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implications for older adults**

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Pepperdine University
Graduate School of Education and Psychology

LINKING COMMUNICATIVE INTERACTION TO COGNITIVE FUNCTIONING:
IMPLICATIONS FOR OLDER ADULTS

A dissertation submitted in partial satisfaction of
the requirements for the degree of
Doctor of Education in Organizational Leadership

by

Denise Calhoun

June, 2019

Eric Hamilton, Ph.D. – Dissertation Chairperson

This dissertation, written by

Denise Calhoun

under the guidance of a Faculty Committee and approved by its members, has been submitted to and accepted by the Graduate Faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

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DEDICATION

To my parents, Radford and Earline Knuckles, and my husband's parents Robert and Jessie Mae Calhoun, who will always be in our hearts, we love you. I am also especially grateful for all older loved ones past and present, who through their guidance and wisdom, have paved the way for our hopes, dreams, and opportunities for the future.

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VITA

Objective: *To pursue life-long professional & personal development by participating in seminars, workshops, study groups and continuing my education.*

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Publications

- 2019-Computer usage and cognitive capability of older adults: Analysis of data from the Health and Retirement Study. Denise Calhoun and Seung Bok Lee. *Educational Gerontology*, Published February 7, 2019.
- 2018-*CHANGING SEASONS: A Language Arts Curriculum for Healthy Aging* Purdue University Press, Published August 18, 2018. *A language based inter-disciplinarian program that is written to help older adults maintain effective communication skills. It provides activities in both oral and written language that are engaging and mentally challenging.*
- 2017-Tapping into the Learning Potential of Aging through Technology. Callhoun, D., Fraizer, L., Miramontes, G., Madjidi, F., Watts, M. *The Journal of the International Center for Global Leadership*. 5, 91-101.
- 2013-*Handbook of Activities for the Elderly* published by Tate Publishing & Enterprises, LLC, *This handbook provides step-by-step directions for quick and easy activities to build effective communication skills.*

- 2011-*Increasing Communication Skills in the Elderly*, (Thesis Project, CSUN),
The development of a brochure to provide knowledge and guidance on ways to enhance communication skills in older adults.

Conferences/Presentations

- October 2018- Critical Thinking Project – Linking language to cognition: Developing a curriculum. Presented in the Proceedings of the 1st Annual Critical Thinking Project, Los Angeles, California
- July 2017- Inequalities of education in China: Closing the gap in rural and remote areas. D. Calhoun, J. Huynh, K. Lux, S. B. Lee, L. Frazier, H. Williams, & F. Madjidi. The Fourth International Academic Conference of Exploring Leadership and Learning Theories in Asia (ELLTA): Perspectives on Leadership, Learning and Social Enterprise in Asia - Sharpening Focus on Research Collaborations and Publications. At: Pathum Thani, Thailand
- November 2016- Making connections: Integrating technology to sustain cognitive ability in the aging. D. Calhoun & L. Frazier. International Organization of Social Sciences and Behavioral Research Conference At: San Antonio, Texas
- November 2016- Reimagining education in the juvenile justice system. Fox, J., Sidhu, S., Harrison, M., Rajabbeigi, H., Calhoun, D., Opong, C. International Organization of Social Sciences and Behavioral Research Conference At: San Antonio, Texas

ABSTRACT

As the percentage of older adults within the U.S. steadily increases, long-term care options are being impacted with growing numbers of seniors to provide for. The reality of these elevated numbers have sparked an interest in researchers to conduct studies on human development, plasticity in the brain, and training and intervention programs in search for ways to halt or lessen the cognitive and communicative decline, in older adults.

As an alternative path to help older adults maintain quality of life, this study proposes to examine the link between communicative interaction and cognitive functioning to educate family members and healthcare providers on how communicative interactions and language influence cognition. Data ($n = 3130$) used in this study was retrieved from the *University of Michigan's Health and Retirement Study* (HRS) 2014 for participants 65 years and older. Examination of the link between communicative interaction and cognition encompassed all factors of the learning process such as socio-emotional influences, environmental experiences, health and nutrition, and cognitive and physical development. Analysis of the study also included exploratory studies on social cognitive neuroscience and how brain training affects dementia.

Findings in this study revealed that cognitive functioning declines with age, but rises with higher levels of education. Results also indicate that increased communicative interaction is significantly associated with improved cognitive functioning, when controlling for age, gender, and education. Considering other influential factors, determining the degree of association may require further investigation.

Chapter One: Introduction

Background

Is there ever a time when it is too late to learn? Awareness of physical and cognitive decline in older adults sparks an interest for many concerned individuals in the aging process. In fact, many of the symptoms in this process seem to revert back to characteristics of early development such as limited mobility, lack of bowel or bladder control, and limited communication (Matteson, Linton, & Barnes 2007). Considering this observation, many questions about the links between early learning and older adults deserve consideration, such as “What is the correlation between these widely distanced stages of development?” and, “Could it be possible to utilize these similarities and differences in intervention strategies to enhance communicative and cognitive development?” In this respect many of the same learning principles inherent in early stages of life apply to later learning such as providing engaging activities; constructing knowledge from one’s environment; family involvement; tapping into skills that can only be mastered with guidance; and making connections to past learning by use of visual imagery and elaboration (Calhoun, Fraizer, Miramontes, Madjidi, & Watts, 2017). Considering the similarities between the two extreme groups, the purpose of this study is to search for effective ways to improve or sustain communicative and/or cognitive skills in older adults by linking cognitive abilities to communicative interaction and by examining the implications it may have in later stages of life.

Problem Statement

According to the World Health Organization (2014), the number of adults over 60 years old will have doubled between 2000 and 2050. In addition, the U.S. Census Bureau (2004) projects that 71 million Americans will be 65 years of age or older by the year 2030.

Furthermore, it is estimated by the Alzheimer's Association (2009) that nearly 10 million baby boomers—older adults born between 1946 and 1964—may develop Alzheimer's disease during their lifetime. In accordance to the facts and figures from the Alzheimer's Association (2017), the percentage of people with Alzheimer's dementia increases with age: 17% of people age 75 to 84 and 32% of people age 85 and older have Alzheimer's dementia. If this problem isn't resolved, nursing and assisted living homes will become impacted with an over flow of older adults dependent on others. Searching for effective ways to improve communicative and cognitive skills in older adults could perhaps extend the time they are independent.

Purpose of Study

There are many factors that affect communication such as sensory loss, decreased processing of information, loss of memory, separation from family and friends, and self-efficacy or the lack of power and influence over one's life (Robinson, White, & Houchins, 2006). Poor communication skills may be linked to one's cognitive ability. According to Seifert (2006), language influences cognition and cognition influences language. Maintaining or increasing cognitive development has been correlated with language development to improve quality of life (Calhoun et al., 2017; Lubinski, 1995; Seifert, 2006; Wertsch, 2008). Sustaining quality of life involves making connections, exerting self-efficacy, stimulating thinking, and establishing friendships (Lubinski, 1995, 1997). In an attempt to accomplish these tasks, individuals need to be engaged in meaningful interactions that promote effective communication skills (Lubinski, 1995). Building awareness of these factors is the primary purpose of this dissertation proposal. Thus, the examination of the link between communicative interaction and cognition could provide implications for preventing cognitive decline in older adults. In this regard, this study could have an effect on securing the welfare and future of our baby boomer population. The

results of this study could also have an impact on extending the time older adults are independent.

Definition of Terms

To bring clarity to this study, certain terms and expressions require clarification, such as language, cognition, dementia, Alzheimer, memory, attention, self-efficacy, plasticity, zone of proximal development, and family members as well as many terms connected to neuroscience.

- *Language* – Language development is the acquisition of linguistic forms and procedures, and social rules and customs for acts of expression and interpretation. Such knowledge has three essential components: content (meaning), form (structure) and use (function). To interpret communications of others involves the cognitive dimension of language in which the message received is evaluated in relation to the knowledge that is already stored in memory. In short, language is crucial to conceptual development and thinking (National Education Goals Panel, 2002)
- *Cognition* – Cognition is defined in terms of knowledge:
 - Representational thought (e.g., the ability to think about things not present; to distinguish between real and pretend)
 - Problem-solving (e.g., the ability to experiment using different strategies; relate cause to effect; interpret and generalize)
 - Mathematical Knowledge (e.g., the ability to put objects, events, actions into all kinds of relationships; explore sequence, cardinal and ordinal number properties; perceive sequenced events in time)
 - Social Knowledge (e.g., to be aware of self, family and community; be aware of physical environment and natural world)

- Imagination: the ability to “formulate rich and varied mental images, see beyond the obvious, or to draw upon experience in inventive and effective ways” (Jalongo, 1990, p. 195)
- *Dementia* – a global term for any neurological disorder in which the primary symptom is deterioration of mental functioning. Individuals with dementia often lose the ability to care for themselves and can lose the ability to recognize familiar surroundings and people; including family members (Mast & Healy, 2009).
- *Alzheimer Disease* – a form of dementia (a progressive, irreversible brain disorder that is characterized by a gradual deterioration of memory, reasoning, language, and eventually, physical function (Alzheimer’s Association, 2009).
- *Memory* – the retention of information over time. Memory is needed in order to connect what happened yesterday to what happens daily in a person’s life (Bauer, 2009).
- *Attention* – the focusing of mental resources. Attention is allocated in a variety of ways, e.g. selective attention-focusing on a specific aspect of experience that is relevant while ignoring others that are irrelevant; divided attention- concentrating on more than one activity at the same time; sustained attention- the ability to maintain attention to a selected stimulus for a prolonged period of time; executive attention- action planning, allocating attention to goals (Kramer & Madden, 2008).
- *Self-Efficacy* – the belief that one can master a situation and produce favorable outcomes (Bandura, 2007)
- *Plasticity* – ability to enhance cognitive reserve (a person’s overall learning potential) (Baron, Willis & Schaie, 2007)

- *Zone of proximal development (ZPD)* – a range of tasks that are too difficult to master alone but can be learned with guidance and assistance from more skilled individuals (Werstch, 1985).
- *Family members* – the term “family members” in this study will include anyone who has a relationship with an elderly resident.
- *Baby Boomers* – people born between 1946 and 1964 when there was a temporary increase or boom in births after World War II.
- *Healthy Aging* – normal changes that happen with aging (American Psychological Association, 2006).
- *Pathological Aging* – age related changes connected to a specific disease or disability (American Psychological Association, 2006).
- *Ventral prefrontal cortex (VLPFC)* – a region in the brain implicated in planning complex cognitive behavior, personality expression, decision making, and moderating social behavior (Erickson, Colcombe, Wahdwa, Bherer, Peterson, Scalf, Kim, Alvarado, & Kramer, 2007).
- *Dorsolateral prefrontal cortex (DLPFC)* – a section in the prefrontal cortex that orchestrates such functions as working memory, cognitive flexibility, planning, inhibition, and abstract reasoning (Erickson, et al., 2007).
- *Functional magnetic resonance imaging (fMRI)* – a tool that measures brain activity by detecting changes associated with blood flow (Lieberman, 2013).
- *Dorsal Anterior Cingulate Cortex (dACC)* – a region in the front half of the brain that helps cognition and motor control (Lieberman, 2013).

- *Anterior Insula (AI)* – a region that is a part of the cerebral cortex of the brain and has to do with emotional awareness as well as taste (Lieberman, 2013)
- *Neural systems* – are extended networks with connections cutting across major structures of the brain. These networks assist in building, supporting, and memorizing the inner world by facilitating and organizing sensorimotor transformations through processing and transmitting information (Perry, 2006).
- *Amygdala* – an almond shaped structure located in the cerebral hemisphere involved with experiencing emotions, motivation, memory (Wolfe, 2006).
- *Fired-together-wired together (FTWT)* – a way brain cells communicate with one another via synaptic transmission. For instance, when one brain cell releases a chemical or neurotransmitter, the next brain cell absorbs it resulting in neuronal firing (LeDoux, 2002).
- *Change-of-a-body-state (COBS)* – as represented in the brain, the body is a frame of reference for what individuals experience in the mind. In other words thoughts and actions in one’s mind are gaged by one’s body (LeDoux, 2002).
- *Executive Functions* – a part of the brain that allows individuals to plan, organize and complete tasks (Caine & Caine, 2006).

Research Questions

This dissertation explores the potential for meaningful communication to improve or maintain cognitive skills in older adults. Due to the awareness of increased longevity, changes need to be made to prepare for the influx of baby boomers. Long-term care options are becoming limited as the percentage of older adults within the U.S. continues to grow (Centers for Disease Control & Prevention, 2013). This dismal reality has prompted researchers to conduct studies on

human development, plasticity in the brain, and training and intervention programs in search for ways to mitigate cognitive and communicative decline in older adults (Calhoun, et al. 2017). In an attempt to understand the implications of effective communication, this research study revolves around the following questions:

- Q1: What is the link between communicative interaction and cognition in older adults, controlling for a number of important individual factors.
- Q2: How is learning, (the process of acquiring knowledge or recalling information), linked to communicative interaction in older adults?

Theoretical Framework

In the past many of the learning theories have been derived from early stages of development (Knowles, Holton, & Swanson, 2011). Some of the research in this study will therefore be based on the theories of Piaget and Vygotsky. The primary learning theory, however, will be based on the theories of Knowles and Tyler in reference to how adults learn. Learning in early stages of development and later adulthood, could be dependent on many of the same factors.

The theory by Piaget (1954) focuses on children's perception of the world, meaning how they think, process information, solve problems, communicate language, and store as well as retrieve memories. These actions are key elements that require examination when researching the cause of cognitive decline in later years. Vygotsky, on the other hand, is interested on how language and culture shape the development of thought in children. Language is perceived as a powerful tool for thinking (Wertsch, 2008).

Vygotsky's theory of *the zone of proximal development* states that learning occurs when a child or individual learns ideas or tasks which can only be acquired with the guidance or

assistance of an adult or expert (Wertsch, 1985). This element deserves attention when analyzing the learning potential of older adults.

Knowles et al. (2011), on the other hand, claim that adults are motivated to learn through experiential needs and interests that learning will satisfy. While Tyler (1969), emphasizes the general principles of learning, such as the principle of practice, the range of possibility, and the fact that the same learning experience can produce several outcomes. Never the less, they are all in agreement on the benefits of connecting prior knowledge for optimal learning and desired outcomes (Knowles et al., 2011; Tyler, 1969).

Besides depending on the theories of Piaget and Vygotsky, Knowles and Tyler, this study relies on two major themes based on gerontological research, a *sense of control* and *social engagement*. According to Avlund, Damsgaard, and Holstein (1998), and Bennett (2002), older adults project positive health outcomes when they are involved in meaningful social engagement with others. Additionally, studies have also shown that when older adults experience a sense of self-efficacy, positive outcomes are exhibited (Rodin, 1989). As such, in this study, a *sense of control* and *social engagement* will be examined within the context of reinforcing communicative interaction.

A major part of this study will be examining neuroscience implications for adult learning. This part of the theoretical framework examines various aspects that affect cognitive processes in the brain. Researchers have come to the conclusion that the brain is a social organ and acquires information through shared experiences (Cozolino & Sprokay, 2006). These authors further claim the brain develops best in the context of interactive discovery and narratives or stories that support memory. With this in mind Wolfe (2006) posits that the brain also works best when meaning and emotion are exhibited. As such, he discusses how strong emotional factors generate

adrenaline which intensifies the emotional state of individuals leading to enhancing both memory and meaning. In regards to measuring the cognitive development of the brain, however, it is important to consider stressors such as traumatic learning experiences or incidences of trauma that have occurred in one's life. In these situations, stressors could have the potential to work against neuroplastic functions in the brain (Perry, 2006).

And finally, this study will investigate a new kind of science called social cognitive neuroscience. Through using tools like functional magnetic imaging, Lieberman (2013) notes startling discoveries of how the brain responds to the social world. Findings in this study have reinforced how the brain is wired to connect to people.

Limitations/Delimitations

Limitations of this project would involve gaining the trust of the participants to respond to the surveys honestly. According to Piette, Heisler, Krein and Kerr (2005), older adults have the tendency to mistrust health providers if a rapport with those providers has not been established. Rapport building is important when establishing a relationship with older adults (Morris, Worsley & Matthews, 2000). In order to gain the trust of older adults, one must consider the needs of others over one's own needs. Consistency and transparency are also factors in gaining the trust of the older adults. This involves exemplary behavior, which would imply doing the right thing and avoiding the use of power for personal gain. The word "leader" in this project would be synonymous with "role model". This would of course imply the highest standards of conduct.

Another limitation to consider is the accessibility to nursing home facilities as well as reaching out to families. In many cases, families do not remain in constant touch with their aging family members. They may be in another state or perhaps have lost touch, therefore questions

referring to family members may not be accessible. Due to loneliness and the fact that many older adults may have lost the desire or ability to communicate effectively, could contribute to an additional limitation (Le Dorze & Brassard, 1995). As a consequence, older adults may not have answered the questions on the surveys accurately.

Other factors to consider in measuring the link between communicative interactions and cognition would be socio-emotional influences, environmental experiences, health, nutrition, and physical development which may not be disclosed in the surveys. In addition, within the perimeters of the Health and Retirement data base, this study will have to rely on the limitations of chronological aging in contrast to biological aging. Another limitation due to using secondary analysis is the inaccessibility of the controlled variable, race. One final point worth mentioning is the fact that many of the survey questions are based on observations. Delimitations in this study, on the other hand, will involve the selection of older adults participating in the research. The focus will be on seniors who are 65 years and older.

Significance of Study

As with any experience; early or later stages of development; portraying a positive outlook on events could have a huge connection on one's learning potential (Calhoun et al., 2017; Murray, 1989). Taking this into consideration, the goal of this project is to show that learning in both of these stages of development is dependent on many of the same variables. Knowledge of these variables would help in evaluating the learning potential of older adults. Awareness of these aspects could also make a difference in how one copes with the aging process as well as help individuals prepare for life in later years. In addition, examining the link between communicative interactions and cognition in older adults could have a significant

correlation to extending the time they are independent. It is estimated that Alzheimer disease triples the health care costs of Americans 65 years of age and older (Alzheimer's Association, 2009).

Organization of Study

This study will begin by examining current literature on the topic. The first section of the literature review will emphasize how communicative losses affect older adults. Before this can be accomplished, however, factors that define old age must be clearly outlined as well as attributes for communicating effectively. Many of the attributes for communicating effectively are the same factors that enhance language development in young children, such as active listening and opportunities to communicate.

Next this study will examine strategies for communicating effectively such as active listening, utilizing visual aids, and building a community of practice. This study will also examine models that have improved language and cognition, as well as an examination of intervention tools for increasing cognitive and communicative skills. Models discussed will include the *Who Model*, the *Communication Predicament in Aging Model*, the *Communication Enhancement in Aging Model* and the *Communication Accommodation Theory*.

The next section will discuss biological functions affecting communication, following up with a discussion on the effects of language on cognition. And as mentioned earlier, a major portion of the literature review will be based on neuroscience implications illustrating how the brain is influenced by social interaction, environment, experience, emotions, and meaning. Another topic along this same line of thought will be a discussion of the sociality factor of humans and how the brain is wired to connect to others.

This literature review will also probe into some of the cognitive intervention training programs that have been established. Many of them deal with sustaining memory and how other factors such as depression and self-efficacy affect memory. Besides examining various training programs, this chapter will conclude with reviewing current theories and issues on language and cognition in early stages of development as well as later adulthood. After which, this study will follow-up by connecting the literature with an analysis of the data applied to address the hypotheses and conclude with a discussion of the results as well as future considerations.

The final chapter of this study will conclude with a detailed discussion of the findings of this study as well as recommendations for further studies on the topic. This might include considering a different data base, testing other variables, and creating workshops to analyze pre and post workshop results.

Chapter Two: Literature Review

The moral test of government is how it treats those who are in the dawn of life, the children; those who are in the twilight, life, the aged; and those who are in the shadow of life, the sick, the needy and the handicapped (Hubert Humphrey, as cited in Congressional Record, 1977, pp. 37, 287).

Introduction

Baby boomers are steadily changing the demographics of the 21st century. By the year 2030 there will be approximately 65 million people either 65 years of age or older (Teaster, 2003). This figure has almost doubled since 1990 (Bouvier & De Vita, 1991). As the number of older adults continues to grow, so does the cost of health care. Teaster (2003) reports that an increased portion of the federal budget will be allocated to Medicare and Medicaid.

With the aging population rapidly growing, the number of people affected with Alzheimer's disease and other forms of dementia are spiraling into uncontrollable numbers. Many older adults are forced into nursing homes or assisted living facilities which results in fewer long term care options to handle the overflow (Centers for Disease Control and Preventions, 2008, 2013). In addition, there are other older individuals who are in jeopardy of losing their rights by becoming wards of the state through guardianship appointments. The urgency to remedy these social issues warrants searching for effective ways to reinforce autonomy for older adults.

Improving or sustaining one's communicative skills could be a solution to help extend the time older adults are able to live independently. Language development has been equated to cognitive functioning (Seifert 2006). As such, the maintenance or improvement of communicative and cognitive skills may reduce the financial responsibility of caring for adults who have been affected by deficiencies in language and cognition (Calhoun et al., 2017). This literature review, therefore, reevaluates the learning potential of older adults through examining

how the effect of communicative and cognitive activities as well as training, can promote critical thinking skills, quality interactions, and self-efficacy to sustain or improve the mental capacity of older adults.

Define Old Age

In order to provide clarity to this study, it is necessary to define what determines old age. The question as stated earlier, is why are there varying degrees in the way older adults can perform in later years? Being old is a relative concept. A debatable topic for researchers has been whether or not to base old age on chronological age—the number of years lived—or biological age—changes in the body that are classified as old age. Worrall and Hickson (2003) note that chronological and biological age are not the same concept. It is suggested that chronological age is more of a convenience. According to Chodzko-Zajko, Ringle, and Vaca (1995), chronological age is more than likely used as an indicator for being old because it is convenient and more straightforward to apply. On the other hand, Worrall and Hickson (2003), recognize the variability of functional abilities of people who are the same chronological age which tends to sway researchers to lean toward considering aging in terms of biological changes rather than years of life. Although biological aging in this study is preferred, due to limitations of conducting a secondary analysis, age will be based on chronological aging. As such, the age range representing 65-105, is not monolithic but entails several distinct phases.

Communicating Effectively with Older Adults

Communication is important because it helps to maintain a certain quality of life and a certain quality of life according to Lubinski (1997, 1995), is important for improving communication. Quality of life according to this author can be sustained from involvement in decision making; facilitating adaptation to change; participating in life activities; developing and

sustaining friendships; experiencing quality care; enhancing well-being ; alleviating anxiety, depression, and loneliness; exercising power and influence; maintaining personal relationships and interactions; and triggering thinking. Implementing these factors into one’s daily life could be instrumental to improving communication skills in older adults (Calhoun, 2013).

As with children, the ability to converse completely with others is crucial to effectively function within as well as expanding across a wide range of activities characterizing everyday life (NEGP, 2002). In addition, many of the elements mentioned above cannot be obtained unless individuals are given an opportunity to utilize or practice language skills. According to the National Education Goals Panel NEGP (2002), it is essential that children are able to utilize language as a tool for communicating their thoughts and feeling as well as to retrieve and interpret communication from others. These key points could apply to older adults as well. Other key points for effective communication are discussed by the Gerontological Society of America (GSA).

GSA (2012) is one of America’s most established and sizable interdisciplinary organizations well known for its devotion to research, in the field of education and practice on aging. Their research frowns on the tendency to stereotype older adults. According to GSA (2012), certain stereotypical beliefs pertaining to diminished abilities about older adults can cause inappropriate as well as demeaning attitudes towards them. In these instances, individuals need to be aware of their own stereotypical views and acknowledge the possibility of relying on their initial perceptual cues guiding their interaction with older adults.

Patronizing speech or baby talk is another factor affecting quality interaction. This form of speech has the potential to result in resistance from older adults as well as more aggressive behavior (GSA, 2012). Furthermore, although terms like “honey “ and “sweetie” convey

affections of endearment, many scientists in the field of communication agree that there are other ways to elicit affection and caring that can exhibit these same emotions without making respondents feel they've been infantilized (GSA, 2012). These examples are illustrated in nonverbal cues such as a slight smile or twinkle in the eye. Nonverbal behaviors can additionally, have a profound influence on one's ability to effectively convey or represent information as well as the quality of one's relationship with the other person (GSA, 2012). In these instances, it is important to maintain eye contact rather than focusing on other things. It is suggested by communication experts such as Leathers (1986) that if individuals' non-verbal behavior constantly sends messages of being unavailable or lack of interest in what a person has to say, the interaction is not engaging or believable.

Loss of hearing is another reason affecting communication. If there is reason to suspect hearing impairment, refrain from using a high and variable pitched voice. High pitch as noted by (GSA (2012), is more difficult to comprehend. Most importantly, when communicating with a person experiencing hearing loss, do not shout. Speaking unnaturally in a loud voice tends to elevate the pitch of the voice (GSA, 2012). According to GSA (2012), it is better to slightly increase the volume of one's voice. Additionally, in cases of age related hearing loss, be aware of the presence of background noise as well as multiple competing conversations (Gordan-Salant 2005). The advantage of communicating in a quieter environment helps in improving older adults' processing of speech perceptually—recognizing spoken words—and also aids in facilitating the skill of integrating concepts with knowledge to interpret and understand messages more easily (Tun & Wingfield, 1999).

Sometimes pictures and diagrams or other visual aids will help reinforce and simplify comprehension in conversations. Visual aids as noted by GSA (2012) may also help to illustrate

complicated relationships amongst words. In addition, to help in addressing hearing-related communication difficulties, visual aids can be very effective, as well. These aids, however, must be well designed with large and very apparent figures (Hout, Doak, Doak, & Loscaizo, 2006).

Another factor of effective communication is active listening. GSA (2012) found that one of the complaints expressed by older adults indicated that health care providers do not listen to them. To reinforce listening attentively, GSA (2012) advised health care providers to resist the temptation of asking yes and no questions and instead, create open-ended questions allowing older adults to use their own words, responding from their point of view. In addition, it is in the best interest of older adults to ask them questions about their social contacts, as well as their living situation, especially if the older adult raises concerns about his/her living conditions.

To help older adults maintain their sense of self-efficacy, Beisecker (1989) mentions the importance of including older adults in conversations when others are in the room. Additionally, engagement in shared decisions engenders trust and autonomy and helps to eliminate authoritarian attitudes of caregivers (Makoul & Clayman, 2006).

GSA (2012) also pointed out that older adults who are inspired to become actively involved in their treatment decisions, experience better health results. When including them in conversations or decision making, be mindful of maintaining a positive communicative tone and avoid speaking extremely slowly. Speaking slowly puts additional burden on working memory, especially for older adults with dementia (GSA, 2012).

GSA (2012) claims that the result of speaking slowly causes problems with comprehending complicated sentences because individuals tend to hold on to words in a sentence for longer periods of time. As a consequence, this longer time interval generally leads to increased misunderstandings. And finally when conversing, use direct, concrete language that

can be observed through the senses rather than abstract language which is correlated to intangible concepts and/or ideas that are void of physical references (GSA, 2012).

Implications of many of the aforementioned factors are evident in various primary frameworks influencing practices in communication disability in the aging. For the purpose of this review, it is therefore necessary to examine some of the theories that are influential in improving communicative skills in older adults.

Primary frameworks that will be discussed in this review are:

- The WHO model: the International Classification of Functioning, Disability and Health (ICF)
- Communication Accommodation Theory (CAT)
- The Communication Predicament in Aging model
- The Communication Enhancement in Aging model

The WHO Model: The international classification of functioning, disability and health.

This model provides an international scientific tool for research on disability on all levels, which includes impairments at the body and body part level; limitations on the person level of activity, and society restrictions of participation (WHO, 2001). According to the World Health Organization, the ICF's emphasis is on health and functioning rather than on disability. This model is therefore, more concerned with the levels of health rather than disability. In addition the WHO claims that this model illustrates the interaction between a health condition, body functions, activities and participation as well as showing the importance of the effects of environmental and personal factors on functioning.

There may be, according to Worrall and Hickson (2003) multidirectional interactions among these dimensions that suggest by improving participation; impairments in individuals

could improve as well. In other words just as with children, environmental influences and being actively engaged are important for maintaining good communication skills in older adults.

Additionally, these authors note that this model shows that contextual factors (e.g., a complete background of life including physical and social environmental elements and personal factors such as gender, age, education, race, etc.) have an influence on the degrees of body functions, activity, and participation.

In sum, Worrall and Hickson imply that this model is important because it lessens the factors of chronic disabilities such as speech, language, or hearing impairment on everyday life of older people. The WHO model also helps to define to others what can be done for people with communication disabilities.

Communication Accommodation Theory (CAT). This model according to Giles, Coupland, and Coupland (1991) explains the process behind communicative interaction. It has its root in theories of communication rather than in theories of aging. The CAT is based on the premise that speakers and listeners have the tendency to accommodate each other's styles of communication. Although most accommodation is appropriate, Giles et al. (1991) indicate that there are two major forms of inappropriate accommodation: under- and over-accommodation. Under-accommodation occurs if the speaker fails to recognize the cues of his or her partner (e.g., if the speaker fails to recognize that an individual is having difficulty hearing, under-accommodation will occur if the speaker does not adjust the volume of his or her voice). Over-accommodation occurs when younger individuals make stereotype assumptions about older people. They assume that older people can't hear and may speak to them in a loud or a patronizing tone. Making unnecessary adjustments similar to this is considered over-

accommodation. This kind of secondary baby talk or patronizing talk according to Caporael (1981) is evident in many nursing homes.

The Communication Predicament in Aging Model. Forms of communication characterized by stereotypical views of the aging such as higher pitch and volume, exaggerated intonation, amplified repetition, and terms of endearment illustrate examples of over-accommodation, which in many cases, may not be welcomed by older people. According to Ryan, Giles, Bartolucci, and Henwood (1986) some older people and staff in residential care facilities consider this type of talk as a form of affection and support; however, the majority of residents do not care for this kind of talk, which in some environments, could lead to dependency. Ryan et al. (1986) developed this model to show how stereotyping the aging could produce a predicament for older people causing inappropriate accommodations. Meaning inappropriate accommodations in interactions with older adults make them feel old as well as the likelihood of having a stereotypical accommodation in their next encounter with a young person. Furthermore, according to Worrall and Hickson (2003) this model, as well as the Communication Enhancement model, places a lot of responsibility on the conversational partner of the older person. Acknowledgement of this factor implies that the difficulty in communication may lie in the interaction between the two parties rather than in the older person's communication skills.

The Communication Enhancement in Aging Model. This model according to Ryan, Meredith, Maclean, and Orange (1995) is based on the assumption that appropriate accommodation must occur and must be based on the recognition of individualized cues. For example an appropriate accommodation may occur if an individual looks puzzled and communication is improved by the act of simplifying the directions. Another example of this

model is when cues are given to indicate that the older person is unable to hear, appropriate accommodation would occur by speaking louder. In other words modifications or adjustments can be made, but only after an appropriate cue is identified by the conversational partner. At the other end of the spectrum, however, appropriate accommodation may not include any modifications to speaking style or content if the older person is showing signs of understanding the conversation.

In conclusion, all of these models seem to contribute to the improvement of communicative ability in older adults, but do not have optimal results without a positive outlook on life and a sense of self-efficacy. Stereotypes against the aging such as wrinkled, forgetful, disabled, deaf, and gray according to Worrall and Hickson (2003) are negative thoughts that need to be eliminated when caring for older adults. A positive perception needs to be imbedded in caregivers and family members. Besides acknowledging the importance of the emotional and environmental effects on older adults, there are biological factors that influence communication.

Biological Functioning

As a natural phenomenon, aging can affect communication in two ways, *healthy aging*—normal changes that happen with aging—and *pathological aging*—age related changes connected to a specific disease or disability (American Psychological Association, 2006). In fact, the aging process itself, according to Worrall and Hickson (2003), has the potential to affect communication in older adults. These authors further claim that the changes older adults experience are difficulty with hearing and word retrieval. Additionally Worrall and Hickson (2003), report that many healthy older adults may have a range of communication impairments that are not recognized and go undetected. Even so, many of these older adults are extremely fortunate to live without being afflicted with complications of more serious diseases.

Serious health issues include a variety of disabilities such as stroke, dementia, heart diseases, arthritis, cancer, osteoporosis and diabetes. The World Health Organization (2001), reports that these age related diseases are part of the *pathological aging*. Dementia, stroke, cancer of the head and neck, trauma to the brain, Parkinson's disease or amyotrophic lateral sclerosis have a direct effect on communication. However, the most prevalent disease which is connected to communication, according to Hopper and Bayles (2001), is dementia of the Alzheimer's (DAT) which affects one in ten people in the U.S. over the age of 65. This figure increases as much as 50% for individuals over 85 years of age.

The influences of communicative impairments can, of course, be life changing for individuals. Communication disabilities have been reported by Le Dorze and Brassard (1995) as causing social withdrawal and feelings of isolation; and dependence and depression. Considering these facts and figures, one has the tendency to wonder how family members and caregivers can help in maintaining or improving language development for older adults. One solution might be to provide them with resources and or training opportunities to educate them on the process of cognitive development.

Cognitive Development

It has been referenced by Seifert (2006) that language affects cognition and cognition affects language. In order to understand the complexity of the interweaving between language and cognition, the effect of socio-cultural and socio-emotional influences, environmental experiences, as well as health, nutrition, and physical development need to be explored to measure the cognitive and language levels of individuals. Anderson, Moffatt, and Shapiro (2006), confirm that what individuals are capable of learning is dependent less on innate characteristics, but more on how well they interact and with whom they interact. This statement

suggests, in other words, that socio-cultural and socio-emotional interactions are influential in determining cognitive development. Furthermore, the shifts in thinking on how language is acquired have led researchers such as Anderson et al. (2006) to believe that the kinds and amount of talk individuals hear as well as participate in, are crucial variables in language acquisition. This is an important fact to consider when caring for older adults. Studies have confirmed that the lack of communicative interaction is linked to dependence as well as depression and feelings of isolation and social withdrawal (Le Dorze & Brassard, 1995). Although caregivers are important in maintaining language and cognitive skills, Seifert (2006), claims that family members are equally as important. Family involvement and support affect the emotional state of individuals, which in turn, influences their cognitive processes (Bedford, 1995).

Besides socio-cultural and socio-emotional variables influencing language, one's health and physical development needs to be examined in analyzing the role of language and cognitive development. Ryan, Fauth, and Brooks-Gunn (2006) report that poor nutrition not only affects a child's health itself, but has negative effects on neonatal care which could contribute to physical impairments possibly hampering cognitive development. Lack of proper nutrition could also affect cognitive skills in older adults. A study conducted by Witte, Fobker, Gelher, Knecht, and Fioel (2009) revealed that after a 3-month period of calorie restriction, the verbal memory of older groups improved. There also seems to be a link between vitamin supplements and cognitive performance. In one study, Wengreen et al. (2007) indicated that individuals 65 and older who consumed increased levels of antioxidant vitamins had less cognitive decline than their counter parts who consumed diminished levels.

Health issues involve cardiac risk factors which have been implicated in Alzheimer disease. These risk factors implied by Abellan van Kan et al. (2009) include high cholesterol,

obesity, smoking, and atherosclerosis. Additionally, because the brain is referred to as a focal point of development by Thomas (2005), it is responsible for interpreting stimuli from the environment, storing information, retrieving stored matter, solving problems and sending directions to muscle systems on how to act; if it is damaged as a result of genetic inheritance, injury or disease, the impairment could hinder optimal growth in development.

Acknowledgement of this fact merits examining the dimensions of human development in relation to the brain implicating cognitive decline or improvement.

Neuroscience Implications

The brain thrives best within the context of social engagement (Cozolino and Sprokay, 2006). The suggestion of possibly improving cognitive functioning through engaging activities stems from Swaab's (1991) *use it or lose it* concept. This principle is supported by a research study he conducted on demonstrating the effect of how neurons and neuronal networks assist in controlling activity in the central nervous system (CNS) on animals. Empirical evidence to support these findings was uncovered in animal studies by Frick and Fernandez (2001) which illustrated how enriched and stimulating environments had a positive connection on cognitive functioning in laboratory animals. This discovery is supported by other studies which revealed how the cortex, the length of neurons, the level of neurotransmitters, and the growth hormones, all increased in the brains of rats raised in challenging and complex environments (Guzowski, Setlow, Wagner, & McGaugh, 2001). With this in mind, Cozolino and Sprokay (2006) claim that the brain seems to be a natural social organ and acquires information through shared experiences and develops best in the context of interactive discovery and the creation of stories that construct and reinforce one's memories. It is suggested by Cozolino and Sprokay (2006), therefore, that

the benefits of a stimulating environment is not only conducive to learning for children, but is very instrumental in learning for adults, as well.

Additional studies on rats that have further confirmed the advantages of having an enriched environment to improve cognitive ability. Diamond, Kroch, and Rosenzweig (1964) and Kolb and Whishaw (1998) also discovered that when rats were raised in intricate and demanding environments, the size of their cortex, the growth of hormones, the number of synapses, as well as the length of neurons increased in their brains which could imply that human brains could react in the same manner. To expand on this theory, there have been other studies with birds in their ability to learn songs. In these studies, birds learned better from being exposed to birds singing live in contrast to birds singing on a recording. According to Eales (1985), some birds in fact, are unable to learn from tape recordings and need social interaction as well as nurturing in order to learn. It is suggested by Cozolino and Sprokay (2006) that the influence of environment and social learning are principles of learning that apply across the life span. The theory is further confirmed by Bandura (2007) who claims that cognitive processes are connected to environment.

Furthermore, it has become common knowledge that humans have evolved as social beings. According to Cozolino and Sprokay (2006) the suggestion of the brain as a social organ originated in neuroscience in the 1970s and researchers since then have been exploring other facets connected to social learning such as emotional processing streams that affect social and emotional behavior. Certain indicators such as emotional facial expressions, physical contact, and gazing eyes are suggested to be in constant, (even if unconsciously), interaction in two-way communication processes amongst individuals in various social situations. It is in this context that brains are stimulated, balanced and made healthy. Most importantly, Cozolino and Sprokay

(2006) imply that the element of caring as well as the awareness of mentorship, support plasticity which leads to improved and more meaningful learning.

Other possible elements activated in a learning environment are stress, thinking and feeling, narratives, and wisdom. Stress as well as negativity from past learning experiences or problems in one's life, can stifle a person's learning ability (Cozolino & Sprokay, 2006). In this respect, the concern of caring facilitators is crucial when considering how easy fear can be learned, in contrast to how difficult it is, to let fear go. In addition, some platforms for learning, may trigger memories of failure and shame from past learning experiences, resulting in another factor contributing to stress (Cozolino & Sprokay, 2006).

Stressors similar to these are implied by Cozolino and Sprokay (2006), to possibly work against neuroplastic functions in the brain. It is therefore, safe to conclude how important it is to understand traumatic past learning experiences when considering the link to cognitive functioning in adults. In view of this awareness, many adults grow up hating school, even though it may be necessary for them to eventually return to school (Perry, 2006). As such, it is important to acknowledge the issues of abuse, neglect, developmental chaos and influences of violence that may inhibit adults' capacity to learn. Furthermore, adult learners are twice as stressed once they return to a learning environment (Perry, 2006). Besides stress, the process of learning and the experience of trauma can alter important neural systems in the brain (Perry, 2006). Perry (2006) further explains the complexity of the brain as consisting of billions of cells that are organized into thousands of neural networks.

Perry (2006) also posits that in the context of fear, information stored in cortical areas is not accessible. This state of fear, which has the same reaction as when one is sleep deprived, exhausted, hungry or anxious, produces regression to a lesser complex area of the brain and is

responsible for mediating one's behavior. In addition, trauma victims have an alarm system which is linked to them over reading verbal and nonverbal cues as threatening, which is yet another reason to consider investigating a person's past history when measuring cognitive functioning (Perry, 2006).

Nevertheless, fear destroys curiosity and interferes with the desire to explore and learn. Perry (2006) suggests that as natural explorers, humans are intrigued and drawn to the unknown to master new skills. In this sense, optimal learning or the love of learning is dependent on the cycle of discovery and curiosity (Perry, 2006). This can only be achieved if a learner feels safe and the environment is familiar. Conversely, however, if the world is too familiar, the learner may crave novelty. Regardless, familiarity is comforting, which implies the need to create a balanced environment, incorporating both novelty as well as consistency in order to feel safe and not too overwhelmed, distressed or frustrated (Perry, 2006).

In adult learning it is also important to note the roles of narratives and wisdom. Cozolino and Sprokay (2006) claim that narratives serve as memory devices and expressions of pride or self-esteem. They, in fact, involve participation in a number of memory networks, where stories are instrumental to improving memory through connected associations. For instance, the process to learn a list of words is more easily remembered if incorporated or constructed in the context of a story rather than without any associations (Cozolino & Sprokay, 2006). Furthermore, the brain areas most affected by learning lists, are also most susceptible to elements of aging and medication, as well as various forms of head injuries (Cozolino & Sprokay, 2006). And in terms of building self-esteem, a learner's narratives have the potential to become a blueprint for goals in the future, which reduces anxiety while stimulating neuroplastic processes required for learning (Cozolino & Sprokay, 2006).

Wisdom, on the other hand, involves the process of integrating thoughts and feelings as well as the blend of experiences, perspectives, understanding, and compassion (Cozolino & Sprokay, 2006). These are areas in which adults excel because they are able to tie their experiences into concepts and principles to expand existing knowledge (Cozolino & Sprokay, 2006). It was also mentioned by Cozolino and Sprokay (2006) that learning in adults is accentuated when it involves teaching experiences, a peer-learning strategy that also incorporates acquiring information within social contexts. Keeping this in mind, current shifts in neuroscience have discovered that human brains requires social interaction to stimulate neural plasticity (Cozolino & Sprokay, 2006). In the context of the aforementioned, it is therefore suggested that there is a constant capacity for the brain to channel pathways based on one's experiences.

Another factor affecting learning in the brain is the role of meaning and emotion. In the past, learning was measured as a behavior (Wolfe, 2006). Recent discoveries, however, illustrate how changes occur in the brain while learning is actually taking place. Wolfe (2006) claims that individual cells referred to as neurons are a fundamental unit of the brain and are in charge of learning. They also have the capability of encoding, storing and retrieving information as well as the potential to control other elements of human behavior (Zull, 2002). Additionally, Wolfe (2006) posits that as one learns the name of a person or a particular skill, connections or a synapsis between neurons occur, consisting of the new information. As such, the more information is repeated and the skill is practiced, the stronger the connection becomes. These neurons also form networks in the brain consisting of connected information. Keeping this in mind, constructivists agree that it is far more important to find out what a learner knows based on previous experiences before teaching new information (Wolfe, 2006). By utilizing prior

experience, adults are able to relate new knowledge to current neural pathways and construct knowledge by participating in current experiences (Wolfe, 2006).

If, however, there is no prior knowledge to build on, adults learn best through concrete experiences. In other words, research on learning and the brain reveals that when one is involved in active experiences, neural networks are created similar to the way networks are created at birth when children begin to explore the world (Wolfe, 2006). Besides building on prior knowledge, problem solving methods are effective in adult learning, mainly because the brain sees the big picture before it sees the details (Wolfe, 2006). Adults have difficulty comprehending or remembering information when learning is focused on discrete parts rather than the whole. In this sense, they learn better when they can see how everything is connected and fits together (Wolfe, 2006).

Another factor influencing the brain's ability to pay attention and retain information is emotion. Emotion is regulated by structures called the amygdala (Wolfe, 2006). The amygdala ensures that individuals react quickly to dangerous or emotional situations. In these situations, adrenaline is released and the heart rate and blood pressure increased (Wolfe, 2006). With this in mind, Wolfe (2006) explains how an effect of adrenaline could possibly cause the memory of an experience to be enhanced, which would explain why most people can remember where they were or what they were doing when the World Trade Center was attacked.

Adding an emotional factor to learning can, in addition, intensify an individual's emotional state leading to enhancing both meaning and memory (Wolfe, 2006). One way to accomplish the task of raising emotional and motivational stakes is by taking on real-life problems. For example in an assisted living home, learning would be more relevant if residents were given the opportunity to address issues in their community. This type of learning would

more than likely lead to a memorable experience by creating an emotional context to cognitive functioning. On the flip side, however, it is important to not only ensure physical safety, but psychological safety within the environment (Wolfe, 2006). Caregivers need to be mindful of the emotions of older adults.

As stated many times, the brain is able to accomplish its extraordinary operations by making contact between neurons. Some of these connections are innately designed such as one's heartbeat, while others are formed in relations to experiences (Scheckley & Bell, 2006). LeDoux, (2002) discusses this process by explaining how neurons that fire jointly wire with each other, or in simpler terms fired-together-wired-together (FTWT). To further illustrate this point, objects in one's environment spark changes in the body's state and the more repetitions endured in a change-of-a-body-state (COBS) experience as well as recognition of the intensity of the COBS experience, the probability of remembering the experience is increased (LeDoux, 2002). An example of this provided by Scheckley and Bell (2006) would be the experience of sipping a cup of coffee. In this instance, they suggest that one is aware of a COBS as a swift change in the mouth's temperature. If consuming coffee is considered a daily routine, this repetitious act would result in neurons firing together many times generating a strong FTWT circuit of the COBS (Scheckley & Bell, 2006). A long-lasting FTWT network can also be created by an intensified COBS without repetition. An example of this would be when a person drinks a cup of scalding hot coffee. In this example the pain of one's mouth on fire would lead to an intense COBS (Scheckley & Bell, 2006). In conclusion, COBS experiences are the core of a person's conscious mind and this state of consciousness is the heart of various cognitive processes such as thinking, reasoning, and problem solving (Scheckley & Bell, 2006).

Making meaning or the sense of things is another concept to consider in cognitive processes. Meaningful learning is described by Caine and Caine (2006) in terms of the philosophy of constructivism. Learning to these theorists means examining decision making, or as referred to by neuroscientists, executive functions. There are many overlapping expressions and processes associated with learning such as memorization, comprehension, intuition, the development of skills, etc. (Caine & Caine, 2006). Making meaning or comprehension is probably one of the most important elements of learning.

Focusing on meaning involves how individuals perceive the world and themselves in it (Caine & Caine, 2006). Visualizing oneself in the world relies on experience more than instruction. Only then, can learners navigate themselves through a world of knowledge grasping concepts and skills relevant to their experience (Caine & Caine, 2006). Meaningful learning, however, also relies on engagement. If one is not engaged, learning is null. For example, it is mentioned by Caine and Caine (2006) that more is required than just reading to make sufficient sense of what was read. According to Caine and Caine (2006) both sensory and physical participation—recall of sensory and physical events—are needed for connecting the reading in order to grasp full meaning.

Acquiring meaning is not only about experience. Decision making comes into play also. Caine and Caine (2006) discuss how situations need to be interpreted and individuals need to decide on appropriate responses. In sum, whenever a situation or problem demand an interpretation of events occurring, choices of action or decisions must be made. Loss of appropriate decision making affects cognitive processes which could result in older adults losing their independence (Dong & Gorbien, 2008).

Due to its functions, decision making is under the semblance of what neuroscientists call executive functions of the brain. Caine and Caine (2006) describe these functions as being centered just behind the forehead in the frontal and prefrontal cortex of the brain. This section of the brain is responsible for thinking, memory, physical movement and the coordination as well as synthesis of emotions (Caine & Caine, 2006). To provide clarity on the functions of this part of the brain, Goldberg (2001) uses the analogy of a conductor in an orchestra who is in command of how the complete score of music converges, deciding how and when each instruments is integrated and played. In this sense, the executive functions are fused with elements of self-regulation, working memory, affect, and inhibition. Working memory is the ability to sustain plans until an action or task can be completed (Caine & Caine, 2006).

Another point worth mentioning in regards to neuroscience implications is the mentor-learner relationship. Johnson (2006) points out how important mentors are to influencing cognitive changes in the brain. Mentors according to this author, promote development in learning by creating trust, empathy, and engaging interactions leading to greater plasticity in the brain. This author further states that caring and encouragement from others promote change in neuronal networks, simply because the brain is plastic. One way mentors contribute to the growth of the brain is through dialogue within social interactions (Johnson, 2006). As such, through dialogue, a mentor has the ability to understand a person's thoughts as well as the ability to raise questions that could possibly stimulate neuronal processes of reflection. Johnson (2006), also claims that because of its capacity to make connections, reflection is equally as important as experience, in the learning process.

Other factors affecting the brain and learning are the types of activities older adults engage in. These factors involve effective information processing attributes such as thinking,

memory, and attention (Bauer, 2009). Demetriou, Christow, Spanocedis, and Platsidou (2002) point out that when processing information, speed is an important aspect and is linked with competence in thinking.

Memory. Thinking involves incorporating information into memory in order to solve problems and make decisions. Memory is just retention of information overtime (Paz-Alonso, Larson, Castilli, Alley, & Goodman, 2009). There are cases, however, in which memory may be inaccurate for a variety of reasons (Paz-Alonso et al., 2009). Bauer (2009) makes note that the mind can give misleading accounts of an event as it computes and saves impressions of it. This distortion is due to society's tendency to reconstruct the past rather than taking an exact account or photograph of the image. Furthermore, Grady (2008) posits that memory is also affected by changes in the brain that influences cognitive functioning which could in turn affect the brain. Hedden and Gabrielli (2004), therefore, believe that the prefrontal cortex of an aging brain is associated with poorer performance by older adults on tasks such as complex reasoning, working memory (manipulation and assembling of information for making decisions); solving problems, and comprehending written and spoken language, as well as episodic memory tasks (the memory of specific events and experiences in time).

Attention. In addition to memory and thinking, attention is another influential factor affecting the decline in language and cognitive development. The process of attention focuses on mental resources and can be directed in a number of ways (Courage & Richards 2008). The various forms of attention include selective, divided, sustained, and executive (Courage & Richards, 2008). Madden (2007), states that older adults may have the same difficulty focusing on relevant information as younger adults. In addition, Rogers and Fisk (2001), claim that older

adults tend to be less skilled at selective attention (concentrating on a particular detail of experience while ignoring others).

Brains are wired to connect. Lieberman (2013), along with colleagues created a new kind of science called *social cognitive neuroscience*. Using tools like functional magnetic resonance imaging (fMRI), they have discovered how the brain relates to the social world. The findings of the studies reinforced how the brain is wired to connect to people. The brain, in other words, is wired for interacting and reaching out to others. Furthermore, research has illustrated how mammals have separated from other vertebrates to the capacity of feeling social pains and pleasures linking well-being to social connectedness (Lieberman, 2013). An example of this is the need for connectedness displayed in infants.

In their social brain hypothesis, Lieberman suggests that human brains are larger so that they can connect and cooperate with one another. For example, to build a house, it is much simpler, if the work is done collaboratively rather than working alone. In addition, Dunbar (1992), in the early 1990's further claimed that the main reason the neocortex grew larger was so that primates could live in bigger groups and be more socially active.

To explain group size, the *neocortex ratio* references the size of the neocortex in relation to the size of the remainder of the brain. In this regard, the general size of the neocortex is correlated with differences in three potential determinants of the brain size: social, individual drive and the size of the group (Lieberman, 2013). Group size, however, was the strongest indicator of the neocortex size.

From another study by Dunbar (1993), equations were used to determine what the number should be for the largest effective social group for each kind of primate. The number for humans was estimated to be around 150, the largest of any primate. Lieberman (2013), therefore

came to the conclusion that the social nature of humans was not the result of having a larger brain, but in contrast, the value of increasing sociality was the primary reason humans evolved acquiring a larger brain.

So why is belonging to a bigger group beneficial? One obvious reason is protection from predators. The downside, however, was that in the past, there was an increased competition for food, as well as mating. Nevertheless, Dunbar's (1998) hypothesis on brain size infers that the lack of human connection could have an effect on one's brain. This conclusion implies that lack of human connection for older adults in nursing homes could be linked to their cognitive ability.

Although, human brains are larger, insinuating higher intelligence, babies are born basically helpless with brains that are not programmed to survive on their own. In fact, Lieberman (2013) claims that humans have the longest period of immaturity than any other mammal and the human prefrontal cortex is not fully developed until the third decade of life. In the beginning stages of life, therefore, humans are dependent on others for care.

This fact warrants looking at Maslow's hierarchy of needs theory. According to Maslow (2013), individuals move up his hierarchy pyramid of needs beginning with the most basic physiological needs and end with the highest psychological need of self-regulation. Lieberman (2013), on the other hand, claims that infant mammals in contrast need a caregiver at birth who is committed to making sure biological needs are met. This theory implies that food, water, and shelter are not basic needs for infants. And instead, being socially connected and cared for take precedence over all other needs. In view of this observation, older adults living in nursing could be affected by a lack of love and a sense of belonging. Lieberman (2013), infers that one's biology is designed to crave for connection for the mere fact that it is linked to individuals' most basic needs for survival.

Another point worth mentioning in Lieberman's (2013) research is his comparison of mental pain versus physical pain. He equates social pain to physical pain, claiming that the brain responds to both the same way. Researchers, however, question the validity of equating social pain to real pain. According to the neuroscientist, Maclean (1993) there is a sense of separation that causes pain for mammals. This concept, however, is very difficult to accept by many. The concept is not implying that social and physical pain are identical, it is simply suggesting that social pain is bona fide pain, the same as bodily pain (Lieberman, 2013). One element of proof that this might be the case is evident in separation distress that infant mammals display when separated from their primary caregivers. This is demonstrated in Bowlby's (1969) attachment theory. He claims that an infant's relentless crying and distress when a mother leaves a child is linked to pain.

Studies have shown that children under the age of five who have been separated for long periods of time, have developed deficits in literacy and behavior (Lieberman, 2013). This acknowledgement could have implications on deficits in cognitive functioning for older adults who are separated from their loved ones while living in nursing or assisted living homes. Furthermore, there have been recent discoveries in the past two decades on the neuroanatomy of pain processes in the brain. Studies have shown that there are individual sets of cortical brain regions that reflect the sensory and distressing elements of pain (Lieberman, 2013). The sensory elements of pain reveal where the pain is in the body as well as how strong it is. A region in the front half of the brain, the *Dorsal Anterior Cingulate Cortex* (dACC) and the *Anterior Insula* (AI), respond to the *distressing elements of pain*. In one social pain study by Lieberman (2013), participants who experienced more pain distress, activated the (dACC) more.

The study indicated that when individuals experienced more pain, both physical and social, there was more activity in the (dACC).

The brain and processes that affect learning and development. A study conducted by Erickson, et al. (2007) suggested that late in life the brain only loses a part of its ability to function and the types of activities older adults engage in appear to be instrumental in its development. This randomized study consisted of a group of 34 older adults ranging from 55 to 80 (mean = 66.11; range = 55-76). Data was also collected on 31 younger adults participating in both groups, the training as well as the control group. The purpose of this study was to examine interventions that could potentially lessen or have an impact on reversing age-related cognitive and neural declines. In short, the results according to Erickson et al. (2007) reflected better task performance results in a higher asymmetry in VLPFC (ventral prefrontal cortex) regions and a decrease in age differences in producing action in both VLPFC and DLPFC (dorsolateral prefrontal cortex) regions. Considering the functioning of the brain, it is therefore concluded that some degree of plasticity is retained well into later adulthood. The types of activities older adults engage in depend on the elements of cognition that affect learning. These elements involve effective information processing attributes such as thinking, memory, and attention (Bauer, 2009). Demetriou et al. (2002), point out that when processing information, speed is an important aspect and is linked with competence in thinking.

New research on the brain. Researchers from Indiana University have identified a brain training exercise that could possibly reduce the onset of dementia (Science Daily, 2017). The cognitive training referred to as speed processing revealed positive results up to ten years following the training process. According to Science Daily (2017), the number of participants involved in the training compared to those without training had a significantly lower number for

developing dementia. While the amount of training was relatively minute and extended over a time span of 10 one hour sessions within six weeks, there were measurable benefits. Science Daily (2017), reported that the participants in this study were 65 and older from a number of sites and were assigned randomly in four intervention groups. These groups consisted of the following:

- Those who received directions and strategies for remembering life events and activities
- Those who received directions and practice tactics for solving problems and relatable issues.
- Those who obtained speed processing exercises on the computer, aimed at helping to improve the time for processing difficult information.
- And a control group who didn't participate in any of the training activities.

After attrition, due to a number of actors, 1,220 participants finished the 10 year follow-up assessment of which 260 participants obtained dementia. The chances for developing dementia were reported to be lower in 29% of participants in the speed processing training than those in the control group, concluding in a statistically significant result.

In another new brain training study called BrainHQ, speed thinking was experimented by giving older adults an exercise of differentiating between a succession of constant changing objects on a computer screen in which objects were in the middle of the screen as well as in the peripheral vision of an individual (Mozes, 2017). Over a period of time the objects appeared faster and began to look similar. Due to these changes, the task became increasingly difficult with the objective to increase one's ability to quickly as well as accurately identify the objects on the screen.

After tracking more than 2800 seniors, the team found that in a span of 10 years, the speed of thought-processing program decreased the risk of dementia by almost 30 percent when compared to others who didn't have the training (Mozes, 2017). In addition the more speed training sessions an older adult experienced, the lower his/her risk was in moving forward. The program was unfolded by Karlene Ball from the University of Alabama, Birmingham, and Dan Roenker, of Western Kentucky University. The program according to them and other researchers was not meant to be just a game on the computer, but was supposed to clearly illustrate how a specific type of training can demonstrate positive benefits for older adults experiencing dementia, which affects one's memory.

Other Age Related Changes

Cognitive aging is inevitable for many older adults. Other changes associated with age-related decline, results in one's pragmatic language ability. Pragmatic language, according to Messer (2015) includes social aspects of language such as the manner in which speech is presented, as well as social appropriateness during communication which involves maintaining appropriate vocal volume and eye contact.

Another component of pragmatic language that is affected by age-related decline is figurative language which involves the cognitive skill of reading between the lines or in understanding the gist of what is said (Roberts & Kreuz, 1994). Examples of figurative language include metaphors, proverbs, idioms, irony, and to some degree even sarcasm. Figurative language deficits are found in older adults who have memory problems (Byrd, 1991). And as memory problems increase with age, the ability to process complex language becomes more of an issue (Kim, Bayles, & Beeson 2008). The inability of knowing what a person is trying to communicate or what the level of understanding is, can be a real hindrance in a two-way

conversation. Ineffective communication in this situation could cause difficulty with social relations. In view of the many age related declines affecting language and cognition skills one tends to wonder if these skills can be retrained. In other words, how much plasticity is lost in later adulthood?

Plasticity and Training in Later Adulthood

To answer the question of what degree of plasticity affects cognitive aging, one must think in terms of biological influences as well as environmental influences. Hertzog (2009), discusses the theory that one's lifestyle—the benefits of behaviors such as practicing good nutritional habits, participating in physical exercise, and interacting socially—influence cognitive functioning. This author notes that these conditions can be mediated by intensifying the function of the nervous system. Physical fitness, for instance, could lead to higher blood flow to the brain as well as to the development of new neurons and new interconnections within neurons (Hertzog, 2009). Schaie adds, “I conclude that the onset of intellectual decline is often postponed for individuals who live in favorable environmental circumstances, as would be the case for those persons characterized by a high socio-economic status,” as cited in Hertzog, 2009, p.421). In short, according to Hertzog (2009), Schaie argues that the risk of cognitive decline is dependent on the level of cognitive functioning generated by a person's lifestyle at work as well as during play. Activities may include traveling, attending cultural events, ample reading, or even expanding one's education. Training, practice, and/or exposure in these stimulating activities could be linked to older adults' level of cognitive reserve (Hertzog, 2009). This hypothesis seems to further validate the term “use it or lose it” (Swaab, 1991).

In one study by Hertzog, McGuire, Horhota, and Jopp (2010), older and younger adults were administered a memory test—free retrieval of a list of words—in which they responded to

questions relating to their performance on the test. Through a structured interview process, they were also asked questions about their memory experiences in everyday life. The results indicated that older adults were prone to lean towards the concept that practice as well as the usage of memory helped to maintain it. Furthermore, older adults were more likely than younger adults to assume that one's behavior influenced how well an individual could sustain cognitive functioning as they grew old (Hertzog et al., 2010). These beliefs were aligned with conclusions suggested in the popular press, publications, and web postings of the Alzheimer's Association (2010), as well as many other organizations that champion the welfare of older adults.

There is evidence, therefore, that training and practice affect plasticity and may improve cognitive performance. Hertzog (2009), further supports this hypothesis with implications that individuals need to practice skills they desire to maintain. A simple example would be keeping up with addition and subtraction skills in order to balance a checkbook. Additionally, Baron, Brown, Willis and Schaie (2007) suggest in a longitudinal study conducted on cognitive functioning in adults—including 172 women and 130 men consisting of a mean age of 76.62 years that individuals' ability to enhance cognitive reserve—a person's overall learning potential or plasticity—as presented in training improvement is paralleled to a certain degree of risk for cognitive impairment. Training, as such, has the potential to enhance older adults' levels of cognitive reserve through participation in mentally challenging activities. In fact, additional cognitive exercises could serve as protective factors for individuals with the onset of cognitive decline (Baron et al., 2007).

Cognitive Training Programs

There are various types of interventions (Baltes & Danish, 1980). Interventions may include concrete technologies involving aspects such as goal oriented interventions which targets

certain behaviors such as memorization, attention, cognitive ability, and perception. Preventions may also include various settings such as classroom, community, hospital, and family settings. And finally, interventions may consist of mechanisms involving training, practice, and health delivery. Training programs might include memory training, self-efficacy, memory maintenance, comprehensive memory improvement, and depression in connection to memory improvement (Baltes & Danish, 1980). Memory training according to McDougall (1999), involves the use of mnemonics—any mental strategy or device that helps in learning desired information by using extraneous material to assist in memory or future recall. McDougall (1999) makes note that the problem with relying on mnemonics is the difficulty older adults may have in transferring these strategies to their daily lives. To remedy this problem, it is suggested by Turnure and Lane (1987) that the incorporation of visual imagery as well as stressing elaboration into teaching mnemonics, may be beneficial in transferring this skill to everyday living.

Memory and depression. It has been inferred by a number of researchers that depression may affect cognitive decline. Considering this possibility, some programs include strategies to alleviate depression. West, Boatwright, and Schlessler (1984), in fact, indicate that depression in later adulthood has been correlated with poor memory, performance, and response. Even though depression appears to be a factor in cognitive performance, other factors such as age may also have a significant correlation to daily memory performance. In a study of 2,495 adult volunteers, West, Crook, & Barron (1992), discovered that age was a consistent significant predictor of everyday memory performance and not depression.

Memory and self-efficacy. Besides examining age as a significant predictor of everyday memory, awareness of self-efficacy is becoming more crucial in evaluating cognitive decline. Bandura (1993) defines self-efficacy as being task specific and emphasizing perseverance when

one encounters difficulties on various cognitive tasks such as remembering. Few programs in the past have considered or even included self-efficacy. Currently, however, the incorporation of memory self-efficacy has become more relevant. One such program is the *Cognitive-Behavioral Model of Everyday Memory* (CBMEM) developed by McDougall (1999) which illustrates the value of utilizing memory self-efficacy strategies. This model, in fact, according to McDougall (1999) is one of the first to include all four components of stress inoculation, health promotion, memory, self-efficacy, and memory strategy training based on the self-efficacy theory by Bandura (1997). In view of this awareness, this program warrants further examination.

The Cognitive Behavioral Model of Everyday Memory (CBMEM). Bandura (1997, 2007) discusses four principle sources of self-efficacy; *inactive mastery experience; vicarious experience; verbal persuasion; physiological and affective states*. The first source involves exercises that increase gradually from less difficulty to more difficulty. Secondly, through vicarious experiences, efficacy beliefs are altered through group sharing experiences of competencies and achievements. Thirdly, in verbal persuasion, the idea is that through continual feedback and encouragement for constant progress, certain capabilities of individuals will be enhanced. Finally, the fourth source reinforces relaxation techniques to alleviate memory anxiety during stressful times (Bandura, 1997, 2007).

McDougall (1999) focused on these sources in the CBMEM model. Activities included *modeling technique* (taking part in non-threatening memory exercises that are fun, enjoyable and challenging for individual levels); *observation of participants' memory; awareness* (members are given an opportunity to develop awareness of attention and concentration); *mastery coping* (building confidence and enjoyment through effective learning experiences); *Controlled*

Handling (specific individuals are called on for participation); and *Suspension* (entails relaxing anxieties and observing themselves and neighbors as problems occur).

Using the CBMEM model, McDougall describes a study which tested three groups of at risk cognitively impaired older adults; a Hispanic community, an assisted living facility, and a retirement village. Findings from the study on Hispanic older adults provided validation that older Hispanics at poverty level income and poor education, could improve in using memory strategies and build confidence in their ability to avoid additional decline in memory. The study on assisted living older adults, on the other hand, showed significant Pearson correlations on the pretest for memory performance and self-efficacy. Changes in scores from the pretest to the post test were reported by McDougall (1999) as significant for memory performance and efficacy as well as the usage of internal memory strategies (elaboration and rehearsal), and external memory strategies. Due to the extensive differences in the size of the cell between the experimental and control groups, however, statistical comparisons of groups were not possible. The omission of statistical group comparisons brought up the issue of whether or not the participants were retaining new learning. Nevertheless, the group had greater pre and post test scores than older adults reported in established normative studies. Finally, the results from the retirement village found correlations between memory efficacy and memory performance to be non-significant. Nonetheless, short-term results of the classes proved to boost memory performance scores, memory confidence, and beliefs about memory (McDougall, 1999).

The Midlife in the United States Study (MIDUS). A later study by Lachman, Rosnick and Rocke (2009), the Midlife in the United States Study (MIDUS) supports the aforementioned research results on the significance of control beliefs in later adulthood. Interviews via telephone and mail surveys were conducted from 1995-1996 and from 2004-2006. The researchers

discovered that individuals with greater anticipated social support were more prone to sustain a sense of self-efficacy. Additionally, those who were in better health, with more adaptive personalities, and higher cognitive abilities showed smaller declines in control over time. The beliefs in the sense of control in conclusion, play an important role in maintaining quality of life in later adulthood. Furthermore, it seems that health and social relations are associated to quality of life changes. Lachman et al. (2009) hinted that psychological influences play a major role in contributing to the maintenance and/or improvement in quality of life. Overall, the general consensus imply that a sense of control is a key element to consider in the well-being of older adults facing declining health and other losses later in life (Lachman, et al. (2009).

Learning Theories

Piaget. As mentioned previously, the theory by Piaget (1954) focuses on children's perception of the world, meaning how they think, process information, solve problems, communicate language, and store as well as retrieve memories. These actions are key elements that require further examination when researching the cause of cognitive decline in later years. According to Thomas (2005), Piaget started out as a biologist which influenced his conception of the development of the mind. Later he shifted his attention to psychology where he worked for Alfred Binet on standardizing tests of children's ability.

Piaget was less interested in producing correct answers and more interested in the thinking processes that guided children to their answers (Thomas, 2005). These processes included schemes, assimilation, accommodation, organization, equilibrium and equilibration (Wadsworth, 2004). Not only does a person's physical body have structures which enable him/her to adapt to the world, but building one's mental structures or schemes are also influential in adapting to life (Ginsburg & Opper, 1988). Adaptation involves adjusting to new

environmental demands. The demands of older adults are challenging with coping with cognitive and biological declines that come with the aging process. According to Carpendale, Muller, and Bibok (2008), Piaget, therefore, stressed that children actively construct their own knowledge of the world. In other words learning is not a process of osmosis. Rather than just pouring information into an individual, older adults could very well benefit from constructing their own knowledge through activities that give them the same opportunities children experience when they discover and learn from their environment (Camp, 1999).

As a genetic epistemologist, according to Thomas (2005), Piaget was not interested in what children are like, but more interested on how knowledge is developed in children. Therefore, in order to understand Piaget's theory fully, Thomas claims it is necessary to first understand his definition of knowledge. Rather than knowledge being a body of acquired information, Piaget conceived knowledge as a process or repertoire of actions. This author also suggested that as a child perceives the world, the picture is biased by the condition of a child's perceptual mechanism. In accordance to Piaget's theory, therefore, a person's past actions can be stored as memories and retrieved when needed and increased with maturation (Thomas, 2005). Memories stored in later adulthood could possibly be the key to their future learning potential.

Vygotsky. Vygotsky, on the other hand, is interested on how language and culture shape the development of thought in children. Language is perceived as an influential device for thinking (Wertsch, 2008). Thomas' (2005) review of Vygotsky emphasizes how children adopt the thought processes surrounding them through language and culture.

Vygotsky's work is in the area of developmental psychology education and psychopathology. His viewpoint is in line with other social cultural theorist, but is taken a step further by aligning with the Marxist's doctrine which according to Thomas (2005) states that the

background of a society in which a child lives and the child's developmental history in regards to his experiences in that society are essential in shaping the thought processes of the child. The idea that historical events, the nature of societies, and different birth cohorts influence individuals may be related to how older adults think (Alwin, 2008).

According to Wertsch (1985), there are three concepts that form the core of Vygotsky's theoretical framework. The first relies on the influence of a genetic or developmental method. Secondly, Vygotsky suggests processes of a higher mental capacity in individuals which originate in social interactions. And finally there is the claim that mental actions can be understood only if one comprehends the devices and signs that mediate them. In addition to these three themes in Vygotsky's theoretical framework, an element called *the zone of proximal development*—learning that occurs with the guidance or assistance of an adult expert—is another point worth mentioning (Wertsch, 1985). This element is very important in analyzing the learning potential of older adults.

Bandura's social learning theory. In this theory, Bandura (1976) posits that individuals learn from observing others around them. He refers to the individuals as models who can be influential people such as family members, friends, peer groups or teachers. These models of different gender types and personalities provide examples of various behaviors for people to emulate. Bandura's theory stems from behaviorists' learning theories such as classical (learning through associations), and operant (learning through rewards and punishment) conditioning.

Bandura (1976) makes a distinction between simply emulating or imitating a behavior and identifying with a behavior. In this case, he refers to imitating as a process that involves copying only one behavior whereas identification may involve the process of embracing numerous behaviors. Adopting a behavior involves thought processes in making a decision on

whether or not to identify with a particular behavior. In other words, people have control over their behavior. The incorporation of thought into his theory, prompted Bandura (1985) to later modify his theory to be referred to as the *social cognitive theory* (SCT). As a consequence, SCT has emerged as a better way of describing how individuals learn from social experiences. The primary cognitive roles in psychosocial functioning include self-regulatory and self-reflective processes (Bandura, 1985).

Pedagogy vs. andragogy. What is the difference between pedagogy and andragogy? Pedagogy is simply the study of how knowledge and learning is used in an educational context for children. Andragogy, on the other hand, has been coined to focus on the practices of adult learning. Due to the fact that individuals learn differently at different ages, both methods have been used interchangeably. Many of the principles of learning in pedagogy apply to adults as well. Similar to children, older adults need attention, quality interaction, engaging activities, and effective communication, as well as a stimulating environment.

Although adults learn best from many of the same principles, there are other elements indigenous to adults that could enhance their learning potential. According to Knowles et al. (2011), there is a misconception that adults have no interest in learning, because they do not take advantage of the many free educational opportunities. On the contrary, free education is not what motivates adult learning. They are motivated to learn through experiential needs and interests that learning will satisfy. Lindeman (1926) states that experience is the most persuasive motivator for adult learning. Furthermore, Knowles et al. (2011) take note that individual differences among people expands with age, therefore, careful provisions for differences in style, time, place, and pace of learning need to be considered for best results in adult education. From this conclusion, there could be value in integrating andragogy and pedagogy to achieve optimal

learning. Also, according to Knowles et al. (2011), it is not about a dichotomy of adults versus youths. It is more about adults versus traditional education. Knowles implies here, that if the needs, interests, life situations, experiences, self-concepts and individual differences were taken in account for youths, they might learn better, as well.

Although self-direction develops naturally, another problem with relying solely on pedagogy is the fact that society doesn't encourage the development self-direction (Knowles et al., 2011). The result according to Knowles et al. (2011) can cause tension, resistance, resentment and even rebellion in individuals when the gap between the need and notion of being self-directed steadily increases. In view of these observations, integrating pedagogy and andragogy could have an influence on improving cognitive development in older adults.

Another point worth mentioning when considering adult learning is the acknowledgment by Houle (1961) of three different types of adult learners. Houle (1961) suggests that learners are either goal oriented learners (e.g. using education for accomplishing specific objectives); activity oriented (e.g. taking a course for fun); or learning oriented, which means seeking knowledge for its own sake. Application of these points should be considered when planning activities for older adults. There are, however, other general principles that need to be incorporated in adult activities. These include the principle of practice; the range of possibility; the fact that the same learning experience will bring about several outcomes; and learning is more than just recall and should be about inductive thinking (Tyler, 1969). Tyler (1969) further emphasizes the power of learning from past experiences. According to him, connecting prior knowledge to desired outcomes, creates interests. And as stated earlier by Knowles et al. (2011), adults learn best when there is an interest. As such, interests are connected to attitudes, which are dictated by behavior (Tyler, 1969).

The concept of interdependence is a powerful tool to incorporate also because it allows activities to be connected to disciplines in other fields such as social studies, science, language arts, math, physical education and the arts. Incorporating the same learning objective in other subjects or learning experiences will provide not only practice, but familiarity and frequency. According to Tyler (1969) the use of information frequently, increases the probability of remembering it. In addition, the probability of later association is increased by bringing up the information in varied contexts. In this regard, it will eventually add more significance to the learning experience.

Finally, understanding attitudes is necessary when addressing adult learners. Attitudes according to Tyler (1969) are defined as the tendency to react even though the reaction does not actually take place (e.g. one may be disgusted with a staff member, but will not express it verbally). Attitudes are important because they influence behavior and a change in behavior, can imply learning. Learning will not happen, however, if the reaction from a learning experience is not satisfying (Tyler, 1969). Therefore, older adult learning communities should attempt to promote desirable attitudes.

Conclusion

After examining the multitude of factors affecting cognitive decline and the characteristics leading to the onset of dementia, it has become more apparent that the interweaving of socio-emotional, environment, physical development, health and nutrition, play an important role in the development and maintenance of language and cognitive skills. It also seems that many of the same learning principles inherent in children, apply to older adults. Improving language and cognition through engaging activities, constructing knowledge from the environment, family involvement, tapping into skills that can only be mastered with guidance,

and making connections to past learning by use of visual imagery as well as elaboration are just a few of the similarities drawn from various theories of learning.

Even though cognitive training may not work for all adults due to various risk factors, depending on setting, prior knowledge, and background of individuals; families, staff, and administrators can be made aware of important factors that could be advantageous to improving language development and cognitive performance in many older adults. One must consider both the theories of Vygotsky & Bandura in developing cognitive tools for training purposes. The incorporation of these theories into cognitive training programs, especially self-efficacy, seems to be an important factor for improving communicative skills in older adults. The sense of control over one's life considering certain boundaries is suggested as a great indicator or gauge for successful aging (Rowe & Kahn, 1998).

Most importantly, however, it seems evident that social interaction is a major contributor to improving cognitive processes. Humans have evolved from the beginning of time as social beings. Just as with children, it is important for older adults to make connections with families and friends. In the process of making connections, curiosity is sparked through interacting and communicating with others. There have been a multitude of discoveries illustrating how the human brain responds to the social world. Acknowledging these findings and conducting further research on the social mind could help family members and others understand on how the neural mechanisms of the brain work. With this in mind, hopefully the world will realized the importance of staying connected with older loved ones.

Chapter Three: Methods

Introduction

This chapter consists of information on how the project will be developed and analyzed. According to research, lack of communication can cause feelings of isolation, social withdrawal, as well as depression and a sense of dependence (Le Dorze & Brassard, 1995). Considering the influences of diminished communication, caregivers and society need to become aware of how potentially harmful these realities can be in order to better understand the problems many older adults are facing, today. In this context, examining the relationship between communicative interactions and cognitive ability to improve language skills could provide pertinent information on how communication affects cognitive functioning. Knowledge of this information could also be conducive to improving the quality of life for older adults. As such, future considerations for spreading the word will be discussed.

This chapter also explains the methodology and rationale for conducting research on the importance of communicative interaction, and provide a description of the evaluation process for measuring the data. Data in this study will be collected from the University of Michigan's Health and Retirement Study (HRS) in 2014. To satisfy the validity and reliability requirements of the research, this project examines the steps HRS has taken to ensure that questions on the surveys measure what they are intended to and the responses to the questions are consistent within the constructs of the surveys.

Statement of Problem

In view of the continuous increase in human life expectancy, this nation is faced with the responsibility of assisting with the care of an elevated number of older adults, presently as well as in the future. The current life expectancy in the U.S. is estimated to be around 78 years of age

and is steadily growing (Centers for Disease Control and Prevention, 2008; 2013). A substantial number of older adults are in assisted living homes, skilled nursing facilities, or are dependent in some form or fashion on others. In 2009, about 5.3 million adults in the U.S. had Alzheimer's disease, and a projected number of 10 million baby boomers—individuals born between 1946 and 1964—will develop Alzheimer disease in their lifetime (Alzheimer's Association, 2009). Besides Alzheimer's disease, another factor contributing to the decline in cognitive and language ability in older adults is loss of hearing. According to Hickson & Worrall (1997) hearing loss is common in older adults with approximately 60% to 70% of older people experiencing hearing impairment. Loss of hearing is another factor that affects one's ability to communicate effectively.

Purpose and Research Questions

Through examining the links between meaningful communication and interaction in relation to cognitive abilities, it may be possible to extend the time older adults are independent and self-sufficient. Therefore, in searching for preventive methods to possibly decrease cognitive and communicative decline in later adulthood, the purpose of this study revolves around the following questions:

- Q1: What is the link between communicative interaction and cognition in older adults, controlling for a number of important individual factors?
- Q2: How is learning, (the process of acquiring knowledge or recalling information), linked to communicative interaction in older adults?

Answering the above questions would involve providing ways to inform the general population as well as families to understand the importance of remaining connected to older loved ones. In addition, for future considerations and further clarity on the aging process, it is

essential to have training opportunities available for staff and administrators in senior communities on how to effectively communicate with older adults dependent on others.

Methodology and Rationale

The proposed approach for this research will be the application of quantitative methods. Through the utilization of secondary analysis, quantitative methods would allow the possibility of reaching out to a larger population. In particular, this study involves analyzing responses taken from surveys of the Health and Retirement Study (HRS), a longitudinal survey conducted nationally of more than 22,000 Americans over the age of 50, administered by the University of Michigan. The Core Survey of the HRS has been carried out every 2 years, since 1992 and collects comprehensive data about the aging population in the U.S. The collected data includes information about the physical and mental health, financial status, and retirement planning of older adults. In addition, supplementary surveys are implemented during the odd number years to gather specific information on other topics. Questions regarding individual activities and household consumption patterns would be an example of an off-year study which is referred to as Consumption and Activities Mail Survey (CAMS).

Measures and Data Collection

This study examines the level of effectiveness of communicative interaction and how it is linked to cognitive capabilities in America's older adults. Statistical analyses will be conducted to test the following hypotheses:

- H1: Communicative interaction increases memory for individuals aged 65 and older.
- H2: Communicative interaction increases word meaning for individuals aged 65 and older.

- H3: Communicative interaction rises with increased number of years of education for individuals 65 years and older.
- H4: Communicative interaction with others decreases with age for individuals 65 years and older.

Data from the 2014 Core Survey and the 2013 CAMS have been applied in this study.

Files from the respondent level data of the 2014 Core Survey ($n = 20,554$) were merged with the data files from the 2013 CAMS ($n = 6,000$) by matching unique identifiable variables present in the data: Household Identification Number (HHID) and Person Number (PN). The mechanics of merging resulted in a joint file consisting of 5,679 individual cases, including 2257 observations with the age variable having a value of less than 65. To promote consistency in the dataset, these cases were removed.

In addition, there were some 281 cases removed due to missing values. These particular cases included the following: *verbal series* score (ovescore), *number good* score, years of education reported, visits in person, email/letters/phone, often active with others, gender, and rate memory. Furthermore, there were 8 cases that indicated 168 visits per week, which would mean the participant had constant visits 24 hours, 7 days a week. Due to the implausibility of this occurrence, a factor of 8 hours a day for sleep was included in these observations which resulted in a maximum of 112 visits per week calculated in the dataset. As a consequence, all reported values over 112 visits per week were also excluded from the dataset. The same principle was applied to email/letters/phone which resulted in an additional elimination of three more cases. The final sample for the study consisted of 3130 adults 65 years and older in 2014.

The predominant outcome variables will be collected from the following: the calculated verbal series score from the 2014 Core Survey, word recall, rate memory (respondent) and rate

memory (caregiver). Although there were a variety of existing measures for cognitive ability in the HRS, Lachman and Spiro (2002), suggested the need to evaluate fluid abilities, which includes executive functioning and speed of response. As a result, new cognitive measures were developed in the HRS entitled the calculated verbal series. This measurement is a continuous variable containing a value ranging from 435 to 560, corresponding to the score resulting from a six-term verbal analogies test. As such, the calculated verbal series—the verbal analogies test—of the HRS will be used in this study to measure fluid intelligence in older adults, focusing on reasoning (Fisher, McArdie, McCammon, Sonnega, & Weir, 2014).

The measurement of memory, on the other hand consists of three variables: rate memory respondent; rate memory caregiver; and recall. The difference between rate memory respondent and rate memory caregiver is that one is a self-evaluation of memory whereas the other is an evaluation of the respondent provided by the caregiver. Both measurements, however, are concerned with the memory of individuals and their ability to think about things. The questions for rate memory are based on a Likert-scale (“1” being *excellent*, “2” being *very good*, “3” being *good*, “4” being *fair*, and “5” being *poor*). For null responses the values (8 DK-Don’t Know, NA-Not Ascertained; 9 RF-Refused; and Blank INA-Inapplicable, Partial Interview), were used.

Another measure used to evaluate memory is word recall. Given a list of 10 words read by the interviewer, the respondent’s task was to recall as many words possible. In this respect, an extremely long list was intentionally constructed to provide a level of difficulty for anyone attempting to recall all of the words. In addition, the interviewer was directed not to repeat any of the words. The responses from the participants, however, could be in any order. Besides analyzing each memory related variable separately, they will all be considered together as a proxy for *memory*.

The main predictor variable for this study will be *visit in person*. However, all three independent variables; the number of visits from family and friends; how often a respondent is active with others; and communication via phone/letters/email, will be a proxy for *communicative interaction*. Specifically, the survey asked the participants the following questions:

- How many hours did you actually spend last week visiting in person with friends, neighbors, or relatives?
- How many hours did you actually spend last week communicating by telephone, letters, email, Facebook, Skype, or other media with friends, neighbors, or relatives?
- Still thinking about everything you do during waking hours, how often are your activities done with other people?

On a Likert-scale based on one to five responses. The measurements are as follows: (“1” being *rarely*, “2” being *sometimes*, “3” being *often*, “4” being *almost all the time*, and “5” being *uncertain*).

The analysis of communicative interaction will also include three control variables: age, gender and years of education. These variables are incorporated in the empirical model to minimize estimation bias. Gender is characterized by a dummy variable designating female with the value of one. The age variable is calculated from the birth year variable in the 2014 Core Survey to denote the participants’ ages in 2014. As mentioned earlier 2257 observations were excluded from the study where the age was less than 65. And finally, years of education, characterized by values ranging from 0-17, is portrayed as a continuous variable. See Table 1 below for clarity on how the questions for this study are aligned with the variables:

Table 1

Variable Chart

RESEARCH QUESTIONS	INDEPENDENT VARIABLES	DEPENDENT VARIABLES	CONTROLLED VARIABLES
-What is the link between communicative interaction and cognition in older adults, controlling for a number of important individual factors?	- phone/letters/email - visits in person - often active with others - communicative interaction (a proxy for all three independent variables)	-overscore: calculated verbal series- assesses fluid abilities including executive functioning & speed of response.	-gender -age -years of education
-How is learning, (the process of acquiring knowledge or recalling information), linked to communicative interaction in older adults?	- phone/letters/email - visits in person - often active with others - communicative interaction (a proxy for all three independent variables)	-rate memory (self) -rate memory (care giver) -number good (recall) -memory (a proxy for recall and rate memory-self & caregiver)	-gender -age -years of education

Participants

Participants for this study will be individuals taken from the HRS who are 65 years and older. The initial 1992 HRS cohorts consisted of persons born in the years, 1931 to 1941 who were 51 to 61 years of age. Currently, these members are in their 70’s and 80’s and have had interviews every 2 years since 1992. A second study, the Asset and Health Dynamics Among the Oldest Old (AHEAD) was added in 1993 which selected people born before 1924 and were 70 and older at the time. In 1998 the HRS and AHEAD cohorts were joined together and the two new cohorts were incorporated to bridge the gaps for U.S citizens over the age of 50. These birth cohorts consisted of children of the Depression Era or CODA born, 1924-1930, and War Babies

born, 1942-1947. Every 6 years the HRS restores samples with younger cohorts. Thus, in 2004, early baby boomers (EBB) born 1948-1953, were recruited and in 2010, the Mid Baby Boomers (MBB) born 1954-1959 were added. Finally in 2016, the Late Baby Boomers (LBB) born 1960-1965 were added.

Participation in the study is strictly voluntary. Once every 2 years, participants are asked to complete a detailed interview and in alternate years to complete a supplementary mail or online survey. A typical interview usually takes about 2 to 3 hours to complete. For participation in the study, respondents receive a monetary token of appreciation for their time. Size of the participants is over 22,000.

Human Subject Considerations

To protect human subjects, research topics require approval from Pepperdine's Institutional Review Board (IRB). The purpose of the review board is to ensure that the research adheres to the three fundamental ethical principles of the *Belmont Report* which includes respecting the rights of individuals; maximizing benefits for the study, while minimizing risks to the research subjects; and assuring that reasonable, non-exploitative, and well-planned procedures are executed fairly. Through informed consents, this research safeguards confidentiality, privacy, and anonymity when appropriate. HRS takes step to ensure that the identity of participants and any personal identifying information disclosed is kept confidential. In this regard, they have developed three levels of data security.

A major portion of the data is public and made accessible to registered users. Sensitive material such as health data, consisting of biomarkers and information on drug prescriptions require an additional step in registration. Most of the information from administrative linkages is restricted data and warrants submission of a separate licensing agreement which ensures

confidentiality, but limits accessibility. Participation in the study is voluntary and includes a proxy in some instances if the respondent is not cognizant or is unable to respond. Furthermore, the Health Insurance Portability and Accountability Act (HIPAA) security procedures, protect individual's medical information (U.S. Department of Health and Human Services, 2016).

Data Analysis

A multiple linear regression model is used to analyze each of the proposed hypotheses. The variables; number of visits from family and friends; email/phone/letters; and active with others will be a proxy for communicative interaction. Before including the three control variables into the multiple linear regression model, however, a simple regression will be conducted with only the predictor variable to observe the isolated effect of communicative interaction on cognitive capability. Additionally, the data will be tested for the possible presence of multicollinearity and auto-correlation through analyses of Variance Inflation Factor (VIF).

In this regard, a bivariate correlation analysis will be administered to measure the relationship between respondents' participation in communicative activities and their level of education as well as their age on improving cognitive capabilities as described in Hypothesis 3 and Hypothesis 4. These correlations will predict if level of education or age are a factor in the number of times respondents have participated in communicative interactions and how level of education and age are correlated to each of the cognitive abilities. A correlation analysis would also reveal if older participants tend to participate more or less in communicative interactions. The purpose of this type of analysis is to determine whether the relationship between two variables is positive or negative. This particular measure will also define the strength of the relationship between two variables (Field, 2013).

Another statistical test administered will be a linear regression measurement which will analyze how the primary predictor variable affects the outcome. In this case, according to Field (2013), before drawing a conclusion, it is important to know how one variable changes with the other variable. In other words, does increasing or decreasing the level of education have influence on increasing the willingness of individuals to participate in communicative interactions which may or may not increase cognitive ability? In simpler terms, will an increment in the time of formal education result in a proportional relationship or desire to participate in communicative interactions? Overall, a linear regression would measure two things. First, does a set of predictor variables do a sufficient job in predicting an outcome variable? And secondly, which variables, specifically, are primary predictors of the dependent variable or the outcome?

Finally, an ordinary least squares (OLS) multiple regression analysis will be administered to examine the relationship between cognitive capability, measured by the calculated verbal series score, and communicative interaction; the number good score and communicative interaction and the memory self-rated score in relation to communicative interaction. In each of these cases, it is important to understand how to formulate a regression equation to illustrate how the predictor variable can be used to predict the outcome. For instance, the following linear model illustrates the relationship between the calculated verbal series score and the proxy, communicative interaction (visit in person):

- Eq. 1: $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \epsilon_i$

where y is the verbal score, x_1 is communicative interaction, x_2 is gender, x_3 is age, and x_4 is years of education. As mentioned earlier, prior to including the three control variables into the multiple linear regression model, a simple regression will be conducted with only the predictor variable to observe the isolated correlation of the proxy, communicative interaction on cognitive

capability. In addition, as stated earlier, the data will be tested for possible presence of multicollinearity and auto-correlation through analyses of the Variance Inflation Factor (VIF) and Durbin-Watson statistic, respectively.

Validity and Reliability

Quantitative methods involve examining the relationships between and among variables in order to answer questions and hypotheses through surveys and experiments. When designing surveys or incorporating existing instruments, it is important to prove validity and reliability. According to Creswell (2014), there are three important questions that need to be explored in order to test validity:

- Do the items measure the content they were intended to measure?
- Do results predict a criterion measure?
- Do items measure hypothetical constructs or concepts?

Reliability, on the other hand, measures consistency. In other words, are the responses of the questions consistent across constructs and are the scores stable over time until the post-survey is administered?

The process of developing and validating an instrument that is reliable in measuring data is crucial in research studies. In this particular study the utilization of self-report of participants may be of concern due to the problems with socially desirable biases (Kimberlin & Winterstein, 2009). Self-evaluations are dependent on respondents being honest. To decrease the margin in error for self-reports, this study will consider and compare the responses from both the participant, and caregiver.

Although, the incorporation of cognitive functioning in surveys is relatively new, and some researchers may debate the effectiveness of certain measures, the incorporation of a core

set of cognitive functioning measures represents an important step in accomplishing a global assessment of health disparities in America's population (Hayward, n.d.). A unique feature of the HRS, although limited, is its ability to track some aspects of cognitive functioning over time and analyze its relationship to physical health and other abilities to improve quality of life (Hayward, n.d.). Even though it is not clear how much influence these types of measures will have on improving cognitive abilities, they provide a more nuanced analysis of health disparities and according to (Hayward, n.d.) is the best available dataset to assess health disparities at the population level.

Future Considerations

Regardless of the findings of this project, future considerations of this study would be to bring national awareness to the power of language on maintaining cognitive functioning. Awareness of this study can be accomplished through publicizing the message in a variety of forms such as social media, blogs, YouTube channels, websites, publications, etc. Spreading the word through the worldwide Internet is probably the most effective method. Technology would not only allow individuals more accessibility and frequency, but would serve as a means for families and friends to connect and accommodate older family members around the clock anytime and anywhere.

Becoming familiar with the multitude of factors affecting communicative and cognitive decline could also serve as a preventive mechanism for helping older adults experiencing the onset of dementia. Besides taking advantage of the many perks of the Worldwide Web, integrating technology into the lives of older adults could be a means to alleviate symptoms of loneliness and social isolation.

Loneliness is a set of feelings resulting from the absence of intimate and social needs (Ernst & Cacioppo, 1999). In addition, according to Crewdson (2016), loneliness affects mental health and is the cause of reduced quality of life in older adults. As mentioned earlier, loneliness is also a result of lack of communicative interactions (Le Dorze & Brassard, 1995).

Besides, incorporating health information, support groups and general discussion sites in technology programs for serving the social needs of older adults, another way of informing the public on how communication and engaging activities affect cognition would be through organizations advocating older adults, such as AARP and the National Institute on Aging. These organizations have a large following that support dementia and Alzheimer's patients.

Chapter Four: Results

Introduction

The purpose of this chapter is to show the relationship between communicative interaction and cognitive functioning in older adults aged 65 and older. Communicative interaction is represented by three independent variables, the number of times an individual receives visits in person, how often a participant is active with others and the usage of communicating through phone/letters/email within a span of a week. Cognitive functioning is represented by three dependent variables, a calculated verbal series score, a recall test (number good), and a self as well as caregiver rating of one's memory. The data utilized in this chapter was retrieved from the Health and Retirement Study (HRS) conducted by the University of Michigan.

This chapter will begin by providing a short description of the independent and dependent variables considered in this study. In order to find the best fit variables, a correlation analysis was conducted, both between the outcome and predictor variables, as well as between each independent variable. This type of analysis is necessary for ruling out the possible existence of multicollinearity. After finding the best fit variables, an independent t-test will be run to examine the association of gender on the outcome and predictor variables. And finally two multiple linear regression analyses will be conducted illustrating the association between the primary independent variables and each of the primary dependent variables. The chapter will conclude with an examination of how each hypothesis corresponds to the results.

Descriptive Statistics

After careful examination of all of the variables, it was discovered that there was no data for the variable *rate memory-caregiver*. As a consequence this variable was removed from the

study. In addition, this variable was necessary to provide reliability for the variable, *rate memory-self*. Therefore, *rate memory-self*, was also removed from the study. The proxy for memory will consequently be represented by the variable, *number good* (recall). All variables considered in this study are listed in Table 2.

The descriptive analysis indicates that the average time a person received visits per week was about seven, which was similar to communication via phone/letters/email, indicating about six times per week. In contrast, the number of times a person was active with others, was approximately two times per week. On average, the overall recall score for *number good*, was 5.09 and the *calculated verbal score* was around 500. The controlled variables, on the other hand depicted different results. The average age was roughly 76 and the level of education for the majority of older adults was around 12 years and 9 months. In respect to gender, a descriptive frequency analysis was run, which revealed that 59% of the participants were women and 41% were men.

Table 2

Descriptive Statistics

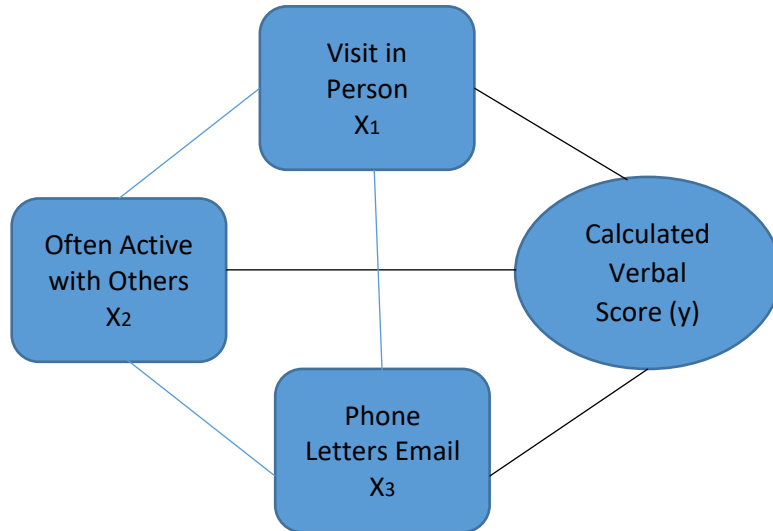
	All Participants			
	mean	<i>sd</i>	<i>min</i>	<i>max</i>
Visit in Person per week	6.99	10.17	0	100
Often Active with others	2.41	.968	1	5
Phone/Letters/Email	6.03	7.74	0	80
Calculated verbal series score	500.05	28.445	435	560
Number Good/Memory	5.09	1.69	0	10
Female	.589	.492	0	1
Years of education	12.99	2.96	0	17
Age	75.99	7.35	65	105

n = 3130

Bivariate Correlation Results

Before a study can be analyzed, it is necessary to do some prep work in order to find the best fit variables (Fields, 2013). The most effective way to accomplish this task is to run correlation analyses, first between each of the independent variables and after which, between the independent and dependent variables.

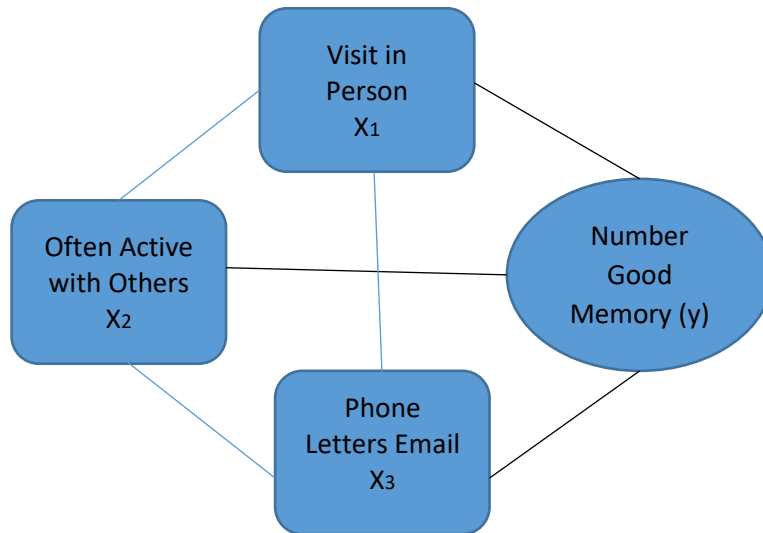
If the independent variables are highly correlated, there is a risk of multicollinearity, which implies the removable of one or more independent variables (Fields, 2013). If, however, the relationship between the independent and dependent variable, is highly correlated, the positive connection indicates a possible good fit for the model (See figures 1 and 2).



Correlation: Visit in person, Often active with others; Phone/letters/email; Calculated verbal score

visit in person (x ₁)	often active with others (x ₂)	phone/letters/email (x ₃)	
Often active with others (x ₂)	.094		
Sig.	.000		
Phone/letters/email (x ₃)	.167	.052	
Sig.	.000	.004	
Calculated verbal score (y)	.103	.038	.023
Sig.	.000	.032	.207

Figure 1. Correlations-calculated verbal score.



Correlation: Visit in person, Often active with others; Phone/letters/email; Number good/memory

visit in person (x₁) often active with others (x₂) phone/letters/email (x₃)

Often active with others (x₂) .094

Sig. .000

Phone/letters/email (x₃) .167 .052

Sig. .000 .004

Number good/memory (y) .079 .086 .035

Sig. .000 .000 .050

Figure 2. Correlations-number good.

In checking for multicollinearity, the times a participant received visitors in person and the frequency a person was active with others revealed a low correlation of .094. Communicative interaction via phone/letters/email and the number of times recorded for visits in person was,

however, slightly higher, but still considered a low correlation at .167. How often an individual had interaction with others and communication through phone/letters/email revealed the lowest correlation of .052.

A bivariate analysis as shown in Table 3, was also administered to check how the relationship of the control variables *age*, and *level of education* was associated to the predictor and outcome variables. The control variable *age* had varying results in regards to the independent variables. The number of times participants had visitors in person showed a negative link to age, but was not significant, $r = -.024, p > .05$. The times participants interacted with others, however, had a significant negative correlation to *age*, meaning the older a person became, the less likely he/she participated in interactions with others, $r = -.082, p < .01$. The usage of phone/letters/email also had a significant negative correlation to age, $r = -.047, p < .01$. The relationships between years of education and the predictor variables, *visit in person* and *often active with others* both indicated a significant positive correlation. These results imply that there is an association between level of education and how often a person is interactive with others, as well as how many times participants have visitors in person. Interaction between phone/letters/email and level of education, on the other hand, had a slightly negative association and was not significant, $r = -.009, p = .625$.

The results of the bivariate correlation analysis in respect to the control variables and dependent variables, calculated verbal series and number good/memory are also presented in Table 3. These results showed a significant positive relationship between years of education and the scores received on the calculated verbal assessment, $r = .437, p < .01$ and the number good/recall test, $r = .300, p < .01$. In respect to age, the verbal scores as well as recall scores

indicate a strong negative relationship, suggesting that as participants become older, their scores decrease on these assessments.

The variable, phone/letters/email, was not only insignificant in relation to level of education, it also showed a non-significant association with both outcome variables. The *p-value* for the calculated verbal score was .207 and the *p-value* for the recall test was .05. Considering these results, the variable phone/letters/email will not be considered in the final analysis of this study. Possible reasons for the poor association of phone/letters/email with these variables could be due to a number of factors.

One example might be the fact that these three entities were clumped together. In this case, it is not known which of these communication methods were used most often. In future studies, it would perhaps be more appropriate to assess each of these communication mediums separately. The poor association of phone/letters/email could also be attributed to a human relation factor. The absence of “face to face” interaction in these modes of communication could have compromised their link to communicative interaction. And finally, these practices of communication may have required more effort and skills. Possessing technology skills becomes a concern, as well as, the maintenance of dexterity in the ability and use of one’s hands.

Table 3

Bivariate Correlation Results (Years of Education and Age)

		Years of education	Age
Calculated Verbal Series	Pearson's <i>r</i>	.437**	-.154**
	<i>p</i>	.000	.000
	<i>n</i>	3130	3130
Number Good	Pearson's <i>r</i>	.300**	-.365**
	<i>p</i>	.000	.000
	<i>n</i>	3130	3130
Times visit in person per wk	Pearson's <i>r</i>	.061**	-.024
	<i>p</i>	.000	.172
	<i>n</i>	3130	3130
Frequency for active with others per week	Pearson's <i>r</i>	.060**	-.082**
	<i>p</i>	.001	.000
	<i>n</i>	3130	3130
Usage of phone/letters/email	Pearson's <i>r</i>	-.009	-.047**
	<i>p</i>	.625	.009
	<i>n</i>	3130	3130

** Correlation is significant at the 0.01 level (2-tailed)

Independent t-test Results

Independent t-tests were conducted to examine the association of gender on the outcome and predictor variables. The results presented in Table 4, indicate that women's mean verbal score was significantly higher than men's $t = 5.34, p < .001$. Women also had higher scores in Number good/memory, $t = 7.84, p < .001$. Furthermore, there were significant differences in how women interacted with others. They had more visits per week, $t = 3.71, p < .001$, and participated

in interactions with others more frequently, per week, $t = 2.33, p < .05$. The results revealed, however, that men had a higher level of education than women, $t = -3.50, p < .001$.

Table 4

Independent Samples T-test Results

	Male	Female		<i>t</i>	<i>p</i>
	mean	mean	mean difference		
Visit in Person per week	6.20	7.54	1.34	3.71	.000
Often Active with others per wk	2.37	2.45	.081	2.33	.021
Years of education	13.08	12.70	-.383	-3.50	.000
Calculated verbal score	496.81	502.31	5.49	5.34	.000
Number good/memory	4.81	5.29	.478	7.84	.000
<i>n</i>	(1286)	(1844)			

*** $p < .001$, ** $p < .01$, * $p < .05$

Linear Regression Analysis Results

The results of the linear regression analysis are presented in Table 5, for the Calculated Verbal Series, and Table 6, for Number good/Memory. In Table 5, it can be seen that the regression coefficients (*b*) for all variables, except for often active with others and phone/letters/email are significant at the 0.001 level. The unstandardized regression coefficient for the main predictor variable, visit in person, from the simple linear regression (Model 1) is approximately .289. This implies that one visit increase per week is associated with an improvement of .289 points in the calculated verbal series score. The Pearson’s product moment correlation coefficient (*r*) for the model is .103 and the r^2 value is .011. From this result, it can be inferred that the number of visits per week account for 1.1 percent of the variability in the calculated verbal series score.

In the multiple regression analysis (Model 2), the three control variables of gender, age, and years of education, as well as often active with others and phone/letters were entered into the model. Pearson's r for this model is .474 with an r^2 value of .225. The predictive power of the overall linear model has been improved to an estimated 23% with the inclusion of the control variables as well as often active with others and phone/letters/email. However, from Table 5, it becomes obvious that the unstandardized regression coefficient for the main predictor variable, visit in person decreased from .29 to .19. This discovery reveals that when controlling for gender, age, years of education, one visit increase per week only explains a .19-point rise in the calculated verbal series score when controlling for other variables in the model. The unstandardized regression coefficients of the variables for *gender* ($B = 6.89$) and years of education ($B = 4.14$) are worth mentioning. When all other variables in the model were held constant, being female accounted for 6.89-point increase in the calculated verbal series score while having one more year of education was associated with an improvement of 4.14 points. Often active with others (-.234) and phone/letters/email (-.046), however, actually accounted for a decrease in the calculated verbal series score.

The results of the linear regression analysis for number good/memory are presented in Table 6. This table illustrates how that the regression coefficients (b) for most variables except for phone/letters/email are significant at the .001 level. The variable, phone/letters/email, resulted in not being significant, $p = .335$. However, the regression coefficient (b) for often active with others was significant, at a level of .039. The unstandardized regression coefficient for the main independent variable, visit in person, from the simple linear regression (Model 1) is estimated at .013, which is pretty low. It implies that each time a participant is interactive with others, there is a 1.3 percent increase in the number good/memory score. The Pearson's product

moment correlation coefficient (r) for the model is .079 and r^2 is .006. These results infer that the number of times a person is active with others per week accounts for about .6 percent variability in the number good/memory score.

The three control variables of gender, age, and years are introduced in the multiple regression analysis (Model 2), as well as the variables often active with others and phone/letters/email. Pearson's r for this model is .483 with an r^2 value of .233. In this case the predictive power of the overall linear model has improved to about 23 percent with the inclusion of the control variables as well as the predictor variables, often active with others and phone/letters/email. As seen in Table 6, however, the unstandardized regression coefficient of the main predictor variable, visit in person per week, decreased from .013 to .007. This finding implies that when controlling for gender, age, and years of education as well as the predictor variables, often active with others and phone/letters/email, one more visit in person increase, only explains a .07-point rise in the number good/memory score when controlling for other variables in the model. The unstandardized regression coefficients of the variables for gender ($B = .520$) and years of education ($B = .159$) show that when all other variables in the model are held constant, being female accounted for a .520-point increase in the number good/memory score. In addition, one more year of education corresponded to an improvement of .159 points.

Table 5

Linear Regression Analysis Results (Calculated Verbal Series)

Model	Variable	<i>B</i>	<i>se</i>	<i>p</i>
1	(Constant)	498.032***	.614	.000
	Times visit in person per week	.289***	.050	.000
2	(Constant)	476.919***	5.436	.000
	Times visit in person per week	.193***	.045	.000
	Frequency for active with others per week	-.234	.467	.617
	Usage of phone/letters/email per week	-.046	.060	.437
	Years of education	4.140***	.152	.000
	Age	-.456***	.061	.000
	Female	6.894***	.930	.000

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 6

Linear Regression Analysis Results (Number Good/Memory)

Model	Variable	<i>B</i>	<i>se</i>	<i>p</i>
1	(Constant)	5.002***	.037	.000
	Times visit in person per week	.013***	.003	.000
2	(Constant)	8.492***	.322	.000
	Times visit in person per week	.007***	.003	.007
	Frequency for active with others per week	.057*	.028	.039
	Usage of phone/letters/email per week	-.003	.004	.335
	Years of education	.159***	.009	.000
	Age	-.078***	.004	.000
	Female	.520***	.055	.000

*** $p < .001$, ** $p < .01$, * $p < .05$

Levene's Test Results

The Levene's test for equality of variances revealed significant results for the predictor variables, visit in person and often active with others as well as the control variable, years of education. Large samples as in this study are usually significant. As such, in this case, both independent variables as well as the control variable for education have violated the assumption. Since phone/letters/email appeared to have had the least correlation to the outcome variables, it was not included. The dependent or outcome variables have not violated the assumption and are non-significant. This means that the variance of the calculated verbal score and number good/memory have met the assumption of homogeneity and have not violated the null hypothesis. The variance in both cases, therefore are similar.

Table 7

Levene's Test for Equality of Variances

		F	Sig.
Times visit in person per wk	Equal variance not assumed	14.376	.000
Frequency for often active with others	Equal variance not assumed	3.922	.000
Years of education	Equal variance not assumed	23.256	.000
Calculated Verbal Series	Equal variance assumed	.704	.401
Number Good/Memory	Equal variance assumed	3.015	.083

Analysis of Each Hypothesis

A correlation's analysis of all predictor variables was administered. The results revealed a significant positive correlation for number good/memory in both visit in person, and often active with others. The results for calculated verbal series, also showed a significant positive relationship for visit in person and often active with others. However, the correlation between phone/letters/email and number good/memory as well as the calculated verbal series was insignificant in both cases, $p = .05$ and $p = .207$, respectively. The predictor variable, phone/letters/email, therefore will not be considered in analyzing the hypotheses. This variable will also not be included as a proxy for communicative interaction.

- Hypothesis 1: Communicative interaction increases memory or recall for individuals aged 65 and older.

The results of a bivariate correlation analysis indicate that both variables, visits in person and often active with others are positively associated with number good which is a proxy for memory in individuals aged 65 and older. This indicates a positive relationship between the number of times participants have visitors in a week and the score for recalling information, $r = .079$, $p < .01$. There are similar results with the variable often active with others, where the frequency of interacting with others per week, also increases memory or recalling information, $r = .086$, $p < .01$.

- Hypothesis 2: Communicative interaction increases word meaning for individuals aged 65 and older.

This hypothesis is also verified by the results of the analysis, which shows a significant correlation between calculated verbal series and visit in person, $r = .103$, $p < .000$. The findings also show a significant association to often active with others, $r = .038$, $p < .05$. While the

correlation is low in both cases, it doesn't negate the fact that there is still a positive relationship. However, due to the extremely low association of often active with others to the calculated verbal series, the preferred primary predictor variable for this study is visit in person.

- Hypothesis 3: Communicative interaction rises with increased number of years of education for individuals 65 years and older.

The results of the bivariate correlation analysis presented in Table 3 indicate that there is a significant positive relationship between the years of education received and the times, weekly, participants have visitors in person, $r = .060, p < .000$, as well as how often individuals are active with others, $r = .061, p < .001$. These results confirm hypothesis three which states that the increase in the number of years of education corresponds to higher levels of communicative interaction among older adults. The Pearson correlation coefficient r is similar for both, visit in person and often active with others averaging about .060, which according to Cohen (1988), suggests that the effect size is considerably low. As pointed out earlier, the variable phone/letters/email will not be considered due to no significance in the correlation between this variable and both outcome variables. In fact, in this case the results were a negative relationship indicating a Pearson correlation coefficient $r = -.009, p = .635$.

- Hypothesis 4: Communicative interaction decreases with age for individuals 65 years and older.

The fourth hypothesis is also verified by the results of the bivariate correlation analysis in Table 3 which shows that there is a negative correlation between age and visit in person, $r = -.024, p = .172$ and often active with others, $r = -.082, p < .001$. The results, however, were only significant in often active with others. This is not surprising since individuals have more control

over their own willingness to participate in activities with others, in contrast to limited or no control over how many times they have visitors in person.

Conclusion

In conclusion, while most of the Pearson correlation coefficient results suggested a small effect size, it is important to note that the majority of the end results were significant.

Furthermore, while the association between communicative interaction and memory, as well as word meaning was small, it doesn't negate the assumption that communicative interaction has some influence on cognitive functioning. Except for the predictor variable, phone/letters/email, the other independent variables indicated a significant correlation, either positive or negative, between number good/memory and/or the calculated verbal series score.

When controlling for a number of important individual factors, model 2 in the multiple regression analysis for both number good/memory and the calculated verbal series score, revealed an overall linear model improvement in both cases of approximately 23%. This meant that there was an increase in the outcome variable scores for each interactive encounter per week. In other words, when controlling for other variables, one more visit in person each week explained .19 point increase in the calculated verbal score and a .07 point rise in the number good/memory score.

Chapter Five: Discussion

The concern of cognitive decline in older adults has become more prevalent because of the increased life expectancy of baby boomers. This trend is likely to continue to grow with a projected rise in the number of older adults as this generation ages (Alzheimer's Association, 2017). Research in human development, neuroscience, brain plasticity and training, as well as intervention programs has explored ways to halt or decrease cognitive and communicative decline in older adults. Studies by Bandura (2007), McDougall (1999), Rowe and Kahn (1998), and many others suggest that a sense of control (self-efficacy) is a key indicator of successful aging. In addition, Lubinski (1997 and 1995), notes that a certain quality of life is important for improving communication and cognitive functioning in older adults. Furthermore, it can be safely asserted that most people find that communication is an essential element to sustaining quality of life. Acknowledgement of these factors, implies that maintaining meaningful communicative interaction and self-efficacy could be key influences on mitigating cognitive decline in older adults. In other words, quality of life may largely depend on staying active, while maintaining a sense of self control when interacting or communicating with others. Because cognition and communication are intertwined, this study examined the relationship between communicative interaction and cognition in individuals 65 years and older.

As the methods section mentions, to examine the link between communicative interaction and cognitive functioning, this study is based on an empirical analysis of a nationally represented sample of 3130 older adults in the United States. This study also examines how communicative interaction is associated with age, years of education and cognitive abilities in individuals 65 and above. To assess the association between communicative interaction and cognition, this chapter

discusses the findings from the analysis of data retrieved from HRS. In conclusion, this chapter will discuss implications for future research and provide a brief summary of the results.

The finding that communicative interaction decreases with age is reflected in the results of the proxy (often active with others). In the literature review it is mentioned by Lachman et al. (2009) that as one ages, besides adjusting to new environmental demands, older adults must cope with declining health and other losses. These changes in life affect a person's attitude, which in turn has the potential to cause depression, loneliness, and withdrawal (Le Dorze & Brassard, 1995). As such, the occurrence of these types of attitudes could influence one's desire to interact with others (Le Dorze & Brassard, 1995). For example, Tyler (1969) notes that adult learning is controlled by attitudes and attitudes influence behavior. An interest in interacting with others, therefore, may depend on whether a person is able to alter their own attitude. Depression, specifically, has been known to interfere with respondents' motivation, as well as their willingness or desire to function (Steffens & Potter, 2008). See Figure 3 on attitudes.



Figure 3. Attitudes affect behavior.

While the proxy (visit in person) had no correlation to age, it appears to have some connection in influencing one's desire to interact with others. Family involvement and support affect the emotional state of individuals and could be associated with their cognitive processes

(Bedford, 1995). Additionally, according to Lachman et al. (2009), individuals with greater social support are prone to sustain a greater sense of control or self-efficacy. Taking this point into consideration, even though the proxy (visit in person) was not influential with respect to age in the equation for communicative interaction, individuals experiencing fewer visits from others may lose their desire to socialize due to lack of communicative interaction as well as lack of social support. Without the support of family and friends, the occurrence of social withdrawal and depression may surface, which as noted earlier, influences one's attitudes and behavior (Le Dorze & Bedford, 1995).

The next finding of the study affirmed the hypothesis that communicative interaction rises with increased number of years of education. Although the effect size was low in these findings, the results nevertheless support the idea that education provides opportunities for strengthening social networks and connecting with others in a community (Kim & Geistfeld, 2008). In addition, the presence of good cognition has been associated with higher levels of education, whereas those with poor cognition are correlated with lower levels of education (Crimmins et al., 2018). Crimmins et al. (2018) also report that those with higher education levels live healthier and longer lives. This fact is confirmed in a randomized clinical trial study by Kim & Geistfeld (2009) where results indicated that education was positively associated with good health and high levels of cognitive ability. See Figure 4 on the correlation between level of education and health. It was additionally reported that individuals with at least a high school diploma had lower chances of developing functional problems such as poor vision, hearing deficits, and depression. The aforementioned influences of depression are correlated with individuals' attitudes and behavior which consequently affect their willingness to function and maybe participate in interactions with others.

Because health status is correlated to level of education and both factors are associated with one's outlook on life, it is not surprising to assume the possibility that individuals with higher levels of education tend to have more communicative interaction with others. Notably, however, age becomes a factor in these assumptions, as well. Sharp and Gatz (2011) found that the oldest participants in similar studies tend to have significantly fewer years of education. In addition, this study found that a rise in age was linked to decreased interaction with others. Acknowledgement of these two points raises concern on the association between education and cognitive functioning. Were the results significant due to the age of the participants, or was education the true predictor variable? In any event educational opportunities serve as a vehicle for strengthening social networks (Kim & Geistfeld, 2008).

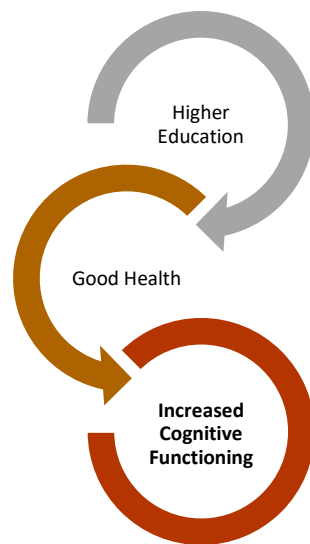


Figure 4. Level of education is correlated to health.

Another finding illustrated that the variable visit in person was correlated with increased word meaning for older adults. The variable often active with others, however, had a much lower relationship to the calculated verbal series score. It should also be noted that both variables represent a proxy for communicative interaction and that the assessment for word meaning or the

calculated verbal series was a test of fluid abilities such as executive functioning and speed of response. The measurement of fluid intelligence in this test focused on reasoning in a six-term verbal analogy test.

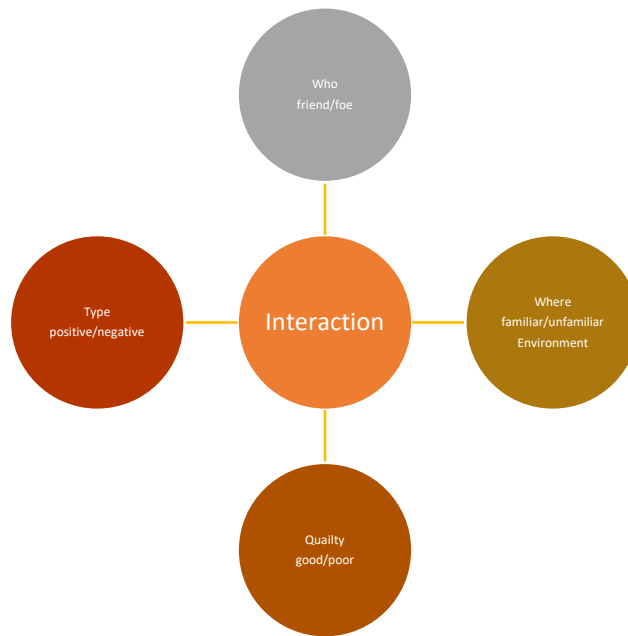
The outcome for visit in person and often active with others aligns with the theory that the brain thrives best within the context of social engagement (Cozolino & Sprokay 2006). To confirm this theory, studies on animals have examined how neurons and neuronal networks interact in controlling activity in the central nervous system. These studies illustrate how the brain seems to be a natural social organ, acquiring information through shared experiences (Cozolino & Sprokay, 2006). It is further claimed by Cozolino and Sprokay (2006), that the human brain requires social interaction to stimulate neural plasticity. So why was there a much lower association between the variable, often active with others and the calculated verbal series score? This finding is very puzzling, especially since both independent variables involve interacting with others.

There are a variety of reasons that could influence varying results in the two predictor variables for communicative interaction. First, there is the question of quality. The act of just interacting with someone doesn't constitute a positive or quality relationship. The interaction could have been a matter of greeting someone. Or worst, the interaction could have presented a conflict ending with negative consequences. Based on the literature presented in this study, stress or negativity as well as problems in one's life can stifle a person's learning ability (Cozolino & Sprokay, 2006). When considering how easy fear is learned in contrast to how difficult it is to let fear go, these authors recommend interacting with caring individuals. Stressors from a bad interaction can possibly work against neuroplastic functions (Cozolino & Sprokay, 2006). Therefore, not knowing the background information on the kinds of interactive activities that

were taking place or if the respondents were even interested in being active with others, leaves one to wonder about the quality of the reported interactive encounters. Another point worth mentioning in trying to understand the lower association between *often active with others* and the verbal score could be attributed to the types of people that were associated with the interaction. This leads to the next question of who is included in the word *others*.

In reviewing the variable, often active with others, the survey doesn't specify who the respondents are active with. This omission leaves the responses open to include virtually anyone. It could be a neighboring resident, a friend, a family member, a staff member, a doctor, a nurse, or even a stranger. Not being privy to this information could affect the results of the analysis. Being active with a family member, could produce a reaction quite different from the interaction with a stranger. Considering the interaction in these two examples, the variable *visit in person*, would probably consist of family and friends, rather than strangers. If this happened to be the case, these visits would be more meaningful than how often one is active with others.

And finally, the question of where the interaction takes place is another factor to consider when evaluating communicative interaction. As demonstrated in studies with laboratory animals, it was discovered that enriched and stimulating environments had a positive correlation to cognitive functioning (Guzowski et al., 2001). The positive influences of a stimulating environment according to Cozolino and Sprokay (2006) are instrumental to learning for individuals. Therefore, the findings in this study may also be dependent on how stimulating an environment is when interacting with others. See Figure 5 for components affecting interaction.



EXAMPLES OF INTERACTIONS

Who	Where	Quality	Type
Family	Familiar Places	Good	Positive
Friends	Unfamiliar Places	Poor	Negative
An adversary	Home	Engaging	Educational
Strangers	Facility	Meaningful	Recreational

Figure 5. Components affecting communicative interaction.

When older adults are transferred to nursing or assisted living facilities, they are initially in a totally strange environment. The place is usually impersonal with no memories. Based on the literature in this study, this type of environment is not conducive to learning. If however, the communicative interaction is taking place in a familiar home surrounded by loved ones, the link to cognitive functioning could have a stronger connection to improving one’s verbal score.

The final finding in this study suggests that communicative interaction increases memory or recall in older adults. Both independent variables for communicative interaction revealed a positive association with the proxy for memory, number good. Based on the literature, memory is a retention of information over time (Paz-Alonso et al., 2009). This would imply recalling

information. The assessment, number good, fits this definition. The assessment in this case, involved recalling a list of 10 words which could not to be repeated by the facilitator. Additionally, the test was more directed towards assessing one's short term memory.

Although the correlation for both predictor variables and memory was significant, the relationship to memory was very low. Again, this could be attributed to many of the same factors that were discussed in the findings for the calculated verbal series score. There are, however, additional factors that need to be considered. Based on the literature presented, West et al. (1992) discovered in a study of 2,495 adult volunteers that age was a consistent predictor of everyday memory performance. Furthermore, to remember a list of words without any association is a difficult task for anyone. Cozolino and Sprokay (2006) claim that narratives serve as memory devices, as well as expressions of self-esteem. Stories are instrumental to improving memory through connected associations. For example, as stated in the literature review, the process to learn a list of words is accomplished easier if it is incorporated in the context of a narrative rather than void of any associations.

It also needs to be noted that the brain area most affected by learning lists is strongly associated with aging and various forms of head injuries. An example of how memory works can be explained in the process of learning the name of a person or a skill. In this process connections or synapses between neurons occur, consisting of new information (Cozolino & Sprokay, 2006). As the new information is repeated and the skill practiced, the connection of synapsis becomes stronger. In contrast, long term memory or episodic memory is associated with recollections of events, times and places and are influenced by emotions and feelings (Craik & Jennings, 1992). Another type of long-term memory is procedural memory. This type of memory is correlated to riding a bike, walking or driving a car and involves repetition and practice (Craik,

1986). Keeping these factors in mind, as well as the difference between long term memory vs short term memory, remembering a list of words without any association or practice is not a simple task.

Other Factors to Consider

As pointed out earlier, there are many disadvantages of using secondary analysis in this study. Although the data revealed a vast amount of information, the data collected did not always answer the questions pertaining to this study. Quantity is not always optimal, though in this study it was the best approach to reach a larger sample.

Lack of control over the quality of the data collected was another concern. For example, the term *interacting with others*, is meaningless unless one knows the details of the types of interactions as well as the quality of the interaction. Based on the literature, the organization GSA (2012), claims that older adults need to be included in conversations and decision making in order to be actively inspired. This organization further discusses the importance of maintaining a positive speaking tone, avoiding speaking extremely slowly. This type of conversation puts added pressure on working memory (GSA, 2012). For optimal results in improving cognitive ability, a positive perception needs to be reinforced, not only by family members, but also by caregivers.

Another type of communication that is frowned on and has no association to improving cognition is described as patronizing speech. This pattern of speech tends to result in resistance and regression from older adults (GSA, 2012). Instead of practicing this type of demeaning talk, body language or non-verbal cues are recommended for eliciting the same type of affection or terms of endearment. On this same note, however, one needs to be aware of how non-verbal behavior can elicit negative messages, such as lack of interest or annoyance to older adults

(GSA, 2012). This type of communication, consequently, can cause a negative interaction which is not very productive in creating a positive association to cognitive functioning.

Effective communication involves active listening, as well as engagement. GSA (2012) reported that one of the main complaints expressed by older adults was that health care providers didn't listen to them. For more engaging interactions, it is suggested that providers and/or caregivers refrain from yes or no questions, and ask open-ended questions, encouraging older adults to use their own words. Additionally, Beisecker (1989) also mentions the importance of including older adults in conversations when others are in the room. This type of engagement engenders trust and autonomy, which removes authoritarian attitudes of others in the conversation or interaction (Makoul & Clayman, 2006). Furthermore, as discussed in the literature, self-efficacy is connected to cognitive functioning.

Based on the literature presented in this study, it is also important to take note of appropriate and inappropriate accommodations when conversing with older adults. Many inappropriate accommodations are practiced due to stereotypical views of aging. Health care providers and others tend to speak to older adults in higher pitched voices, exaggerated intonation, and amplified repetition, which in many cases is not welcomed by older adults (Ryan, et al., 1986). This type of engagement according to these researchers, may make older adults feel very old, reinforcing stereotypes such as wrinkled, forgetful, disabled, and deaf. Making assumptions as in this example can be harmful. Even though, cognitive aging is a natural process that is inevitable, age is relative (Raz, 2000). The degree of cognitive aging can be different between individuals. Based on the individual, these stereotypical views may not apply.

Depending on the person, there are health concerns to consider which were not revealed in the surveys, such as loss of hearing. In these instances, appropriate accommodations would

have to be made in communicative interactions with older adults. In addition, according to Worrall and Hickson (2003), there are other communication impairments that need to be recognized and may also go undetected. One example of such an impairment would be word retrieval. With this in mind, awareness of pathological diseases afflicting participants should also be acknowledged in this study. Serious health issues would include strokes, dementia, heart diseases, cancer, osteoporosis, and diabetes, all of which could affect the results of the study. The most prevalent disease connected to communication, however, is dementia of the Alzheimer's or DAT which affects one in ten people in the U.S. over the age of 65 (Hopper & Bayles, 2001). While the participants were deemed cognizant, this does not eliminate the possibility that some may have been experiencing the onset of dementia. This acknowledgement yields yet another factor that could sway the findings.

And finally, besides social-emotional influences, other factors such as environmental experiences, health conditions, and nutritional consumption need to be explored. For example, lack of proper nutrition is another factor that could affect cognitive functioning in older adults. Witte et al. (2009) concluded that verbal memory improved after a three-month calorie restriction. This finding suggests a potential association between vitamin supplements and cognitive performance. Acknowledging the factors discussed, it is important to consider the possibility of other elements influencing the results of both outcome variables, the calculated verbal score and number good/memory.

Implications for Future Research

In order to validate the hypotheses evolving from the responses of the survey, it would be beneficial to include additional background information on the respondents. Information might include their mental capacity at the time of the survey, health issues that may compromise their

responses, and the kinds of interactions they experienced, as well as making a distinction on the types of visitors they encountered (e.g. family, friends, staff members, etc.).

Taking into consideration the limitations of conducting a secondary analysis, future research might also include developing surveys more closely related and specific to questions presented in the study. Additionally, surveys need to be designed so that cognitively aged individuals are willing and able to participate in the survey. This type of methodology would limit or minimize the amount of survey error. Considering this approach might involve retrieving data from a random sample of participants from various senior communities. Creating survey questions indigenous to the study would probably be more reliable as well as appropriate. Another method to consider is the possibility of designing communication workshops. In this context, it would be necessary to administer pre and post surveys in order to measure the association of communicative interaction on cognitive functioning.

Additionally, in view of the limitations of this study, the only available cognitive assessments were dictated by HRS. For future research, other methods of assessing one's cognitive ability should be considered. In this respect, measuring a person's overall cognitive potential could also consist of math skills and problem solving strategies. According to Hertzog (2009), the simple task of maintaining a checkbook reinforces addition and subtraction skills.

There are also implications connected to the findings for the variable phone/letters/email that need to be discussed. Poor correlation results for this variable could be due to a variety of reasons. By clumping these modes of communication together, there was no way of knowing which method of communication was used most often. For future research, it might be more effective to analyze each of these methods of communication separately.

Another thought to consider is the fact that there was no face-to-face interaction in this style of communication. This would suggest that the absence of human interaction when communicating should be of concern when considering future advances in technology. Suggestions that might help in providing a face-to-face experience would be to incorporate technology that provides visuals such as skype or face-time when making long distance connections. Another suggestion would be to train staff in nursing and assisted living homes to be more mindful when residents receive calls and assist them when connecting with family and friends through the use of ipads or laptops. This task could also be accomplished by setting up a face-time room where older adults could book a time to connect with love ones. Offering these types of services would probably require training the staff in technology.

Another point worth mentioning for future consideration is the role of technology in promoting social interaction. Technology could serve as a conduit for communicative interaction anytime and anyplace, which could help older adults connect to family and friends more readily. A study by Krueger et al. (2009) discovered that higher levels of social engagement were related to increased levels of cognitive functioning. Although social media is recommended for providing more opportunities for older adults to connect and interact with others, infusing computer usage into the lives of older adult would not only require computer training, but changes in government policies and funding. Currently, there is little federal support for improving computer-related skills of older adults and most of the assistance is at the local level (Calhoun & Lee, 2019). In addition, because many older adults are on fixed incomes, the issue of affording a computer as well as internet services becomes a concern.

Besides making it easier for older adults to connect with others, computer usage promotes autonomy and improves cognitive functioning (White et al., 2002). Leveraging technology into

future studies would therefore build a stronger foundation in understanding the link between communicative interaction and cognition. Integrating technology into the lives of older adults could possibly provide them with the necessary tools and strategies to connect and interact with more individuals.

Policy Considerations

As America's older population continues to increase, so does the cost of health care. The growing incidents of Alzheimer's disease and other forms of dementia have an impact on high health care costs. Many older adults are forced into nursing homes and assisted living facilities which affects long term care options (Centers for Disease Control and Preventions, 2008, 2013). Finding ways to extend the time older adults are independent could possibly mitigate health care costs and improve or sustain cognitive functioning. Studies, as noted earlier, by Bandura (2007), McDougall (1999), Rowe and Kahn (1998), imply that self-efficacy is key to successful aging which could be conducive to improving and/or maintaining cognitive and communicative functioning. Awareness of these realities warrants further researching on ways to reinforce autonomy for older adults.

Autonomy. Autonomy is affected by one's ability to make decisions. And decisions are controlled by cognitive abilities to communicate and comprehend. Findings in many studies have shown that keeping one's mind stimulated and active through learning, participating in engaging activities, and staying connected, could have an impact on slowing down the development and occurrence of AD (Ruthiarkkuhan et al., 2012; Wilson et al., 2002). Furthermore, it has been proven that the brain is malleable and can be trained in later life (Kueider, Bichay & Regok, 2014). In view of these findings, it might be cost efficient as well as effective for policy makers to consider ways to support learning and/or cognitive training programs as preventative methods

to delay the onset of dementia. Investment in continued education for older adults could be influential in extending the time they are independent.

Conclusion

In summary, this study highlights the importance of connecting language or communicative interaction to cognitive functioning. While incorporating secondary analysis provides an advantage of reaching out to a larger population, researchers need to be mindful of other uncontrollable variables that can influence the results. The factors of the quality of the interaction, the kinds of interactions, who is involved in the interaction as well as the place of the interaction and health issues, all need to be considered in producing accurate findings. In any event, this study's main findings revealed that there was an association between communicative interaction and cognitive functioning. Determining the degree of the association, may require further investigation in the future.

There are a combination of factors ranging from lifestyle to genes, as well as pathological setbacks associated to cognitive decline. Improving cognitive skills is dependent on many variables. Analyzing the link between communicative interaction and cognitive functioning is only one alternative for intervening or slowing down the onset of dementia. A caution against any interpretations of reverse causality, also needs to be noted. The fact that communicative interaction is associated with cognitive functioning does not mean that communicative interaction causes increased cognitive ability. There are other variables that may be a factor. Consider the assumption that individuals who are very verbal, usually are more interactive. In this example, one tends to wonder if it is the verbal skills influencing cognitive capability or if it is actually the interaction.

To conclude, the purpose of this study has been to educate the general population on the factors associated to cognitive functioning as well as to set the stage for future research on linking cognitive ability to communicative interaction. Old age is characterized by weakened ties to society and family. Through this research, perhaps family members and communities can minimize the extent in which older adults feel isolated by being better prepared in understanding the importance of remaining deeply connected to society's oldest members.

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APPENDIX A

IRB APPROVAL

PEPPERDINE UNIVERSITY

Graduate & Professional Schools Institutional Review Board

February 5, 2019

Protocol #: **252019**

Project Title: Linking Communicative Interactions to Cognitive Functioning (Memory, Verbal Reasoning and Fluency): What are the implications for Older Adults?

Dear Denise:

Thank you for submitting a “GPS IRB Non-Human Subjects Notification Form” related to your *Linking Communicative Interactions to Cognitive Functioning (Memory, Verbal Reasoning and Fluency): What are the implications for Older Adults?* for review to Pepperdine University’s Institutional Review Board (IRB). The IRB has reviewed your submitted form and all ancillary materials. Upon review, the IRB has determined that the above titled project meets the requirements for *non-human subject research* under the federal regulations 45 CFR 46.101 that govern the protection of human subjects.

Your research must be conducted according to the form that was submitted to the IRB. If changes to the approved project occur, you will be required to submit *either* a new “GPS IRB Non-Human Subjects Notification Form” or an IRB application via the eProtocol system (<http://irb.pepperdine.edu>) to the Institutional Review Board.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete explanation of the event and your response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at <https://community.pepperdine.edu/irb/policies/>.

Please refer to the protocol number denoted above in all further communication or correspondence related to this approval.

On behalf of the IRB, we wish you success in this scholarly pursuit.

Sincerely,

Institutional Review Board (IRB)
Pepperdine University

cc: Mrs. Katy Carr, Assistant Provost for Research

Dr. Judy Ho, Graduate School of Education and Psychology IRB Chair