping individual students work through the varied demands of college. The PAL approach both complements traditional educational formats, and has been shown to transform the educational experiences of their students. PAL's metacognitive approach to learning addresses many challenges that traditional modern education find intractable.

PAL professors are doing more than teaching content or learning strategies. They are providing their students with the tools, support and opportunity to take control and direct their learning. They are teaching their students the processes necessary to author their own life narrative. It is a program that offers an immediate benefit to students in their college course work, and the long term benefit of leading them to become actively involved in their world. It is an approach focused on instilling habits of self-directed learning by developing a personally

motivating understanding of their learning that honestly represents the best use of the student's ability. It is an approach through which practitioners seek to teach students how to identify and achieve an optimal manifestation of themselves as a learner.

### ***Learning Conversations***

This study identified a core PAL approach to metacognitive education. This approach was specifically labeled by interview Subjects B and H as the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006). These *Learning Conversations* were found to not only instruct metacognition, but also build a student teacher relationship capable of supporting the expansive development of a student's processes of understanding. Through learning conversations with their PAL professor, the student develops the ability to enact strategies to meet the demands of school and life. But what exactly are learning conversations, and how does one engage in a Learning Conversation with a student (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006)?

First, learning conversations are done predominantly in individual or small groups. These conversations require a high degree of intimacy and a freedom of expression. Students must not only feel safe to express their thoughts and identify their weaknesses, but they must also have the time and space to do so. Even in what has been traditionally considered a small group structure, the size and configuration, may not be ideally suited to the depth and freedom of expression/exchange that is imperative to properly engage in this teaching style. Moreover, traditional classroom formats are particularly poorly suited for these conversations to take place in. The very size of traditional classroom formats impacts a student's ability to speak freely, and engage in the level of raw self-investigation required by this educational approach. Plus, the management structure of the traditional classroom places constraints on a student's opportunity

and ability to express themselves. Such constraints run counter to the goals of the learning conversation itself.

Massachusetts educational law 603 CMR 28.06(7) defines small group special education as eight students per certified teacher, with twelve being the legal limit with the support of an aide (Massachusetts Department of Elementary and Secondary Education, 2018). However, as a teacher who has managed many of these small group programs in a variety of Massachusetts public school settings, my experience has shown that even a group of five students may be too many to have meaningful metacognitive conversations. The process is degraded not only by the natural time constraints produced by having more people involved in the conversation, but also the exponential extrapolation of social variables that occur when more people are brought into the process. Three of these social components, mentioned repeatedly across the interview process, were power, bias and derogatory judgments.

Several professors in this investigation, and Dr. Webb (1972) herself identified that a pronounced differential in power was an impediment to metacognitive teaching. Many investigations (Foy, 2018; Janis, 2008; Plous, 1993; Sapolsky, 2017) have shown that large differentials in power biased judgments (Janis, 2008; Plous, 1993), and impaired performance (Foy, 2018; Sapolsky, 2017). The negative effects of power differentials can range from individuals withholding information to only presenting information that is thought the person in power wants to hear (Janis, 2008). Power differentials can cause individuals to try to judge what they think others want them to say rather than focusing on the factors that are most relevant to them personally (Plous, 1993).

At its most elemental level, power is defined as one's capacity to alter another person's behavior, condition or state of mind (Keltner, 2007). This is very close to the definition of

education. The influence of power is built into the educational relationship, it is not possible to simply remove power from the educational relationship. In some cases students desperately need their teacher, or professor, to get them to a point where they can gain power/control over themselves (S. Pennini, personal communication, December 4, 2020). Younger and less experienced students are more reliant on the judgments of others to develop their own (Foy, 2018; Plous, 1993). However, the negative influences of power on behavior and cognition can be invisible to both the student and the teacher. Through a metacognitive approach the influences of power, both obvious and obscure, are identified with the students and open for honest discussion.

Metacognitive discussions about how power relationships affect learning are not done in a power vacuum, but rather with the intention of teaching how power can be understood and managed, just as any other factor that affects a student's learning is discussed. Power imbalances resulting from implicit bias can be most difficult to address due to their abstract nature (Foy, 2018; Sapolsky, 2017). As the number of individuals in a group increases, so do the number of influential and confounding factors that could impact a learning conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) or degrade a student's metacognition. Differentials in power between students are frequently overlooked as a factor impacting metacognition and instruction more generally.

Traditional approaches to education frame student behavioral expressions regarding power or judgmental bias as an issue of classroom management. However, at PAL, behaviors are addressed through learning conversations rather than simply managed. For example, Subject G described, "If I have a conflict with a student, I will say to them, 'Help me think about this.' Help me understand what just happened here.'" Issues are discussed and investigated openly with the student. This is because while a teacher can learn to address the impact of their own

power, bias and judgment, their students will, necessarily, lack this knowledge and behavioral maturity. Learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) impart this knowledge and aim to develop maturity and a knowledge of the educational power dynamic.

Students are generally not developmentally ready to address the impacts of power. They are likely unaware of the subtle influence implicit biases have on their behavior. As groups become larger, participants need to be more metacognitively aware, particularly of these influences, if such groups are going to function in a way that promotes the metacognition of each member of the group. When numbers become large, metacognitive learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) simply become impossible. The conditions necessary to address deeper levels of metacognitive insights are stunted as the need for passive conformity and classroom management become more necessary to maintain cohesion.

Ideally, learning conversations at PAL (Pennini, 2006) start as highly personal, one to one, conversations between a student and educator. As a student's ability to understand and utilize metacognition develops, it becomes possible for them to more effectively participate in larger group metacognitive discussions. Such group level metacognitive discussions were identified by Dr. Webb (1989) as having many positive results. The most important result of small group metacognitive learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) is that they develop a student's ability to engage in learning conversations with peers and may increase the likelihood that these kinds of conversation will occur outside of formal institutional educational constructs.

The PAL program has historically provided mentoring and leadership experiences to their students. It is hypothesized that developing a student's ability to engage in learning conversations with other students could be used to further harness and spread metacognitive learning techniques across a population, improving and developing peer support networks (Hulbig, 2019). However, even in small group situations students and teachers must maintain the ability to drop into one to one, learning conversations to accommodate the highly individualized ways of knowing diverse life circumstances dictate.

### **Structure of Learning Conversations**

The structure of learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) closely align with the main theoretical findings of this investigation, which will be described in detail later as the general model of metacognitive instruction. The structure of a learning conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) has been defined through integrating ideas drawn from across interviews, and narrative investigations. First, these learning conversations involve bringing ideas and realities into awareness for purposes of investigation. Subject F described it as, "Just bring it to his conscious level of awareness," and subject B detailed this process as, "They'll say something and then we'll take that apart and then they'll say something else and we'll diagram that sentence. Really doing their own task analysis or thought analysis, but showing them how to do that."

The second idea involves deeply connecting with a student and supporting their ability to stay connected with their world, accepting all its splendor and complexity. This view was best expressed by subject H when they said, "Metacognition is... about connection. Not only just a connection to yourself, but a connection between the two of us. Connection to the classes. How it



connects deeply to your life... What works? ...What will make you remember? What triggers something good, or bad? ...connection to the world, and connection to the people around you.”

Learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) are personal interviews about the student’s progress toward their goals. It requires a skilled intertwining of questioning and modeling on the part of the professor. It requires a student to look critically at themselves, in a deep and non-superficial way. If these conversations are to be useful they must touch on the emotional factors that impact the student’s learning, and the learning relationship itself. The common goal of the teacher is demonstrating to the student how to identify their problems and solve them. This will by its very nature necessitate deep listening and highly sensitive routines of self- evaluation.

Learning conversations begin by questioning. The questions take two forms. One type of question is information seeking. These are questions that allow the student to tell their story. They also reveal the students' definition of themselves. What their goals are, what they value, what they believe their strengths and weaknesses are. With careful listening, professors are able to identify patterns in their students’ behavior and thinking that the student may not even be aware of, or are powerless to do anything about. This leads into the second form of questioning, which seeks to bring into consciousness those less defined areas and patterns of behavior for deeper practical discussion. This is the stage where ‘how’ questions become most important.

However, it is more than simply asking how a student does a certain task. Professors work with their students to construct a schema of the students’ own conception of learning. Then, the professor uses the conversation to direct the students’ attention to areas of self-development that have not yet been deeply considered or perhaps are blocked in some sort of way. It is a process of closely listening and helping the student identify the weaknesses and

strengths of their approach to the various demands of their life. Sometimes it is demonstrating or helping them develop an approach from scratch. Sometimes it is an examination of their fears or motivations. Sometimes it involves getting students to try something new. It is highly personal, and both requires and produces a close bond between the professor and the student.

### **Outcomes and Objectives of Learning Conversations**

To the untrained eye these learning conversations (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) may seem like simple conversations between a student and professor about their education. Perhaps, even the students themselves may be unaware that they are deeply engaged in a learning experience. However, the professors are conscious and intentional about how they are directing conversation. “They think we’re just chatting,” mused subject B, “I’m very deliberate and intentional about what I say to them, what question I might insert, one maybe a cheerful jolly joking comment, or labeling.” Through these conversations professors are helping to name and identify things the students do not have a name for, describe things they do not have a description for, and explain things they do not have an explanation for. When students do come to realize that these are more than simple conversations, they become more intentional about the conversations also. I believe that this is where transformational learning occurs in the PAL program.

Students who realize their role in these learning conversations begin to use them to deeply reflect on themselves as learners, and use them to connect their goals and aspirations with actions. Learning conversations lead students to conceptualize learning as a process they not only have control over, but can invite others into for support and development. Subject C described it as an, “implicit curriculum that we’re making explicit,” and produces a student who “sees his learning as collaborative.”

Success and failure are not conceptualized as definitive, but rather part of the process, and data to use. The reality that failure is a potential is not hidden. The fact that success is frequently less assured than failure is open for discussion. However, PAL students are accepted when failure happens, and they are supported through the steps that come next. These are the crucial steps required to recoup, continue learning and expand one's skills in ways that will reduce their risk of failure in the future.

More than this, failure and success both become framed, as momentary conditions. Regardless of the outcome of events, these conversations demonstrate for the student how to think through the events of their life. These conversations focus on the processes of thinking and behaving that allow a person to stay connected to their work and the things that matter most to them. Students learn how to think about themselves, and really look at and address the hardships and failures that impact them. Through learning conversations PAL professors can demonstrate how students can reduce the frequency of their failures and learn how to overcome the problems of their lives as they arise in the future. Over time these learning conversations become part of an internal dialogue that the student learns to have with themselves when facing the myriad of self-regulatory challenges of life (Harri-Augstein & Thomas, 1991).

Through learning conversations PAL professors attempt to help students learn to see themselves and their power of self-control. It is a process that helps the professor see what kind of learner the student is, and communicate that knowledge to the student. Subject H described why the process of really trying to see your students for who they are is so powerful in the context of metacognition. It is because “when someone else sees you, you begin to see yourself.” It is through this process of seeing themselves as the professor sees them that enables the metacognitive student to become better able to think deeply about their thinking.

*Evaluation Through the PAL Approach*

While the majority of PAL professors indicated that they did not think students should be formally graded on their metacognitive ability, all described using a process of evaluation in a constant and ongoing manner. The centrality of questioning procedures and the kinds of questions utilized, made it clear that PAL professors are guiding their students through a process of evaluating their own evaluations. They are teaching and evaluating the techniques of evaluation with their students all the time and highlight for their students how these evaluations can deepen their understanding.

Discussions of learning preference and disabilities, while presented as knowledge, are being used as a way to define features of the student's own learning so that they can better evaluate their abilities and take more effective actions. Rather than being an end point of instruction that attempts to objectify the students' knowledge into a number or normative average, PAL professors work with their students to help them both identify standards and learn how to effectively apply them in the evaluation of themselves.

This is an almost continuous process of evaluation. One that reflects upon nearly any level or type of activity the student engages in. Simply put, the PAL approach to evaluation is through evaluative demonstrations of self-evaluation. Progress can be measured by comparing the steps a student identified as important during planning, the steps actually taken, and the student's general level of success achieving the goal.

Some PAL professors did formalize this process by having their students write papers reflecting on their metacognition, but even these classically pen and paper response essay forms of evaluation function differently than traditional forms of evaluation. These were largely mechanisms through which formal writing and research skills could be taught. Subject F stated,

“those papers will be graded. There will be a rubric and there will be expectations, and they'll be graded on what they write, yeah. Not so much how perfectly they articulated.” Moreover, these written evaluations were extended and added to overtime as the student developed more awareness of themselves and their learning. The paper becomes a source of data for future discussions about the student's metacognition, providing examples of the student's earlier level of ability in writing, self-conception and reasoning. “Reflecting on it in writing,” was identified by subject F as important, “So if they can't discuss it with someone else, at least they could maybe journal it,” indicating that writing may be used by an individual as a surrogate to the learning conversation.

Most professors performed this evaluative technique through questioning and interviewing their students. Some specifically identified student learning difficulties or anxiety around writing as the reason why they did not more formalize the process. “I have a series of questions that I ask my students about the semester and I ... I don't have them write out the answers...Usually they like it that I do the writing because then they can just think,” identified subject E. The notes taken by the professors resulting from these meetings, formed the data for future metacognitive discussions. “I have notes in my planner. We need to work on this today, because a student will want to talk to me all day about sports,” reflected subject B.

Another common theme echoed by all the professors was that metacognitive reasoning could be disrupted. Metacognition was described as a developmentally sensitive process. There was a general sense that metacognition could be disrupted by traditional arbitrary grading systems. The skill of self-evaluation was one that must be nurtured and grown by the professor as opposed to introduced and evaluated. Findings suggest that metacognition could be disrupted or nurtured by emotional experience. A centerpiece of the PAL evaluative technique was to

investigate, with the student, how emotions were impacting their student's ability to properly evaluate their experiences and take action.

In conclusion, the PAL evaluative technique is composed of four elements. The first is a constant and continuous evaluation of a student's skills of self-evaluation. This includes asking questions as to what the student intends to do, and how they intend to do it. The second element involves setting plans for completion and execution. The third is a reflection on the actions actually taken by the student towards these ends. A fourth evaluative technique used at PAL is the summative report that is written at the end of each semester where the professor attempts to gather an evaluative snapshot of their progress. These elements can be compared to make evaluative determinations of a student's progress that are informative for the professors, articulable to other professionals, and helpful in a way that is practical to the students, their parents, or anyone interested in the student's progress. However, perhaps the most important feature of PAL's evaluative procedure is that these evaluations are primarily intended to help give students the feedback they need to better reflect on events that have happened to them. Students become better at evaluating why what happened turned out happening as a result of their planning and execution. It is a form of evaluation that improves the student's ability to plan more sophisticated actions in the future.

### ***Unique Solutions to Professional Development***

The nature of the Learning Conversation (Adelizzi & Goss, 1995; Fox, 2010; Harri-Augstein & Thomas, 1991; Pennini, 2006) approach to metacognitive education practiced at PAL, necessitates individualized and small group practices. The close interaction of the program's learning conversation (Pennini, 2006) places qualitatively different demands on the learning experience, and requires a qualitatively different approach to program development.

These approaches must be highly individualized and supportive to the unique needs of the students in the program. Professors entering the program will require practical face to face experience and specialized knowledge in learning, neurology and psychology. However, there will remain gaps in their practice that will be difficult to develop professionally. This is because the program seeks to serve a neurologically diverse range of learners. This not only requires a detailed knowledge of numerous diagnostic categories and the best educational practices of addressing these student's learning needs, but a conditional knowledge that comes from practice. PAL's interdisciplinary approach to learning makes the professional development needs of the program unique in many ways.

PAL professors deal with profiles more than curriculum, and circumstances more than subjects. For PAL professors to meaningfully approach their students they must possess a diversity of experiences teaching atypical learners. By necessity, their approach must differ specifically and systematically depending on their students' presentation or profile. It is not what they teach, but how they teach it. Professionally it is difficult to communicate such intricately conditional knowledge to new teachers or those that lack a wide diversity of educational experiences.

Programmatically capturing and enshrining in policy the practices of professionals who have mastered the art of teaching metacognition will require the collection of both data and an interpersonal transfer of knowledge and history. Care must be taken not to simply attempt to align the PAL model to better conform with traditional education paradigms that do not address transformation or self-directed learning. Rather than attempting to make PAL more commiserate with traditional approaches it may be more fruitful for the program to clearly identify the best practices of their own educators and programs. To this end, it is suggested that PAL preserve and

develop the program using a model that closely aligns with the Learning Conversation (Pennini, 2006). The processes of transferring and developing the program's professional practices could be modeled on PAL's own model. This would not only be instructive for new staff, but the process could be adapted to identify and preserve metacognitive understanding, practices, and insights in a way that could be more broadly catalogued. Such a practice would enhance transfer through discussion, questioning and modeling. It would also aggregate, communicate and archive the specialized approaches developed in the service of their students and situations.

One way to bridge this divide was mentioned by interview subject A who felt there would be real value in hearing the stories of other professors, "What did she do, that was successful... Just to hear people's little stories because those really stick for me, when people describe a kid and something that was effective." However, interprofessional communication is only going to be as successful as the ability of professors to communicate what they are seeing and what they are doing. For a program like Curry's PAL program, which has a legacy that is more than fifty years old, preserving the historical contributions of its professors becomes an important consideration.

Along with being the first college level program for students with learning disabilities, PAL was also one of the first programs to develop, largely out of direct practice, a pedagogy for transformative learning. PAL's ability to collect and share student and situation specific insights about metacognitive instruction will prove valuable to itself and other institutions endeavoring toward the same educational goals of transformative metacognitive education in the future. As professors retire, preserving their knowledge and communicating it to future generations of PAL professors, will become increasingly powerful and important to the institution's metacognitive ability as a whole.



### **General Theory of Metacognitive Instruction**

When the insights of these professors were compared and contrasted with my early insights and research, certain common traits of metacognitive teaching came to light. These will be outlined in this section as the general theory of metacognitive instruction (GTMI). It is believed that these are the core and most generally applicable methods of metacognitive instruction. Central commonalities like the finding that rather than mastery of subject matter, the greater goal was the desire to teach a thinking process that could enable a student to achieve deeper investigational abilities and more self-control. Subject C described it as, “I don't want to give them things to do and tell them to do it... I want to teach them what they could do, and how they could do it. So that when they come to a new situation they can say to themselves, what could I do and how would I do it?”

Certain themes and ideas were identified across interview subjects, my reflections, and the diverse literature of metacognition. These themes are hypothesized to be elemental components of a metacognitive instruction that are separable from other aspects of pedagogy, and are grounded in neuropsychological developmental phenomena. These are elements of a learning process that supersede subject knowledge formation. Subject knowledge can be thought of as the vital medium through which we teach a deeper understanding of the routines, processes, and behaviors that improve learning and personal performance. The self-regulatory aspects of metacognition require active involvement in a task, goal or situation.

The GTMI are elements of instruction that are structured around what was found to be the central goal of metacognitive education, self-authorship. This process of metacognitive self-authorship is dependent upon an internal cognitive process that is self-similar to the interactive practices employed by both the learner and a teacher. It is a process that balances the need for developmental support and the development of understanding, utilizing prediction and

data driven discussions of behavior. The GTMI can be thought of as the essential components of an education that develops a student's ability to act, even in areas of personal difficulty.

### *Self-Authorship*

A cursory look at the most general problems that impact learning reveals a set of problems that are not within a teacher or curriculum's power to adequately address. These are problems that occur within a student. They are caused when a student lacks an awareness or knowledge of something. It could be the result of organic issues, or internal manners of thinking that make understanding hard for them. They may be missing information due to disruptions during learning or environmental impacts. Additionally, if a student does not feel capable, they may give up. Furthermore, a student may limit their behavior or their expulsion of cognitive energy due to habitual or socially constructed limits. These problems are categorically the subjective experiential problems of the learner. While teachers and administrators can devise educational structures to support the learner, they can never be truly sure the learner has committed themselves to addressing the problems. The subjective issues that impact an individual's learning tend to be particularly intractable to large, public institutions.

Subjective issues, however, can be addressed directly through metacognition. When a student is able to identify the issues that impact their learning and development, they become empowered to address those issues. By directly attempting to address those things that stand in the way of their learning and development students become more academically capable because they are now involved in a process of self-authorship.

Kegan (1994) defines self-authorship as a stage of human development that occurs when an individual achieves a level of personal awareness and self-control that enables them to consciously take responsibility and control over their development and its expression. The broad

array of skills that are harnessed through metacognition support an individual's educational development, academic attainment, and ability to self-direct their own learning, making the attainment of self-authorship possible. Conceptually, self-authorship provides a powerful and personal motivational reason to learn and practice reflective metacognition. It connects the process of metacognition with its product. Self-authorship requires a willful, metacognitive effort and a willful metacognitive effort produces self-authorship. It is a cyclical, integrative, cognitive activity where students learn new skills and integrate them into their daily practice. This integrating cognition consists of three interacting processes. These are the processes of identification, order, and evaluation. A trio of cognitive skills that seem to sit at the base of any educational model or personal learning strategy.

### ***Identification and order***

Identification is the logical first step of any cognitive process. It is fundamental. To learn anything, a student must become adept at identifying a subject and its important features. Metacognitive learning seeks to identify the important features of a student's way of knowing. This is achieved through ever more nuanced variations of two questions: How do I understand the subject/task at hand? And, how successful am I at it? The first question seeks to identify what is known and the second question seeks to evaluate its practicality. Through this investigative process of identifying and evaluating, the need for order develops. As one brings order to both the process and product, new understandings can be identified. Different kinds of order can be identified through the use of discussions, notes, planners, calendars, lists, organizers, and be utilized to guide, manage, define or relate to the task/subject at hand.

Order is a unique quality. Using order, we can organize both our external and internal environments. Order need not to be symbolic in nature, just meaningful. For example, we may

place things in designated places, or color code things to produce order in our visual environment. Order has this quality that makes things more easily understandable, accessible and functional. Internally, our brains can briefly construct feelings, sounds, images, sensations and other mental constructs to simulate aspects of our external perception. These mental constructs organize our internal environments the way that designating a place or using color codes orders our external environment.

Order also seems to be fundamentally tied to identification. It is an abstract quality that can be qualitative, like an arrangement of colors, or quantitative, like a numerical counting pattern. Order is fundamentally involved with learning by making information more understandable, accessible, and functional.

When order occurs randomly in nature it leads to stunningly complex and creative physical systems, like the water cycle, galaxies or living organisms. Even an abstract ordering of expressions as ‘something’ and ‘nothing,’ allow programmers to produce rich and complex computational systems. Understanding is tightly bound to this quality of order. Ordering supports the process of learning by presenting information in ways that make it understandable and functional. How order is made possible through an extrapolation of the ability to make identifications is not well understood, but what is clear is that identifying and ordering are as fundamental to learning as memory. They are even more important to metacognitive learning, which seeks to help students address the more ambiguous and shifting subject matter of self-authorship.

While order does ease the difficulty of identification, order and identification are linked in a way that does more than allow one to enhance the other. Ordered identifications make new identifications within that order possible, and new meta-identifications. On a personal

metacognitive level, it helps students see things about themselves that they never noticed and discover choices they did not believe they had. This relationship between identification and order suggests a mental phenomenon at their base. This would be a fundamental phenomenon that binds aspects of perception to cognitions making future perceptions more easily identifiable and cognitions capable of producing tools of thought (Vygotsky, 1934).

Tools of thought (Vygotsky, 1934) are ordered systems of thinking that organize and bestow practical powers to the intellect. Metacognitive thinking allows the learner to experience a transcendence of these systems and tools of thought. For example, one of the most useful systems of organization at the mind's disposal is the process of language. Not only does language enable interactions between people that support complex levels of interpersonal organization, but language confers the ability to internalize communication, making an internal dialogue possible. With the development of an internal dialogue intrapersonal organization can occur. However, language is doing more than increasing an individual's power of thought, it is also a tool that contributes to behavioral self-control.

As stated, internally generated sensory experiences are transitory and brief. The amount of time the brain is able to perform any kind of internal representation without external stimulus is constrained by the time. Whatever the brain represents is degraded by the constant ebb and flow of distractions within the mind. For example, we know from investigations of non-meditators that focused awareness, without the object of focus, quickly decays (Holzel et al., 2011). The brain cannot throw up an internal vision for much more than a fleeting second, and attempts to reflect on that vision can often more quickly distort it. But language, by design, produces quick information dense inputs that can be used to regulate the rapid flow of thought and direct attention as it wanes. Once one begins to understand how language enables behavior

to be directed, one can begin to use it to better regulate their actions. Not only with self-talk, but written notes, agendas, calendars and through communication with other individuals. Language is a tool of thought that improves one's metacognitive ability to utilize and exploit its own abilities. It facilitates identification and ordering, and so by necessity fosters deeper levels of understanding and more complex behavior.

Students can improve their understanding of anything they set their attention to. Conscious attention has a power that leads to more nuanced identifications. When this ability is turned back on itself it begins to identify the many dimensions of the self. The better a student understands the self that they are constructing the more sophisticated they will be at organizing themselves. The more organized a student's understanding of themselves becomes, the more choices they will find available to them, as choices come out of a cognitive organizational structure that produces multiple behavioral possibilities. As students come to better identify the details that make up who they are, they become better at organizing themselves and productively integrating with their environment. A lack of productive behavior by a student, by this model, would be attributable to a lack of understanding about the self or the situation the self is embedded within.

### ***Behavior Modification and Metacognition***

Classical models of behavior modification can be successful in the short term, supporting an individual in regulating a behavior, the weakness is over the long term. In one sense, behavior modification plans order behavioral situations and identify behavioral consequences more clearly making it easier to choose correct courses of action in the situation being modified. However, classical behaviorism also treats the mind like a black box, so the metacognitive understanding that promotes transference of behaviors to new situations does not always happen. This results in

the student going back to doing similar maladaptive behaviors when the rewards or other environmental features of the behavior plan are lifted. However, by adding the element of metacognitive knowledge and self-reflection, long term intentional behavior change can occur. One can also see how the opposite can occur in systems that do not include a behaviorally modifying focus, but rather only seek to address cognitive elements of behavior change like traditional psychodynamic approaches. Here a knowledge of the behavior is developed without an active element. There is no impetus to use the knowledge to produce detailed strategies of behavior change. This results in a student who is able to speak deeply about their self-regulatory problems, but remains powerless to do anything about them.

Through supported use of metacognition the student can come to understand the component tools of behavior modification and self-reflection. More than this, they learn to use them to aid in their own personal process of self-authorship. This is why the most successful forms of behavior modification have been found to involve bringing the student into the process with behavior contracts and collaborative problem solving (Greene, 2009). Through metacognition students can learn to modify their own behavior. They both learn and develop the ways that allow them to address or work around the constraints placed upon them by their internal or external environments.

### ***Metacognitive Teaching Interactions***

A teacher of metacognition will work to improve their student's ability to identify tools of thought and the aspects of their behavior that impact goal achievement. The process requires students to make choices and then reflect on the outcome of those choices. Questions become very important, opening a channel through which a dialogue about the task can occur. Modeling similarly opens a channel, which shows how to move orderly through the task. Regardless of the

channel, the process of identifying, organizing and building an understanding remains a primary learning structure, whether the focus is on the student or their course work.

For learning to become self-directed, it must be self-conscious, self-aware, and reflective. From self-consciousness comes a level of self-control. Mistakes serve to refine this process. Teachers support and refine the ability of the student to identify and address the specific points in a process where mistakes can occur. Being aware of the mistakes that can occur in a given task generally has the effect of producing more successful self-regulated behavior. Identifying mistakes paves the way for ordered behaviors that can be employed to avoid the identified mistake. These adaptive behaviors in turn can, over time, become internalized and subconscious. Moreover, organizing mistakes into categories serves in the identification of correct choices, which in turn can be used to build a conceptual organization that can improve the execution of the identified positive behaviors in a variety of situations.

Generally speaking, understanding is developed through a process of sitting with a problem, allowing yourself to experience the problem. This ability to sit with a problem is an issue with intentional consciously focused attention. To address the problem of a student's shifting attention in education, teachers create tasks to bring their student's mind back to the issue or ideas relevant to their development of understanding. Skilled teachers are able to create and mediate learning experiences (Feurstien et al., 1980) in ways that enable their students to experience and solve problems that would occur so subtly in a student's life that they would not otherwise notice them or be able to identify the discernable order they make. While such a constructed learning experience can take virtually any form, the core of that experience will be to help the student identify a problem and all of its salient components. Discussion and verbal



feedback are powerful mechanisms for this. By saying something, the teacher can tap into an underlying natural heuristic of human communication, and that is the desire to respond.

Questions powerfully compel a response in most learners, and when carefully choreographed, questions can focus the student's conscious awareness on a component of a problem that they may not have become aware of yet. We may not be aware of something for two reasons. First, it may be we have not yet had a conscious experience of it. Maybe we have never seen it before. Maybe, it was never taught to us, or no one ever mentioned it. This even includes experiences that may be happening all around us, like the growth of a specific kind of wild plant in our environment. Such a plant may grow relatively unnoticed by the conscious mind for years in the very environment we live. Despite the fact that we may even look at it every day, its existence is merely blended into the background scenery. Becoming consciously aware of its existence starts the process of understanding. Identification, as explained, is the first step, and it is the step that is repeated over and over, producing order, knowledge, and understanding.

The teacher's first step in instruction is generally to identify then facilitate communication of what has been identified. In metacognitive instruction the first step starts with helping the student to communicate what they identify as their most important characteristics. The teacher's role is to give the student a forum to identify themselves to themselves. Through question and response the teacher strives to build the student's ability to project that communication more clearly. Often this takes the form of restating what the student has said back to them. For example, a teacher might say to a student, "I heard you said X," restating what the student said, "does this mean Y" highlighting ways that the statement could be interpreted by a receiver of this information.

This kind of back-and-forth exchange builds a student's ability to communicate their understanding, and creates a space to safely contemplate other ways they could be interpreted or misinterpreted. The broad goal of developing self-authorship will necessitate an investigation of the student's goals and responsibilities as well as an evaluation of how well they are doing achieving their goals and addressing their responsibilities. As a student becomes more metacognitively aware, they will refine their communication, bringing in written and visual models to enhance the process. To do lists, calendars, and journals are our records of intended courses of action and important sources of data for reflective discussion. The metacognitive teacher is there to support their student in the process of identifying and articulating what has been identified. Helping a student identify to a teacher the internal and external impediments to their learning will better enable that teacher to support the student, and in turn better enable the student to access the help and support they need in the future.

Over time, as the student learns to better work with their metacognitive teacher, they come to realize the importance of identifying where breakdowns in their knowledge, communication and task execution occur. A skilled metacognitive teacher will help keep their student aware and focused on both the internal and external points of difficulty confronted when pursuing a goal. Internal points of difficulty may have to do with self-communications about task difficulty, self-confidence, or motivation. External points may have to do with factors like how well the student is communicating with others about their expectations or even how to avoid an argument. Many different types of internal and external factors can come to bear. They are interrelated in a multitude of ways requiring a teacher to be metacognitive and flexible enough to understand when to avoid or switch approaches to keep learning moving forward. This line of thought suggests a teacher's skill set and a student's needs can be incompatible. It may require

another person to step in and work with the student. However, it also suggests that a teacher can work to identify the concise and precise methods of communication, whether they be spoken, written, visual, or mixed media, that will assist the student in this process of identifying their strengths and weaknesses in learning and performance, regardless.

Sometimes a student's descriptions of themselves have become so rigidly aligned with definitions attributed to them by parents, peers, professionals or culture that they have lost sight of the reality that they are more complex than any definition or diagnosis or role they may be playing. For example, there are students with ADHD who take their diagnosis to literally mean they have little to no control over their attention, so they make little to no attempt to try to focus their attention. A strong metacognitive teacher would identify these false beliefs and help this student to reframe their self-definition in a way that is more growth oriented and hopeful.

The ability to define an identification leads to a natural kind of closure. After an understanding is achieved, it is natural for a student to feel they have explained everything. At these points, the metacognitive teacher's role is to not only praise and reward the student for their accomplishments, but also remind them that this is not the end of the learning process. A student's new understanding represents a growth in their knowledge. It is an understanding they can use to attack new problems and work toward new goals to achieve new growth, which in turn will lead to new understandings that have not yet been identified, but are now possible because of the achieved understanding.

Students need to learn that communications they have about themselves, that they may use to explain themselves, are not themselves. Even the representations produced by their senses are not capable of expressing the infinite relationships of a simple object they may see everyday. Like that plant in your environment that you never noticed before, once you have identified and

defined it, you begin a chain of identifications that will come to be linked to your perception and knowledge about that plant. For example, once identified, a plant can be understood by its name, taxonomy, growth cycle, adaptations, cell structure, chemical makeup, medicinal or nutrition value, history, and even highly personal facts like its beauty or if it provokes an allergic reaction. There is an infinite quality to the human capacity for understanding, and part of the metacognitive teacher's job is helping the student realize this capacity about himself and others.

A truly metacognitive education strives toward opening up a student to a manner of thinking that leads to the active pursuit of improving their skills of understanding. Because of the infinite variation in skill, ability and disability it is a task that is never fully completed, and may plateau or decline if obstacles toward it become too great. There is an elegant universal design to metacognitive education that stems from the infinite depth of a process that seeks self-authorship for its students.

Metacognitive self-examination is a process not unlike the scientific method. It requires collecting personal data points that can be compared, contrasted, or researched to assist the development of a student's self-understanding of their skills. They are the skills that make understanding and discovery possible. A metacognitive teacher draws these skills out of their students by creating a learning experience where setting goals and executing the behaviors needed for goal attainment are directly identified and organized to produce more effective behavior. Students learn to use metacognition to build understanding of who they are and what they need to do to gain control of their internal and external environments in a way that promotes learning and development.

### *Environmental and Emotional Impacts*

The final critical element of the GTMI is the relationship of metacognition to emotional qualia. Starting with Hart's (1965) investigation of the feeling of knowing, an aspect of metacognition has been found to be bound to a class of cognitive experiences called qualia (Chalmers, 1996). These are non-computational (Penrose, 1989) aspects at the visceral level of experience. They are qualitative aspects like the redness of a rose, the warmth of the sun, or a feeling you get when you may or may not understand something. Emotional qualia are the sensory experience of emotion. They are very highly tuned to situations in the environment, and represent the viscerally felt emotional quality of the experience. Interestingly, metacognition, despite its cognitive nature, seems to be very interconnected with this visceral level of perceptual experience.

The impact of emotion on metacognition is much more significant than is presently appreciated, both in its positive and negative dimensions. Present research (Sapolsky, 2017) has been primarily focused on the negative impact of emotion and the destructive impact traumatic events can have on thinking generally. In this study, emotional qualia were identified repeatedly as an impediment to the development of metacognition.

There were equally as many statements that indicated that a large piece of metacognitive questioning involved helping students identify positive emotional relationships. "I have met many students that may not be doing well, but when they hit something that they feel good about (they become capable of things) they didn't think they could do." Subject A felt that identifying what brought a student positive emotion was a foundational element of her approach, "let's look at what you did that led to what made you feel so good, or what you think made you feel so good. I think that's a good opening."

There is a qualitative, felt, aspect to metacognition that is sensitive to emotional experience. To teach metacognition one must be aware of the impact of emotion. Teachers must study the effects of emotion on their students and be ready to both harness and blunt the effects of these emotions in a transparent, thoughtful way. Emotions can be identified and ordered such that they enhance the metacognitive capacity of students as well as restrict them. A metacognitive teacher must be aware of how emotional experiences and trauma can limit a student's ability to reason, or even engage, metacognitively, but they must also be aware that emotional experiences of hope and curiosity expand it.

The student teacher relationship has historically been identified as an important feature of education. A strong student teacher relationship is particularly important to address the emotional undercurrents that underpin the act of self-regulation and metacognitive learning. Weak student teacher relationships may strain under the emotional burden of self-reflection, or lack the personal investment needed to find and resolve difficult problems. The visceral feeling of emotions can deter us from having certain thoughts, engaging in certain behaviors, and sustaining in certain situations. A big part of metacognitive education is examining why these specific thoughts, behaviors and situations are difficult and how they impact student learning.

Metacognition is a process that allows us to identify different modalities of thought. It allows us to evaluate and order those modalities in a way that identifies some as being disruptive or disabling and others being more supportive and enabling. The goal of every teacher of metacognition is to develop a relationship with their student that peeks their honest and active engagement in the developmental processes of their learning, and enables them to be an honest editor of their life.

Depression and anxiety are examples of two common disruptive and disabling modes of thought that must be addressed through metacognitive education. However, only the student will be able to directly address the internal evocations of these experiences. The experience of disruptive qualia explains why imparting metacognitive insight was not always achieved by all students, even with the support of a PAL professor, “I have students that are still flailing in the same ways that they were flailing at the beginning (Subject A).” A teacher of metacognition will only be as successful as their ability to get their student to orient their attention toward identifying and understanding the qualia of their cognitive experiences, which could be painful and frightening for them, but also enjoyable and empowering.

### ***Metacognition Evaluative Technique***

The evaluation of metacognition is necessarily unlike traditional standardized testing metrics. Traditional, standards based and statistic driven assessments have certainly been applied to the evaluation of a student’s knowledge of metacognition. Evaluative questions about the subject, like Schraw and Dennison’s (1994) Metacognitive Awareness Inventory (MAI) instrument have been utilized toward this end. However, regardless of whether the evaluation is a Likert Scale, multiple choice, sophisticated open response or other such common evaluative techniques only one aspect of metacognition is actually being evaluated, metacognitive knowledge. Such evaluation techniques do not measure the regulatory aspects of metacognition, which are highly conditional and situation dependent.

Traditional mechanisms of assessment are fundamentally unfit to fully evaluate metacognitive ability because they are fixed in time and cannot take into account the situational or subjective features of self regulation. The temporal weakness of any kind of one and done testing technique, could be blunted by the use of formative testing or by using a testing regiment

that tracks the growth of knowledge over time. While these approaches greatly improve the validity of traditional testing results they still fail to address the subjective regulatory aspects of metacognition.

Metacognitive evaluation requires integrating information and action. For a full evaluation of metacognition, traditional assessment techniques must be integrated with the subjective lived experience of the student during the entire process, even during the assessment itself. By integrating the collection of objective and subjective information metacognitively, both the student and the teacher are able to make far more nuanced and actionable evaluations.

Metacognition is as much of a skill as a subject. There is an active quality to metacognitive evaluations that is missing from assignments generally. For example, I could test you on all the aspects of skateboarding, but there could be a significant differential between what you know about skateboarding and what you can actually do on a skateboard. Skills are frequently introduced and evaluated in a form that has been so abstracted from real life that they provide the student with no practical ability to effectively perform the skill, despite having tested competently. Inversely, a student could end up in a situation, like mine, where they are assessed as far less capable than they actually were. For proper metacognitive evaluation to take place, a third node of evaluation must be integrated, and this is the students' own subjective evaluation. This three point evaluative architecture includes the student and develops a student's ability to evaluate themselves. This three node system allows the teacher to better understand the student's learning for the purposes of building better lessons that can better target and stimulate student learning. It enables administrators to make more informed and helpful institutional decisions about student needs.



Metacognition integrates disparate modes of thinking and perception, knowledge and regulation, objective and subjective, conscious and subconscious, emotion and cognition. Standards are still necessary to evaluate the achievement of self-regulatory objectives and the quality of metacognitive knowledge. Part of these standards will necessarily be derived from the insights of another more skilled educator or individual. However, regardless of their skill they will only be able to evaluate behavioral observations of their student's regulatory ability and awareness. Students will necessarily need help identifying subconscious influences on their thinking or behavior that impair their ability to evaluate.

Despite this, students are the ones in the best position to evaluate the subjective qualities of their own learning and express how those qualities are experienced by them. For this reason, the metacognitive evaluation process requires the honest participation of the student. The approach is to have the student repeatedly ask themselves, how do I describe myself and my learning at that critical recursion point in the learning cycle. The professor's job is to promote deep reflection, supporting the student in identifying deep truths that can be taken into the future to support their problem solving. The ability to be part of their own evaluation is critical to developing the student's ability to evaluate their own management of external demands and their internal management of emotions and cognitions.

To develop a student's accurate self-evaluative ability lessons are derived from the student's own actions. The teacher supports self-evaluation that is student centered and nurturing of the fundamental human drive toward problem solving and creativity. Students learn to evaluate themselves through engagement with their processes of learning, acquiring increasingly more self-control over their learning. Teachers devise experiences, create lessons and generally help students to identify and bring what is being learned under their control, supporting their

students in the areas that tax or require improved self-control so they can identify and address impediments to their achievement of greater self-efficacy.

### ***Overview of GTMI***

The general theory of metacognitive instruction (GTMI) is intended to provide a clear educational structure that is simple enough to be communicated and practiced by students, while allowing teachers, professors, and educational professionals a way to conceptualize the very complex and multifaceted work of metacognitive instruction. This description of metacognitive teaching can be used both to guide the development of metacognitive lessons and evaluate their effectiveness. Its elements can be found throughout the educational literature, but are being presented here as a way to separate the elements of metacognitive teaching from other more subject or skill driven modes of education. It is done to clarify what is meant by metacognitive instruction so that its elements can be better integrated into other educational structures. The basic structure is as follows:

1. Goal
  - a. Self-authorship and self-directed learning
2. Procedures
  - a. Cyclical identification and ordering routines
    - i. Identify a problem, goal, or task to complete
    - ii. Compose a plan to solve problem or achieve goal
      1. Discussion and Questioning
      2. Modeling
      3. Structured tasks
      4. mediated experiences
    - iii. Execute steps

- iv. Evaluate the outcome
- v. Identify a new goal, problem or experience to address
- b. Key procedures
  - i. Make choices and reflect on the results
  - ii. Develop greater awareness and self-control through practice and reflection
  - iii. Identify and address environmental and emotional impacts on thinking and behavior
- 3. Evaluation
  - a. Integration of three domains
    - i. Objective assessment
    - ii. Teacher observation and critique
    - iii. Subjective student measures

Metacognition can be appreciated and understood by all ages and aptitude levels. It can add structure to ambiguous learning situations and provide meaningful direction for the student and teacher while working together. By consciously turning the reflective element of learning back upon the learning process itself, a deeper understanding of one's own processes of learning becomes possible, producing a capacity for greater behavioral control and complexity.

### **Grounding Metacognition**

This final area of discussion is an attempt to describe the most abstract features of metacognition. It is an attempt to ground the above-described teaching practices in physical, biological, and conceptual phenomena. The need for this level of explanation stems from the

central conjecture that the effectiveness of metacognitive educational routines are tied to an alignment with underlying neurobiological processes of learning.

The subjective first-person experience of metacognition is one that opens abstract levels of objective cognition and sophisticated behavior. It is a basic neurocognitive experience whose core features can be extrapolated to form the basis of an educational routine. Metacognitive educational elements have been shown to achieve high levels of success supporting student learning (Dunlosky & Metcalfe, 2009; Hattie, 2012). This is particularly true for students with learning differences who do not perform well using more traditional educational models. This is because the metacognitive experience bears a fundamental relationship to core elements of physical, biological and information processing systems of thought.

It is asserted that the human capacity for understanding and self-control can be identified, ordered, and directed back upon itself by the individual in a way that produces new knowledge and behavior. This process refines learning behaviors and develops an individual's capacity for understanding by providing for an ever-evolving expansion of their ability to develop complex behaviors and self-control. Metacognition exploits foundational elements of the learning process, to produce higher order thinking. It is a tool of learning that can be utilized by all kinds of learners, at many different ages, and developmental levels of appreciation making it better suited to address the diverse needs of individuals.

Education, by this formulation, is cyclical and expansive. Unlike more linear approaches to education that place arbitrary limits on both the individual and on what can be taught, metacognitive procedures are cyclical, expansive and eventually become self-reinforcing and self-directing. This is because metacognitive learning expresses a quality that is manifested across abstract fields of thought. This is because at its base is an integrative synthetic phenomena

called **metaing** (Hulbig; 2018), which integrates quantitative and qualitative dimensions of experience to produce new understanding.

### ***Problem Solving and Metaing***

It has been observed by David Deutsch (2011) in his book, *The Beginning of Infinity*, that humans are an organism that have evolved a capacity for universal problem solving. Much like a Turing machine, which uses patterns of ones and zeros as its mechanism of universal computation, the human brain uses a mechanism of explanation in its capacity to infinitely problem solve. Deutsch (2011) identified explanation and error correction as fundamental qualities of a universal problem-solving mechanism. Processes of explanation and error correction have historically been considered primary components of learning. The GTMI educational routine attempts to impart a generalized practice of personal problem solving. Historically, institutions have struggled to produce standardized non-biased curriculums. By contrast, the GTMI focuses on providing support to an individual in solving the problems of their life, society, and culture, with the goal of applying problem solving strategies more independently. This is a form of problem solving that seeks to enlist what is known about the neuropsychological processes of learning to develop the student's infinite capacity for individual skill development and personal achievement, which are indicative of human learning.

Metaing is believed to be a neuro-biological phenomena that allows humans to extrapolate meaning from the discrete parts of what is learned, to form a new kind of understanding that they can act upon. This new kind of understanding can be described as a synthesis that joins the million little parts of an idea into a singular useful identification. This experience is largely qualitative, but requires organization, thereby making aspects of it more easily represented and explained quantitatively. Experiential information is processed to produce

an intelligible understanding that can be refined and expressed to others. Metacognition can be thought of as the way these basic modes of cognition are exploited by the human mind for the purpose of expanding understanding and directing behavior.

One finding of this study was that metacognition demonstrates both conscious and unconscious qualities. Conscious qualities of learning are those the learner is aware of. Subconscious qualities of learning are those that the learner is not aware of, however they can be brought into consciousness through a direction of attention. There are also non-conscious elements, which are more mechanical or abstract elements of brain function, like the transference of protons into bursts of neuroelectric charge in the eye, which are aspects of the process of sight that the learner cannot consciously experience, but can be understood through learning and producing explanations about vision. All indications are that the process of metacognition must be conscious first, and then some aspects like strategies and habits of mind are moved over time to become more subconscious. This theory would suggest that there is a level of consciousness represented all the way down through the cognitive process. Conscious elements of experience are necessarily integrated with non-conscious elements to become tools of thought. To quote Subject G “I don’t think you can have one without the other.”

The brain's ability to synthesize information cannot be simulated by computers, and no approaches to programming seem likely to describe this discrepancy (Penrose, 1994). Steven Pinker (2018) described presently publicized attempts to produce an artificial general intelligence with human level metacognitive abilities as, “commercially dubious...because the concept is barely coherent” (p.298). Not only is it becoming clear that metacognition is a far more intractable computational problem than previously appreciated, but also it has confounded explanation in a classically physical way. In response to the lack of substantive progress toward a

model of cognition using the logic of computation and classical physics, it is proposed that phenomena underlying the human ability to understand are the result of the brain's ability to harness quantum physical properties (Penrose, 1989; Hameroff & Penrose, 2014; Hamelin, 2014).

It has been theorized by Roger Penrose (1989) that the cognitive ability of understanding is related to a quantum mechanical process called the collapse of the wave function. This concept of metaing follows from Penrose's argument suggesting that there must be an interaction between quantum and classical mechanics in the brain that are responsible for learning and development in humans. The concept of metaing, at this time, is believed to only be a part of the phenomena of understanding, and is intended to be a conceptual place marker for a component of cognition that is not well explained utilizing classical theoretical conceptions. However, there is a quality of learning that displays a strongly analogous relationship to certain quantum phenomena, such as entanglement that allows for a non-physical and non-local transference of information (Einstein et al., 1935; Bell, 1964). A practical implication of this line of thinking may be that to truly understand learning we may first need to better understand quantum level physical interactions.

### **Meta Integration**

Metaing is an integrative power in the mind. Through a metaing process that binds identified ideas into larger concepts, our minds are able to produce a single bounded consciousness capable of identifying boundaries within its field of perception. Through this metaing interaction, boundaries are perceived, and functional constraints can be utilized to make further identifications. From these perceived boundaries holistic entities emerge, constituted of parts that themselves can be identified and bound to other identifications in useful ways.

Metaing is a power of the mind that is built off of the idea of recursion (Chomsky & Kenstowicz, 1999; Hofstadter, 1979; Pinker, 2003). Recursion is a process where the steps of a procedure involve invoking the procedure itself, producing a similar representation at a different scale. In linguistics, this would be represented by the sentence, “Chompski thinks language is recursive,” which can be expanded to include another related perspective, for example “Pinkard thinks that Chompski thinks that language is recursive,” or “I think that Pinkard thinks, that Chompski thinks that language is recursive.” Such a linguistic cognitive structure can be built to include an infinite number of individuals concluding the same thing. Recursion has also been demonstrated both visually and mathematically.

**Figure 5.1.**

*Mathematical recursion example*

$$a(n) = a(a(n-1)) + a(n - a(n-1))$$

*Note: Hofstadter-Conway \$10,000 Sequence*

**Figure 5.2**

*Visual recursion example*



*Note: Visual example: M C Escher Print, Escher Art, "Smaller and Smaller", Circa 1956,*



Metaing differs from recursion in that it creates a non-similar bounded whole. While recursion generates multiple iterations of essentially the same thing, metaing produces something new; a cognitive representation that can be understood as separate from its constituent parts. For example, words are made out of recurring patterns of just 26 letters, but from these recurring patterns of letters one is able to generate an infinite number of words. In turn, recurring patterns of words can be structured into sentences that express infinite ideas, and from these ideas patterns can be expressed that produce new ideas feeding the initial process of letter, word, and idea production. So, while recursion speaks to a repeating pattern, metaing speaks to an extrapolation of meaning from these recurring patterns that in turn can be used to form new patterns that in turn produce new knowledge.

Tools of thought can be constructed from certain constituent parts of perception that allow for a new abstract level of perceptual experience. In turn, the perceptual experiences produced by the new understanding become the constituent parts of the new tools of thought that will in turn produce new understandings. This process develops over time, from a state of subjective, concrete, sensory experience to one of more objective, abstract understandings that bind details into metarepresentations that produce various kinds of abstract understanding. By virtue of this underlying metaing phenomena, qualitative features of cognition are integrated with the quantitative. An integration apparent in the metaphors used to describe abstractions. For example, highly actionable abstract boundaries are often expressed in visual terms such as “clear”, while less actionable abstractions are described as “unclear” or “distorted”. Moreover, there is evidence that the phenomena of metaphor exerts a strong influence on the human psyche and behavior (Lobel, 2016). An integrative metacognitive property would explain how the brain

formulates metaphors and why metaphor would exert such a powerful force on human understanding and behavior.

A visual metaphor that could be used to describe the process of metaing was first demonstrated in a short film by Eva Szasz (1968) and was most recently recreated by astrophysicist Danail Obreschkow (2018). This visual effect is caused by zooming out from a fixed point, like a picnic in the park to a point where the whole park, whole state, whole country and whole world constitute the frame of the visual image. This experience can also be generated by *Google Maps*, or experienced while taking off and landing in a plane. The visual transformation that is experienced is an example of the mind's metaing capacity in the visual field, as it is forced to build new representations of information that account for the increase in visual data. I am suggesting that this kind of transformation happens with all information processed by the mind. As the amount of data related to a given conception is widened, our perception produces new patterns and representation, as related ideas aggregate to produce meta constructions akin to the transformations that are seen as the image of the park gets subsumed into the geometric pattern of city blocks and the fractal images of large-scale geographic elements.

### ***Linking Learning to Perception***

Perception seems to be one of the earliest abilities to evolve in cells. According to the fossil record, simple eyes evolved some 540 million years ago (Parker, 2009) during a period of rapid evolution, dubbed the Cambrian explosion. The evolution of eyes initiated this period of rapid evolution, as organisms with more advanced organs of sight out-competed less developed organisms (Parker, 2003). While simple structures, like the eyespot found in the euglena, were capable of detecting differences in light intensity, and little else, behaviorally these organisms

were able to demonstrate that qualitative perception existed long before the evolutionary development of the neuron (Hameroff & Penrose, 2014; Parker, 2003).

The evolution of the eye also demonstrates that despite the rapid development and diversity of organisms with vision, the actual biological machinery employed across species for purposes of vision are developmentally common to all eyed organisms (Kelly, 1994; Parker, 2009; Swanson, 2003). This kind of repurposing of common, simpler mechanisms at ever larger scales to produce new complexity is common throughout biology (Kelly, 1994; Swanson, 2003). Perceptual behavior in single celled organisms demonstrate that perception predates the evolution of the neuron and eye, and that the eye's evolution served and extended a process of perception that had already been under way in living organisms even during their earliest evolutionary stages, (Kelly, 1994; Parker, 2009; Swanson, 2003).

One can imagine how metaing information would evolve differently in different organisms. Interacting with the evolutionary development of new sensory receptors, neurocognitive structures and environmental demands, the level and type of metaing a species was capable of would also lead to the evolution of different cognitive tools of thinking as well as physical organs that support the species' survival. This would lead to the evolution of different neurological organizations and produce different kinds of conscious experiences.

A tremendous amount of information is stored in the initial neuronal firing that makes up a mere split second of actual perception. Consciousness seems to keep all of this data together, and pulls in more, as we move through time and space. So, a bat may have a similar fundamental awareness, but a differently evolved consciousness capable of utilizing the split-second sensory information that is coming from their senses to identify their prey (Nagel, 1974). But, unlike human hunters, they are not using light, but rather, they are using sound. So, while a bat's

conscious experiences are dissimilar in input and presumably in qualia to a human's (Nagel, 1974), the deployment of their conscious knowledge, understanding and experience leads to a categorically similar behavior described as hunting. Despite what appears to be different modes of input, one being light and one being sound, there is a universal commonality expressed in the awareness of their environment.

Sound and light may seem like strikingly different experiential phenomena, but they are physically similar phenomena in that they are transmitted in waves. Moreover, the mechanical sensory interactions between these waves and our brain's sensory receptors are strikingly similar. Sound waves vibrate hair like structures in the cochlear behind the tympanic membrane in the ear. Hair-like cilia structures on the ends of rods and cones detect light waves in the eye. In both cases, a wave interacts with a hairlike structure, and in both cases these hair-like structures are composed of subcellular structures called microtubules. The sensitivity of these structures to wave phenomena and their ability to transmit information received from these waves is interesting and may connect the learning phenomena of metacognition to even more fine grain quantum mechanical processes of the universe.

It has been hypothesized (Hameroff et al., 2014) that microtubules may be involved in how sensory neurons utilize quantum mechanical properties to produce conscious perception. Along with being ubiquitous in neurons, microtubules form the cilia structures at the base of all classes of sensory receptors (Swanson, 2003) and orchestrate the division of genetic material during mitosis (Hameroff & Penrose, 2014). There is building evidence that quantum mechanical properties may be more involved in biological processes than previously appreciated. (Gleiser, 2014; Verny, 2020).

Though much of the evidence for biological exploitation of quantum physics comes from

the study of plants (Olaya-Castro & Fassioli, 2011; Romero et al., 2014; Yarris, 2010) and animals (Mouritsen, 2018; Pinzon-Rodriguez, et al., 2018), there is some evidence of probable quantum processes being involved in the sensory processing of humans (Verny, 2020). Palmer (2013) found that, along with the classically understood lock and key molecular mechanisms, the human sense of smell also utilizes quantum properties to produce our experience of smell. Palmer (2013) found that humans could smell the difference between hydrogen with one neutron and a form of hydrogen with two neutrons, also called deuterium. These two compounds fit into the same lock and key receptors of the nose, but because of the quantum vibrational differences between the two substances, caused by a difference of only one neutron, the sensation is perceived as two distinguishably different smells. Previously intractable problems in cellular biology, like photosynthesis (Olaya-Castro & Fassioli, 2011; Yarris, 2010) and the migratory ability of geese (Pinzon-Rodriguez, et al., 2018), indicate that macro scale biological organisms can actually utilize physical properties that only exist at exceedingly small quantum level physical scales (Verny, 2020).

### ***Science and Metacognition***

Metaing is actually a common and generally understood feature of cognition. Its common understanding has become encapsulated in the phrase, “That is so meta!” Reddit’s r/meta, and other online forums that seek to collect popular memes related to the phenomena. Scientifically, however, it is a feature of cognition that has eluded a full explanation, and yet is identifiable across the scientific literature. Rather than an explanation, science has done better at identifying the environments and experiences that influence its expression. For example, in psychology, scientists have devised tests to identify the kinds of environments that promote metacognitive thinking (Brown, 1978; Dunlosky & Metcalfe, 2009). Likewise, neurobiologists have devised

scientific procedures and equipment capable of identifying the general parts of the brain that are activated during certain kinds of metacognitive thinking (Carter et al., 1998; Fernandez-Duque et al., 2000; Peterson et al., 1999). However, a fully descriptive explanation of what is occurring when the human mind shifts from one identification to a meta interpretation remains forthcoming.

What is most relevant to this discussion is that individuals can subjectively investigate their metacognitive thinking in ways that are scientific in nature. A deep metacognitive education will import many of the general investigational procedures of the scientific method into the investigations of the self through reflection. Likewise, scientists themselves must demonstrate high levels of metacognitive self-regulation if they are going to engage in objective science that makes actionable predictions (Popper, 1963). Interestingly, scientific methods like questioning, researching, developing hypotheses, collecting data, and drawing conclusions are as applicable to self-investigations of the cognitive environment as they are to objective investigations of the physical environment. They are universally effective methods of investigation and problem solving that also exploit the mind's metaing power.

All scientific endeavors must rely heavily on the metacognition of the scientist doing the study. Science requires high levels of organizing, planning, executing and evaluating to be effective. It would follow that methods and procedures that enhance scientific investigations would also enhance an individual's ability to self-reflect metacognitively. The steps of the scientific method exploit neurological processes of identification and organization to stimulate understanding, again suggesting that there is a common cognitive process related broadly to problem solving in humans (Deutsch, 2011). The educational power of metacognitive educational routines like connection, relationship, reflection and choice, may represent a

self-exploitation of deep quantum physical properties to produce understanding, which in turn facilitate the storage, communication and cultural transmission of that understanding.

### **Chapter Summary and Conclusion**

This chapter has discussed PAL's learning conversation. The findings were further related to fundamental components of metacognitive instruction called the general theory of metacognitive instruction. The general theory of metacognitive instruction was in turn tied to neuro physical connections between perception and learning that revealed a quality described here as metaing. Through this chapter, it has been proposed that the most optimal forms of teaching will closely align with the brain's neurological processes, which are neither all quantitative or qualitative, nor all environmentally or internally driven. This integrative neuro cognitive phenomena, described as metaing, ties the process of metacognitive education to fundamental biological and physical phenomena occurring during the process of learning.

These findings open up several important avenues of future investigation. Investigations that will challenge human limitation and the classical paradigms of what it means to be a student and a professor. Metacognitive teaching practices like the learning conversation integrate what it means to be a teacher and a student into a singular educational approach that is more respectful of the needs of each individual learner. As a pedagogy, metacognition is capable of addressing the educational needs of a free postmodern society while promoting the supportive connection of its people. As a personal practice of an individual, it is a vehicle of positive self-transformation.

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## Appendix A

### Consent for Participation in Interview Research

I volunteer to participate in a research project conducted by Philip R. Hulbig from Lesley University. I understand that the project is designed to gather information about my work and understanding of metacognition. This research study could later be included as a part of Phil Hulbig's dissertation on this subject, and will not reveal my identity as a participant. I understand the following stipulations:

1. My participation in this project is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time without penalty. If I decline to participate or withdraw from the study, my withdrawal will remain confidential.

2. I understand that most interviewees will find the discussion interesting and thought-provoking. If, however, I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.

I understand that there will be a pre interview piloting stage to insure that the interview questions are clear and understandable. I may be asked my feelings and understanding about certain questions before the actual interview. This piloting process will be to ensure the clarity and quality of study questions.

3. Participation involves being interviewed by Phil Hulbig from Lesley University. The interview will last approximately 30-45 minutes. Notes will be written during the interview. An audio documentation of the interview and a subsequent transcript of the dialogue will be made. A speech to text resource may also be used to create the transcript.

4. I understand that the researcher will not identify me by name in any reports using information obtained from this interview. Audio information obtained from this interview, may be used as part of a broader research project. If this does occur, I will be contacted and may choose to withdraw from the study at any time.

5. I understand that this research study has been reviewed and approved by the Institutional Review Board (IRB) for Studies Involving Human Subjects: Behavioral Sciences Committee at Lesley University. My faculty supervisor is Dr. Gail Simpson Cahill of the Graduate School of Education and can be contacted at [gcahill@lesley.edu](mailto:gcahill@lesley.edu) or 617-349-8799. There is a Standing Committee for Human Subjects in Research at Lesley University to which complaints or problems concerning any research project may, and should, be reported if they arise. Contact the Committee Chairpersons at [irb@lesley.edu](mailto:irb@lesley.edu)

6. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

7. I have been given a copy of this consent form and transcript to review.

\_\_\_\_\_  
Your Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Your Printed Name

\_\_\_\_\_  
Signature of the Investigator

For further information, please contact: Philip Hulbig, 508-838-0591, [phulbig@lesley.edu](mailto:phulbig@lesley.edu)

**Appendix B****Stage One Interview Questions**

1. What is your job and how does metacognition factor into what you do?
2. How do you define Metacognition?
3. How do you see the pedagogical practices of metacognition influence the personal practices of metacognition and why?
4. Do you see metacognition as conscious, unconscious or a bit of both and why?
5. What do you consider the most important element of metacognition?
6. How should teachers approach the subject of metacognition with students?
7. Do you believe a student's approach to metacognition should be evaluated, and if so how?
8. Do you see shortcomings or weaknesses to metacognition?
9. What questions do you feel are critical to the development of metacognitive understanding?
10. What would you like to see as the future of Metacognitive research?
11. Is there a question you wish I would have asked in this interview?

## Appendix C

### Stage Two Interview Questions (Post workshop)

1. What did you think of the information presented on the neurology of metacognition?
2. Did you read the paper Toward a Neurology of Metacognition before or after the workshop, or did you choose not to read it? Why?
3. What aspects of the workshop did you find most helpful? Aspects of the paper?
4. What presented information did you feel was most relevant to your practice?
5. Were there aspects were you already using in your practice? If so, what were they?
6. Was there any information that surprised you? In what ways?
7. How would you integrate this information into your practice? Which ideas would you integrate and how?
8. What do you see as the best way to disseminate information on metacognition, learning and the brain?
9. What areas of executive function and metacognition would you most like to know more about?
10. Do you have any questions about metacognition or executive function that you presently feel we do not have an answer for, or perhaps the present explanation you feel is a little weak?
11. Are there any questions you wish I asked or subjects you wanted to touch on before concluding our interview? (any angle on Metacognition you feel I have overlooked?)

## Appendix D

### Narrative of Metacognitive Development Phase II

This section of the dissertation contains my second narrative investigation of metacognition from the subjective, first person, embodied perspective. It captures my personal conceptualization as well as history of professional practice before I began the analysis of the interviews of the eight PAL professors. It outlines my personal and professional development of metacognition.

#### *What is Metacognition?*

By my definition, metacognition is an integration of an organic based species of thought with more algorithmic cognitive tools of thought, like those identified by Vygotsky (1934). Metacognition can be thought of like a skill, not unlike writing, mathematics, or skateboarding. You start with a certain level of natural aptitude and, through a combination of focused attention and practice, you improve at it. Like all skills, if there is no one there to teach it then it will likely not develop as far or as quickly as it could. Most skills, like language, have peak times for learning. Individuals who make it to adulthood without ever having been exposed to language, may never be able to manage it productively (Newport, 1990). I believe this could be the case with metacognition, but presently there are no research studies that I am aware of that have investigated this. Nature and time, however, are not the final arbiters. In all cases, learning can occur, even in those where trauma has done long term damage. Individuals can improve virtually any skill of their choosing, but only if they are willing to investigate how they perform the skill, and apply their knowledge to that behavior through conscious effort (Doidge, 2016). It is the conscious day-to-day effort, and a kind of problem solving oriented self-reflective thinking, which characterizes metacognition at the individual level.

Metacognition is a cyclical two-part phenomena (Flavell, 1979; Nelson, 1996) that brings an individual to new understanding and new ways of doing. It uses self-knowledge to produce, self-regulation and motivation. It is a repeating cycle of information processing, which produces deeper, more nuanced knowledge and more effective regulatory behavior. I feel metacognition has two truly special properties. First, metacognition is unique in that it is a skill that improves the execution and development of other skills. The other special property of metacognition, and perhaps its most fascinating, is that it can be turned upon itself through a repeated process of self-investigation. This self-reflective property, I feel, produces deeper, more abstract levels of self-knowledge, which in turn produces greater levels of self-regulation and more sophisticated developmental capacity.

My personal hypothesis toward this end is that improved self-knowledge and regulatory ability drive the development of acquired skills, and human development more generally. The greater an individual's ability to identify how they approach a skill the more precise and complex behavior they will be able to perform relative to that area of skill. When the skill being approached is the metacognitive skill of self-regulation and self-control the process moves the individual towards greater levels of human development.

Most individuals possess an innate ability for some of the self-reflective practices of metacognition, and a person who has never been directly taught metacognition can develop a basic level regardless (Pressley, 2002). I believe the expansive developmental nature of metacognition as a cognitive activity will continue to unveil new insights and techniques as it is practiced, not unlike traditional subject areas such as mathematics or science. However, there are certain forms of self-regulation that require formal training to progress past a certain point.

Just as a basic mathematical sense generally develops in people through the everyday demands of life, the development of metacognition is equally influenced by life experience. Even without formal training the planning and organizing components of metacognition can lead to a sense of relief from the confusion and the stressors of life, encouraging its natural development. As individuals organize and project themselves into the future, the behaviors associated with getting their life in order can be very therapeutic and self-supportive promoting their development without formal instruction. However, through instruction individuals will benefit from the aggregate societal knowledge about metacognition improving their natural capacity to therapeutically support themselves and others. I believe this therapeutic feature of metacognition is also another strong reason to teach it formally and directly to all students.

### **Stress and Metacognition**

So much stress comes from the manner through which we reason (Dweck, 2008; Valiant, 1993). If we attribute our overbearing stress to forces outside of us, we anxiously withdraw from the world. If it is placed internally, we collapse depressingly into ourselves. Metacognition offers a way to avoid being locked into maladaptive behavior at either end of this continuum.

Active metacognition appears to be a very personal form of scientific method, involving hypothesizing about one's situation, planning and executing a response and then reflecting on the outcome. Its products are developmental and gradual changes in the patterns of one's thinking and behavior. Its development is dependent on the proper function and integration of a myriad of cognitive processes. However, its conscious implementation opens up the possibility that an individual will notice when something is amiss with any of these processes, making adaptation to personal weaknesses possible. This, I believe, is the evolutionary explanation for metacognition.



It seems to be an extension of the human ability to observe the external environment and detect ways in which it can be modified.

There also seems to be a force of human cognition that seeks to maintain stability, which is ingrained in the neurological processes of the brain (Sapolsky, 2017). This biologically driven process seeks to retain/maintain thoughts and behaviors through habituation and produce a level of cognitive stability where it becomes possible for a developmental process like metacognition to occur. Cognitive stability provides a mental environment where the kinds of insights and behavioral changes that metacognition makes possible can occur. It is somewhat paradoxical in this way, because metacognition is a kind of willful disturbance of the very cognitive stability that is necessary for it to occur, and yet makes maintaining stability over longer periods of time more possible.

I know that I engage in metacognition personally to bring stability to my environment, both internal and external. Often what I am trying to bring to bear is a predictable future for myself, one where I will not be caught off guard by events or one where I will be able to execute a task with a high degree of precision. However, everyone has different levels of stability that they can maintain, and different levels of instability they endure. My disability makes a certain level of organizing very difficult and confusing for me, but I also believe I can endure higher levels of instability than most. I sometimes wonder if my inability to manage stability has promoted my ability to endure high levels of instability, or if it was the reverse? Did my high tolerance of instability impair my ability to manage stability? Though I can't be positive where these tendencies came from, I am sure my high tolerance for instability has served me well in my professional career, and my understanding of my degree of tolerance has given me the confidence and fortitude to undertake a career path that someone with a lower tolerance to

instability probably would find unbearable. However, I also believe it is a specific kind of cognitive instability that metacognition produces that runs counter to the kind of uncontrolled cognitive instability that leads to mental illness and disability.

### **My Pedagogy**

When teaching metacognition, I try to keep my own metacognition in sharp focus. It is important for me to remember that I engage in metacognition to forge a level of stability and predictability for myself. This is why I always structure my sessions with students around those things that are producing stress in their lives, and the future demands they must plan for. I tell them that first we will focus on any immediate crisis of the moment, then we will plan for the future, and then we will talk about metacognition, learning and the brain. Focusing on the crisis of the moment generally consists of bringing up deadlines that are fast approaching, or passed. It can also be a time when the students can bring up personal problems that are impacting their day-to-day life and weighing heavy on their hearts and minds.

Planning for the future involves a student in creating game plans for completing certain tasks, setting goals and deadlines, plus, studying how similar events occurred in the past. During this stage I directly teach metacognitive regulation. I try to do two things. First, I try to make the program as discussion based as possible, and target areas the student has shown either difficulty or interest. Then, I directly teach students about nine cognitive components of problem solving and how they function, which is modeled off of Dr. Webb's (1989) original cognitive ladder model. My hope is to stimulate an enjoyment and habit of thinking about the brain and how thinking works.

If there is a problem affecting students, examining what they think about the problem, what the potential solutions of the problem are, and then attempting to execute a solution, are

themselves therapeutic. When a success is achieved through this process, students will tend to keep utilizing metacognitive techniques that worked for them. This is because metacognition offers the possibility of a solution to problems, even when there is no clear solution, and compels action even if the action is new and ambiguous. The process itself can come to be seen as a way to keep at bay the crippling anxieties that generally prevent individuals from doing anything about their situation.

Anxiety is an emotional energy that lacks a clear target. It is an energy that is unsure of where it belongs and how it should be expressed. A big piece of the work I do with students is to try and figure out where this emotional energy is coming from, so that we can direct that emotional energy at the problem that is producing it. Without support, it is possible for the true source of the student's anxiety to become obscured by psychological defense mechanisms.

When I first start working with a student, my initial metacognitive lesson is to discuss illusions, cognitive biases and the subconscious factors that affect perception. Often the things that are causing instability are things our defenses are trying to protect us from because they are scary, and we don't even know where to begin to understand them, not to mention how to handle them. We work to keep these things outside of our conscious thought. I try to make it clear to the student, up front, that we are going to be looking for these hidden and scary impediments to their learning.

### **Effects of Trauma**

For most students I have worked with, it is the debilitating effects of trauma that most impair the ability to use metacognitive skills effectively. Trauma functions in the mind like a physical injury. Through physical trauma the body can become so accustomed to protecting an injury from further damage that it is now limiting that injured part of the body's motion and use,

despite the healing that has taken place. Likewise, emotional trauma leaves a neural injury (Fang et al., 2021) that can impact a person's range of cognitive motion (Finkelhor et al., 2011; Sapolsky, 2017; Valiant 1993), as they work to protect themselves from further insult and injury. Just as is seen in physical trauma, an individual can fall into an almost reflexive response to perceived psychological threats. Without support through the healing process, even when the psychologically damaging factor is no longer present in their lives, their brain will seek to protect the mind from the painful memories connected to the trauma, even long after the trauma has occurred.

The result of both physical and mental trauma is often an adaptive behavior that becomes an impairment because of its continued impact on the injured person. This may occur even though, by an objective evaluation, there may be no reason why it should. Interestingly, the answer to both physical and emotional trauma is therapy. In the case of damage to the body it is an overt and willful physical therapy that seeks to get the body moving again without fear. In the case of the mind, it is therapy that seeks to allow the mind to move back into certain cognitive areas without fear and reflexive emotional recoiling. In both cases, the role of metacognition is apparent in the process of healing.

An example of reflexive emotional recoiling can be seen in individuals raised in environments that do not promote cognitive balance. These are often traumatic environments that forbid certain kinds of thinking or self expression, and lead an individual into an over reliance on one particular tool of thinking and an avoidance of others. Feuerstein (1980) described this as the phenomenon of cultural deprivation. Cultural deprivation is a condition where the culture of individuals reinforces modes of thinking that impair their ability to learn and behave flexibly. Rather than conceiving of the world as related through cause and effect, individuals adopt an

episodic view of reality, conceiving of the world as if they were unrelated moments to be endured rather than comprehended. It is a situation where a person's formative experiences have left them metacognitively ill-equipped for more complex problem solving. These individuals often need to relearn what is involved in the learning process and unlearn the habits of mind that they have developed that block learning. Before my exposure to metacognitive ways of thinking I had a very culturally deprived manner of thought that led me into arguments, and made me a generally difficult person to deal with. I had to relearn how to argue to become a better learner.

### **Personal Development of Metacognitive Thinking**

In my youth, I was hurt by the experience of failures that aroused disapproval and feelings of incompetence. I was often wrong, and I could not understand why. Often the explanations given made no sense to me either. I can now look back and see how my dyslexia impacted both my receptive and expressive language even before I started writing, something I did not realize until I had a child of my own.

It was my son's demonstration of a linguistic quality that I had up to this point only noticed in certain students I had taught, and never related to my self. However, now the behavior was being demonstrated by my son in a way that was startlingly familiar. This was the tendency to talk only in terms of actions, frequently dropping the subjects of sentences altogether, and becoming an impediment to clear articulation. When my son would do this, I would gently remind him to include a subject so that I would know what he was talking about. I believe my insight into my son's communication issues kept him off of an Individualized Educational Plan (IEP), but for me, things were different. I can remember the frustration I caused. I was frustrated also. What I did not understand at the time was the frustration was coming from my own failure to communicate, and my teachers failure to identify my communication failure for me in a way

that would have helped me overcome it. Overtime, when a teacher became frustrated with me I would become frustrated right back. It was cathartic, but also an impairment to my ability to learn.

My arguing was a learned skill, supported by a broader American entertainment culture of stereotypical conflicts between young and old, students and teachers, parents and children. My mindset was that of a disturbed postmodernist, in that I saw all ideals as constructs of their holders' self-interest. In high school, before I met my tutor, no one could really win an argument with me, as my idea of winning an argument was complete emotional evisceration of an opponent. Facts were simply one in the arsenal of verbal weapons used to break down an opponent. Through this style of argumentation, the only goal was to make the other person feel stupid, and my experience with that feeling made me good at it. However, I was not the best. I had friends, of course, who were superior. Sadly, I learned from them, because when we were not dissembling a teacher or parent, we were dissembling each other's self-esteem. At that time I was embedded in a culture of self-defense.

What I developed as a teenager was a mindset with debilitating consequences for learning. Emotion, rather than being a guide through obscurity, became a weapon. At least part of this attitude came from the majority of adults I was exposed to, who at this time were under the impression that if discipline was done right then the child should 'show remorse,' usually in the form of crying. After enduring many moments of tear-filled humiliation, I learned how to choke back the tears. I adapted this into my argumentative beliefs and style, and I became primarily focused on hurting my opponents on as deep an emotional level as I could muster. Due to my familiarity with failure, I knew what kinds of arguments would hurt the most: the ones that hurt me the most. The arguments that attacked and trivialized the things you most cared about,

and I had an uncanny knack for identifying those things in others. I think the reason the concept of metacognition affected me so powerfully was that it revealed this quality about myself to me; a quality I despised in others that I was also guilty of.

I also feel this change for me was dramatic. One moment I was locked into thinking about exchanges in purely emotional terms, where things like having the last word and trying to make the other person cry were as important as maintaining my own, fragile, composure, and the next moment I realized how pointless and insipid this behavior was. A large part of this change, I owe to another PAL advisor, who for confidentiality reasons we will call Jack.

### **My First Professor at PAL**

When I entered the PAL Program at Curry during the summer 1989, Jack became my PAL professor. He was a Catholic Deacon who also worked in the prison system and literally, wore his religious beliefs out there for everyone to see. His standard dress was a black short sleeved shirt and clerical collar. Jack approached every subject in a way that would lead you back to examining your own beliefs and prejudices. Where my tutor Stan was able to tap into the personal, emotional aspects of learning and self-discovery, Jack was able to tap into the dynamic, intellectual and scientific aspects of metacognitive thinking. He nurtured and fed a developing obsession for brain science, which enabled me to actually understand, from a scientific and biological sense, the work that Stan had done with me earlier.

Jack had a gift for breaking very difficult concepts into easy to understand and relatable parts. Many times I remember walking out of his office on the second floor of the PAL library absolutely energized by our conversation. Through his work with me, I came to realize that, not only could I understand advanced college level material, despite my obvious functional weaknesses, but that my ideas were important to the discussion. I became a voracious reader of

anything on the subject of neurology, learning or learning disabilities because of his tutelage. Thanks to him, I attempted to read texts that were well beyond my ascribed reading level, and came to realize that not only could I read such texts, but I could also express ideas on those subjects. Jack fed my sparks of insight until they became a smoldering academic interest that would become the foundation of a future career, and what has brought me to the point of writing this dissertation.

By examining my macabre enjoyment of argumentation what I have come to discover is that I have a real skill at spotting weaknesses in certain types of arguments, a skill that has served me well in my present career. But in my youth, most adults hated to argue with me. This was because my natural skills, in conjunction with my mindset that the only way to win an argument was to punch people in the emotional and metaphorical breadbasket, made me toxic to anyone who thought they were presenting some kind of truth. I know I was exhausting for most educators, asking questions, changing the subject, and endlessly reframing the debate so that the idea presented seemed trivial. I would push back on sensible arguments with the intention of getting them to no longer make any sense. However, rather than getting offended by my behavior Jack seemed to enjoy my argumentative quality.

In fact, Jack would use it, spin it, turn it on its head and direct it right back at me, in the most pleasant and jovial of ways. With him, we were playing with ideas to figure out where they were stupid, and not labeling the other person as stupid for having that idea, which would have been my usual course of action. With Jack, my nit picky argumentation became an expression of my intellectual curiosity. He taught me how to transform my curiosity into inquiry, as valid as any other person's intellectual inquiry. The argument became a tool he would utilize in a very



reasoned and systematic way, to work with me to break down ideas. Soon his mental tools of inquiry became my mental tools, and a source of one of my greatest intellectual strengths.

### **Metacognition and Dichotomy**

I believe what metacognition creates is the ability to perceive dichotomies as merely manifestations of the same thing. These are the kinds of phenomena that are encapsulated in the Daoist taijitu symbol, commonly called the Yin Yang. Metacognition promotes the ability to see these dichotomous, yet unitary phenomena because they are representative of many aspects of the human condition. For me, my greatest intellectual strength was actually what stood in my way from receiving the information I needed to learn. Jack never told me that, however I believe I learned it from him. It was my internalization of this process driven approach to thinking, which he had brought me to, that led me to my own startling self-realizations. I discovered my own mental trap, a trap I created and reinforced repeatedly through my interactions with others.

Back and forth exchanges with another person help parcel out, intellectually, differences between what is said, and what is meant by what is said. As a person with a language-based learning disability, I have to gauge whether or not I'm saying what I truly mean, and judge my understanding of what is being expressed to me. From this vantage point, communication is a desperate, emotional, back and forth exchange that amazingly allows us to understand the mind of another person. Of course, this is only if we want to understand. To the unhealthy mind, this back and forth exchange is a mechanism of obfuscation. Rather than expanding understanding, communication can be used to protect the ego, and prevent understanding by degrading our sense of self and compassion for others.

In my youth, I wanted to show "them" they were wrong about me. I hated those people that labeled me disabled, those teachers and others that predicted and encouraged my failure. I

needed an enemy to hate, an enemy to battle. However, through the metacognitive teachings of Stan, Jack, and Dr. Webb my hate was processed into achievement. My achievement created more things in the world that I came to care about and love. I still find it ironic that my hate drove my expanding achievement, and expanded my capacity for love, but I now see they are aspects of a similar phenomena. My capacity for hate moved from being directed at an actual person, to an abstract “them” and then an abstract system that produces the conditions, social and environmental, that block development.

### **Success and Failure**

I graduated Curry with the conviction to be a great teacher. I knew it. Otherwise, I would not have made it this far. How we conceive ourselves is fundamental to our motivation. Our self-conception motivates us toward success or failure. When I conceived of success and failure as polarities I withdrew as far as I could from responsibility, or anything, I felt there was a good chance of failing. When I learned that failure was only made possible by success, I discovered failure could be carefully avoided or beaten back with effort. After graduating college I had come to believe in myself, and in my ideas. I wanted to show the world that you could teach in a way that maximized learning through empowering the students with a sense of metacognition. With my experience and enlightened way of looking at thinking, I felt I was going to make a tremendous impact on the way children were taught, but then I got my first teaching job.

My first job was as a public-school educational assistant in a third grade classroom. Before I started, I was briefed on what to expect. This was the beginning of the inclusion movement in public education. I was going to be a one-to-one support person for two students, who in the past would have been excluded from a general education classroom due to their behavioral presentation. One was diagnosed with attention deficit disorder (ADHD) and the

other was diagnosed with pervasive developmental delay (PDD). I was honest about my lack of familiarity with PDD, but I was sure about my knowledge and understanding of ADHD. I was told that I would be trained in physical restraint when it came up in the natural course of events, but was not sure what that meant.

For my first day of school, I dressed up and wore a goofy tie that I knew any 3rd grade student would love. First, I was introduced to my PDD student and his father. He was a brilliantly quirky student, and seemed to immediately trust me. My ADHD student was the complete opposite. He was immediately guarded and stand-offish with me. When it came time for morning work, I noticed he was not doing it. I asked if he would like a pencil, and if he needed any help. He took the pencil and began to write his name in a slow struggling way. All of a sudden, he yelled, "Fuck this Shit!" a profanity as he broke his pencil in half, threw the pieces, flipped over his desk. At this point, my first formal introduction to physical intervention began.

I had never seen behavior like this, from any person, child or adult. He threw whatever I thought I knew about learning into turmoil and laid bare my inexperience as a teacher. How could I teach someone I could not even get near? His rages were often barely predictable. Everything I thought I knew about education was called into question. The behavior modification techniques I had been taught in college actually had the tendency to provoke his explosive behavior. Plus, you could not ignore the fact that this little boy was deeply hurt by his tantrums and the effect his behavior had on those around him. It was as if he had rage attacks like epileptics have seizures. At times, he was so truly sorry it was heartbreaking, but at other times he was shockingly condescending, insulting and manipulative. When I tried to be firm and consistent, he would melt down; when I would try to be accommodating and understanding, he would take advantage of the situation until it provoked a tantrum or other dangerous situation.

The individuals enlisted by administrators to help me with this student were soon out of supportive solutions. No one knew what to do with this child. At this time there was no program to offer, and there were no clear schools of thought that could be used to frame the situation.

There was no history of trauma. He had a wonderfully loving mother and a compassionate and involved stepfather. The classroom teacher I was there to support gave her all to this student, and the staff were consummate professionals in all ways possible. His behavior was so reactive it was dangerous to be any other way. He was obsessed with power and manipulation. Physical interventions were long threatening struggles. Remorse came with wailing sobs of apology or frightening threats about what would happen next time.

After three months of employment, the school was ready to throw in the towel. I was told if I could not demonstrate some type of improvement, then it was not safe to keep him in school. I would fail my first student. I would fail again.

However, I had become metacognitive, and, rather than seeing the event as a failure, I saw a tremendous opportunity to test my ideas about learning, the ones I had developed in college with the help of Jack, Stan and others. This was a real-world test, and I had an opportunity to work creatively with him without the fear of being told that I was doing something wrong, because at this stage, my theories on intervention were as good as anyone else's. In the midst of repeated failure, I saw the potential for success, a potential to learn from this student as I helped him.

Through careful observation and reflection, I noticed that there were aspects of his behavior program that were actually setting him off. I also realized that there were patterns of communication that he perceived as condescending and also set him off. I realized that I could, in fact, get close enough to communicate, commiserate and empathize with him. He was actually

desperate for control. I came to understand his mind, his disability, and I was able to predict his unpredictable behavior and use that knowledge to influence his thinking and actually teach him. It turned out that he was extremely smart, yet no one knew how smart he was before this point since his out of control and oppositional behavior made it impossible to assess him in any formal fashion.

By our next progress meeting, the number of physical interventions he required had dropped drastically. By the end of the year, they were even more infrequent. By the end of the next year, this student, who was exploding over three times a week was no longer exploding at all and blended seamlessly into a mainstream class with his peers.

I was clearly doing something right, but what was it? I continued to use metacognition to build theories on teaching, learning, and behavior. When they were demonstrated wrong, I would tweak them, change them or throw them out. In the day to day search for real life solutions, my students were succeeding in measurable ways. Still I wasn't really sure exactly what I was doing that was producing this success. Grand ideas were put to the side because at this time I needed to learn. How could these kinds of students be successful? No schooling could have provided the kind of education that my daily work was presenting me with, and because I approached the experience metacognitively, I learned more.

As time went by, my ability to work successfully with students with learning and emotional disabilities enabled me to secure a job rebuilding and improving a substantially separate special education classroom in a small public school. My success here led me to be given the responsibility of creating, from the ground up, similar programs for students with learning and emotional needs at both the elementary and middle school level of a much larger school district. The ability to build my own programs from the ground up and run them was an

unprecedented opportunity for me, one that complimented my learning style in a way that I do not think I can fully express here. I had finally found a place in the world that respected my talents. I had achieved a place where my insights and achievements were valued, and people genuinely were working to understand and teach all children.

I knew that my knowledge and experience were valuable assets to the school district, but there was so much work to do. There were so many intractable problems related to the day to day function of the program that there was little time for anything else. Problems with no clear solutions needed to be solved every day for the success of the program. Plus, I needed to figure out how to teach four content subjects to three or more separate grades, differentiated to account for the diversity of ability and disability. In addition, there was a seemingly endless stream of writing, testing, meetings and consulting related to the many complicated Individual Educational Programs (IEPs) I was entrusted to implement. Also, I was responsible for the development and implementation of behavior plans, orchestrating crisis interventions and managing the day to day drama that was the lives of my students. How was I managing all this? For me the answer to this question was best expressed in the lyrics of a song called "How You Sell Soul (Time Is God Refrain)" by Carlton Douglas Ridenhour, aka Chuck D (2007):

“When you love something you develop the mental capacity to reach that thing you love.”

### **Managing with metacognition**

Again, metacognition was how I kept the overwhelming monstrosity of demands related to running these programs under control. However, despite my success with the students, I struggled to explain the uniqueness of what I was doing to administrators, or even other educators outside the program. Administration was never interested in providing the resources to address the scheduling, planning and protocol issues related to the program. I was left to solve

these issues myself inside the classroom the best I could. I toiled for years, believing I could craft the perfect program with limited support from an administration that was becoming increasingly concerned with testing and saving money. I became disheartened, and part of me felt I was wasting my time. I was engaged in what seemed like fruitless self-reflection, but again the solution to this problem appeared in the form of a teacher. The solution to this problem I will call Tea.

Tea was brought on as the co-teacher of the program the year after the classroom's student numbers surged past the state limit for substantially separate programs in the public schools. For the first time in my career, I had another teaching professional who was living the same situation I was. I had another teacher to talk to and bounce ideas off of who could understand what I was talking about because she was there having the same unique experiences and dealing with the same unique challenges that I had been dealing with for years. It was empowering for me to finally know for sure that I could not only get another highly trained educator to understand and appreciate what I was doing, but that she actually wanted to take the things that I was doing and apply them for herself.

Thanks to Tea I came to realize that my disability was again holding me back. However, now it was not simply my communication difficulty that was the problem, it was the uniqueness of my situation. My formative educational experiences were much different than other teachers. Moreover, the daily work of my job was so different from most other educators that they simply had no frame of reference from which to relate to me. Plus, since I had taken to hiding my disability from other teachers and administrators, the best tool and mechanism that I had to help build a frame of reference between us was missing. This was the source of many of the problems and confusions that occurred when I spoke with administration.

Thanks to Tea I had someone to share my troubles with, someone to ask me clarifying questions, someone to assist me in my own metacognitive process. Thanks to Tea I came to realize, from a wider perspective, the importance of working with others metacognitively.

### ***Conclusion***

When metacognition is practiced on an individual level, you need a frame of reference. That reference frame can be strengthened with the support of another person. When I came to realize that metacognition was deeply tied to supportive relationships it led me to more deeply value the people in my life who were willing to engage in this style of thinking with me. It was the support that others offered my thinking and self-regulatory processes that enabled me to better achieve my professional goals and more strongly stand for my core ideas and principles.

I now realize that metacognition has a developmental piece to it that is only recoverable through our historical narrative. This extends to our ability to explain our understanding to others. So much practical understanding comes from raw experience and how we choose to perceive it.

Metacognition prepares and allows the mind to think through raw experiences from different perspectives. The metacognitive perspective of another person can further deepen and expand this process when they understand how your thinking came to be developed. However, this is a perspective they can only gain from thoughtful meaning full discussion of it with you. Through a process of explaining yourself, you come to know yourself. By allowing another person into your metacognitive practice you can share and connect your experience and perspective in such a way that it produces new knowledge you can use. In conclusion, it is my belief that the practical practice of constructing a personal narrative of one's own understanding



of themselves allows for an ever deepening capacity for metacognition, which can become transformative when supported by others who are willing to support its engagement.

## Appendix E

### Neurology of metacognition workshop slides

**Neurology  
of  
Metacognition**

By Phil Hulbig (PhD Cand. Lesley University)  
2019

#### Overview

- > [Historical Relevance](#)
- > Review of Brain Areas Involved in Metacognition
  - o [Hindbrain](#)
  - o [Midbrain](#)
  - o [Parietal](#)
  - o [Frontal](#)
- > [Investigational Implications](#)
- > [Neuroplasticity](#)
- > [Default mode](#)
- > [Mirror Neurons](#)
- > [Potential for Research](#)

#### What it means

### Meta-cognition

- The prefix **Meta** means "beyond" or "growing out of"
- Cognition** is thinking.

**Meta-cognition is using thinking to go beyond, or understand thinking it is sometimes called **thinking about thinking**.** (Flavell 1979)

#### The Meta Problem

- Flavell (1979)-

"metacognition plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and, various types of self-control and self-instruction; there are also clear indications that ideas about metacognition are beginning to make contact with similar ideas in the areas of social learning theory, cognitive behavior modification, personality development, and education."

Metacognition is a conceptualization that can accommodate all our knowledge about the brain and mind. It can be both an institutional interdisciplinary subject area and a personal individual developmental practice.

Structure Brain Mapping	Physical development	Knowledge	Transcendental Meditation
	Neurology	Objective data	Psychological development
Frontal Parietal Pathway	FMRI+PET	Analogy	Blooms Taxonomy
Lesion	Memory	Trauma	
More Physical	Learning	More Conscious	
Neural networks	Metamemory		
Synaptic chemistry	Sleep tests	Psychology	
Electrical stimulation	Cognitive behavior therapy		
Electro-chemical interactions	Executive function	Body based meditation	
	Subjective data		
	Regulation		

#### How does it work?

Nelson (1996) presented a theory of metacognitive consciousness.

### Historical Relevance

- The modern conception of metacognition was originally defined by John Flavell in 1979, as “learning about learning” (p.906).
- John Dewey (1997, 2007), placed self-reflection as the most crucial component of both learning and a healthy democracy.
- Socrates, lamented, “know thyself and thou shall know the universe and God.” (Vyshebkyy, 2014).
- Hindu Rigvedic parable of the Body and Soul:

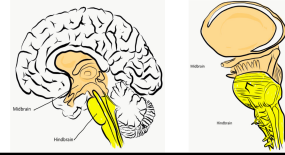
**“Two birds with fair wings, inseparable companions;  
Have found refuge in the same sheltering tree.  
One incessantly eats from the fig tree; the other, not eating, just looks on”**  
(De Nicolás, 2003, p.66) +2000 BC.

**How is it that our knowledge of learning was so sophisticated at these most ancient times?**

### Hindbrain & Midbrain

Much of what the midbrain engages in lays the groundwork for later, more advanced cognitive tasks.

- Hindbrain responsible for the regulation of subconscious autonomic bodily function like digestion, heart rate and breathing
- Midbrain responsible for the processing emotional information (Swanson, 2003).
  - Emotional factors are the primary drivers of attention and may be an iteration of emotion (Pessoa, 2010).



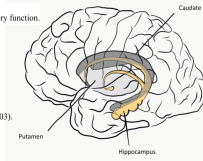
### Putaman, Caudate, Hippocampus

◆ The Putamen and Caudate regulate the “flow” and transition of information

◆ The hippocampus have repeatedly been found to be related to memory function.

➢ hippocampal size have been identified in

- London taxi cab drivers (Maguire, et al., 2000)
- Language acquisition (Slaming, et al., 2002)
- Learning to play an instrument (Gaser & Schlaug, 2003).



### Neurochemical effects of emotion

Emotional intensity impairs control over one’s attention, focusing it on external events and decreasing access to working memory and impairing higher-level thinking processes .  
Inversely, low emotional intensity decrease attention to the external environment .  
but facilitates higher order cognition (Gabel & McAuley, 2018).

#### Implications for learning...

When a student makes a mistake they produce an emotional response, which in turn provokes the release of neurotrophic compounds that support memory, priming the brain to better remember events that subsequently follow the mistake (Roediger & Finn, 2009)

*Emotional understanding is of central importance to Self-Regulation.* (2006)

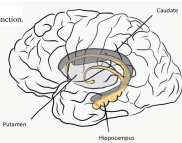
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### Corpus Callosum

Differences in the size and shape of the corpus callosum have been found in dyslexics (von Plessen et al., 2002).  
Malformations of the corpus callosum are most common congenital brain malformation observed in human beings (Dohtyus, 1996).

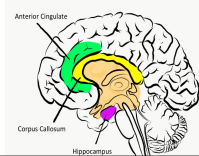
Most language skills are lateralized in the left hemisphere and most visuo-spatial processing skills are processed on the right (Sperry, 1968).



### Anterior Cingulate

◆ The Anterior Cingulate has been shown to have definitive involvement in metacognition

- ◆ Activates most strongly when the test subject is confronted with competing stimulus that require a shift in attentional demands (Peterson et al., 1999; Carter et al., 1998).
- ◆ Activates in error monitoring and detection (Carter et al., 1998).
- ◆ Detects conditions where errors are likely to occur (Allen et al., 2017)



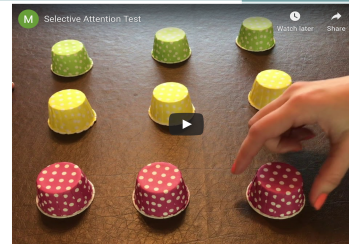
### Stroop task

1. So the question is how much does a task like this... Stroop task... Relate to your ability to do metacognition.



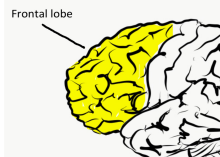
## Parietal lobes

- Abstract thinking
  - metaphors (Ramachandran & Hubbard, 2003)
  - directing spatio-visual attention toward salient features in the environment (Sghier, 2012)
  - visuospatial working memory (Todd & Marois, 2004)
  - arithmetic fact retrieval (Dehaene, Spelke, Pinel, Stanescu & Tzivkin, 1999)
  - symbolic numerical information processing (Cantlon, Brannon, Carter & Pelphrey 2006)
  - perception of emotions in facial stimuli (Radu et al., 2010)
  - distinguishing specific contextual details (Wagner et al., 2005)



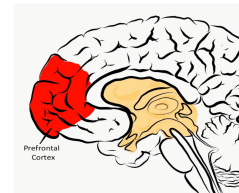
## Frontal lobes

- The center of metacognitive activity (Fernandez-Duque, Baird & Posner, 2000).
- Damage produces dysexecutive syndrome (Baddeley & Wilson, 1988)
- Feeling-of-knowing (Fernandez-Duque, Baird & Posner, 2000)
- Self-reflective metacognitive thinking (Macmillan & Lema, 2010, Baddeley & Wilson, 1988; Allen et al., 2017; Fleming and Dolan, 2012).



## Prefrontal Lobe

- Crucial for integrating thought and behavior (Allen, et al, 2017; Badre, et al, 2010; Fleming, M., Huijgen & Dolan, 2012; D'Esposito, et al, 1995).
- Working memory- ability to hold ideas in our mind (Petrides, Alivisatos, Meyer & Evans, 1993; Jonides, J., Smith, Koeppe, Awh, Minoshima & Mintun, 1993)



## Prefrontal Lobe

- Two competing conceptualizations for what is occurring in the frontal lobes:
- **PFC is making ever more accurate associations related to contextual features** (Cohen & Servan-Schreiber, 1992; Kimberg & Farah, 1993)
  - **PFC inhibiting the expression of superfluous or irrelevant information processing** (Knight, Staines, Swick, & Chao, 1999; Fernandez-Duque, Baird & Posner, 2000; Shinamura, 2000)



## What has been learned from Damage

- Phineas Gage
- Wernicke's and Broca Aphasia
- Hemispheric Neglect
- HM
- Split Brain Patients
- Acquired Savant Syndrome



## Neuroplasticity

Learning produces neurostructural change

- **There are direct morphological effects on brain regions associated with use.** (Gaser & Schlaug, 2003; Levitin, 2006; Maguire, et al., 2000; Sluming, Barrick, Howard, Cezayirli, Mayes, & Roberts, 2002)
- Exercise routines, production of brain-derived neurotrophic factor that stimulate neurogenesis (Cotman & Berchold, 2002)
  - John Pepper (Dodge, 2016)

## Other Neuroplastic interventions

### Cognitive-behavioral therapy (CBT)

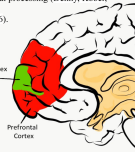
- Significant metabolic changes in the hippocampus and dorsal cingulate (Goldapple, Segal, Garson, Lau, Biegel, Kennedy & Mayberg, 2004)
- Morphological changes in the treatment of:
  - phobias (Paquette, Lévesque, Messour, Leroux, Boudoin, Bourgoin, & Bourgoin, 2003)
  - obsessive-compulsive disorder (Bélisle, Gauthier, Diharreguy, Tiquet, Houlou, Allard & Anoussim, 2009)

### Meditation

- Meditation has been shown to affect the size and conductivity of frontal brain regions (Laders, Clark, Narr, & Toga, 2011)
- Transcendental Meditation has demonstrated marked improvement in creativity, practical intelligence and fluid intelligence (Higelin, 2014).
- Impacts the efficiency of processing (Korasa, Sato, Lucena, Barreiros, Radvány, Russell, & Amaro, 2012)
- Alleviates symptoms of mental and physical disorders (Gotink, Chu, Buschbuch, Benson, Fricchione & Hunink, 2015)
- Effective intervention for:
  - ADHD
  - Anxiety

### Default Mode

- Several studies have found that people engage in self-referential processing when they are not attending to the outside world. (Backner & Carroll, 2007; Moran, Kelley, & Heatherton, 2013; Spreng et al., 2009)
- The medial prefrontal cortex (Brodman's area 10 has been found to be engaged in self-referential processing (Denny, Kober, Wager & Ochsner, 2012) and activation occurs when the brain is at rest (Damoiseaux et al., 2006).
- These regions are considered the "social brain" (Heatherton, 2011; Lewis, Rezaei, Brown, Roberts, & Dunbar, 2011; Meyer & Lieberman, 2018)



### Mirror Neurons

#### Mirror neuron activate when one observes directed behavior

The interesting points:

- Neuronal activations mirror what would occur if a person was actually engaging in the observed behavior ( Keyesers, 2009; Keyesers & Gazzola, 2006; Rizzolatti & Craighero, 2004)
- Selectively fire when confronted with goal directed behavior as opposed to just the observation of a given movement in general (Fogassi, Ferrari, Gesierich, Kozi, Chersi & Rizzolatti, 2005).
- It has been proposed that mirror neurons are the source of human self-awareness (Oberman & Ramachandran, 2008)
- It has been suggested that the mirror neuron cannot possibly be carrying out this function independently and must be being activated only after other brain structures have identified goal directed behavior (Kosonogov, 2012)

### The neurology of Metacognition suggests a problem with how neurons are conceptualized

- There is growing evidence that there are aspects of the conscious mind, **which includes metacognition**, that cannot be performed through computation such as subjective experiences of colors, feelings and sensations, also known as **qualia**. (Chalmers, 1996)

### The neurology of Metacognition suggests a problem with how neurons are conceptualized



### Questions?

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