GROWING MINDS: EVALUATING THE EFFECT OF A SCHOOL GARDEN PROGRAM ON CHILDREN'S ABILITY TO DELAY GRATIFICATION AND INFLUENCE VISUAL MOTOR INTEGRATION

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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May 2016

Major Subject: Horticulture

ABSTRACT

Youth in today's society have a multitude of opportunities at their disposal that encourage instant gratification. Technology is paramount almost everywhere and allows information transfer and communication at the touch of a fingertip. Often there is no force to inhibit impulses or delay gratification unless an individual imposes these strategies upon him or herself. While technology allows access to desirable information, it can also encourage sedentary behaviors through computer and gaming usage, which is especially dangerous to our nation's youth who are facing obesity challenges and need to be honing motor skill development and self-control strategies. Since delaying gratification and appropriate motor skill development have been linked with successful academic achievements, there has been a rise in interest regarding interventions that could address these challenges. It is especially important to encourage healthy behaviors and an active lifestyle early, which makes interventions in early school years a special area of interest.

The purpose of this study was to examine the effect of a school gardening program on children's ability to delay gratification and examine the influence of a school garden program on children's visual motor integration. The sample of this study was drawn from children ages 2-6 in a combination of private preschool programs that had no active garden on site. Treatment and control schools were selected based on similar teaching methodologies. Pre and posttest measures were taken for delay of gratification

using a predetermined script created based on previous research in the field and visual motor integration was measured using Beery-Buktenica Developmental Test of Visual-Motor Integration 5th Edition (short form).

Results from this study showed no significant main effect between the treatment and control schools in regards to change in delay of gratification times or visual motor integration from pre to posttest. However, further analysis of gender revealed interesting trends relating to both measures. For delay of gratification, females showed a response to the intervention through a trend of increasing control at the project end. The Beery Visual Motor Integration measure revealed a statistical significance in average scores for males ($F=5.22$; $p=0.028$) between control and treatment groups. These insights provide a starting point for future studies examining gardening programs as an intervention.

DEDICATION

This dissertation work is dedicated to all who believe they can, and that I could. As long as there is belief and prayers, there is the possibility of accomplishing something that seems out of reach. It was not easy, and often not fun, but persistence endured and overcame many challenges. Encouragement from family and friends means more than they can possibly know. I have made difficult choices that slowed my completion but blessed my family, and my family has made sacrifices to their home and social life so I could finish this work. It may not be how I thought it would be, but we are never sure where our path will lead us. So, thank you to anyone and everyone who ever offered a kind word of encouragement or extended an offer to help, motivation comes in many forms and fashions! In short, to anyone and everyone who has helped me along the way: I dedicate this to you.

ACKNOWLEDGEMENTS

First of all I want to give thanks to God for surrounding me with a supportive network and the means to follow this degree and project to completion. I am grateful for the many opportunities that have been given to me, too numerous to list, but always remembered. Thank you to everyone who has supported me, listing them all would take up many pages. I would like to give a special thanks to my parents for believing in and pushing me from the very beginning, my sisters who gave me sneak peaks into life and helped me realize there is always more than one way to look at things, and Nonna and Poppa who helped make me who I am.

To my husband, Patrick, and our kids Aurora, Sophia, and Rowan I thank you for dealing with my often divided attention and writing frustrations as well as the stress of trying to do more than I felt capable of at times. Kelsie Beth and Krystel, I think it is safe to say I don't know if I could have actually completed this without you! Brance, who got called in at random times made finishing possible is another one of my heroes. A huge THANK YOU to Amy McFarland for offering advice and help with statistics, being someone to talk to, and just being a friend.

Dr. Zajicek and Dr. Waliczek-Cade, you are amazing ladies and I admire your perseverance in the field of research more than you probably realize. I think your dedication to education is amazing and I sincerely appreciate you for continuing to support me as I as I worked my way through life and the research. I am also learning more and more to appreciate your editorial skills and your ability to teach me not only

what to do, but different ways to think about and approach things. I also want to thank my other committee members Dr. Juntune and Dr. Dooley for broadening my horizons and making me feel like a rock star with an all female committee! I love you all and thank you for hanging in there with me through my very indirect and often interrupted PhD experience.

I would like to thanks the administrators at the schools where research was completed, clearly I couldn't have done it without you! However, your interest in the project and your willingness to work with me on scheduling and discussions just made my life so much easier and I truly appreciate it.

Once again, I want to express my thanks to the ladies of Belsterling Foundation. Your generosity and support of academics through graduate students is so incredibly important. The monetary support was huge for me as a graduate student with a family, but moral support through meetings, field trips, and interested discussions provided evidence that I was doing something that mattered. So, I want to thank you, not only for providing financial assistance, but for being interested in graduate students as well.

I would also like to acknowledge Life. Sometimes it felt like it got in the way, but I know that was me just learning some new lesson. Therefore, thank you God once again, for the ability to finish what I started. Lord, please help me to follow a path that provides options for others and helps make the world a better place!

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CHAPTER I

INTRODUCTION

For children today, entertainment and information is simply a click away on television and media such as cell phones, iPads, and social applications (American Academy of Pediatrics, 2013). Instant gratification and a feeling of entitlement are commonplace in the life of typical American youth (Renard, 2005). Movies stream through home entertainment systems; drive-through options are available for food, medicines, and alcohol; convenience stores are located on most corners; and laptops or smart phones access information at virtually any location. While some of these conveniences are limited to urban settings, many of them are available in most locations in the developed world.

According to the American Academy of Pediatrics (2013), media is a dominant force in children's lives usurping more time than being in school. It is the leading activity for children other than sleeping, and can contribute to many risks and health problems (American Academy of Pediatrics, 2013). In a study of children under the age of 11, median media time on a weekday was slightly more than two hours, with television viewing being surpassed by the combination of video and computer game usage (Christakis et al., 2004). Other research has documented connections of increased media usage and sedentary activities to an increase in children's' BMI thus creating major obesity related health concerns in the future (Tremblay and Willms, 2003; Vandewater, Shim, and Caplovitz; 2004).

According to Kaplan (1995), "All too often the modern human must exert effort to do the important while resisting distraction from the interesting. Thus the problem of fatigue of directed attention may well be of comparatively recent vintage" (p. 170). While resisting an immediate interest for a future desire can present challenges for adults, it is particularly challenging for children in early childhood who are developing skills related to self-discipline. Self-discipline is a mechanism to be introduced early in a young person's life and includes developing skills related to concentration, inhibiting initial impulses, and delaying gratification (Taylor et al., 2002). The ability to delay immediate gratification at a young age can be a successful predictor for social and cognitive competence and coping skills at an older age (Eigsti et al., 2006; Rodriguez, Mischel and Shoda, 1989; Mischel et al., 1988).

Modern conveniences and technologies providing instant gratification are often the same, offering adults and children opportunities for indoor-based entertainment and activities (Pergams and Zaradic, 2006; Renard, 2005; Robinson and Ridenour, 2012). Pergams and Zaradic (2006) define their new term 'videophilia', as "the new human tendency to focus on sedentary activities involving electronic media" (p. 392). Youth motor skills previously developed through outdoor activities and interactions with nature are being replaced with the use of hand-held electronic gaming devices and buttons on television remote controls (Straker, 2011). Research suggests natural outdoor environments offer youth greater capacity for physical activity, increasing opportunities for gross motor skill development, though not excluding development of fine motor skills (Fjortoft, 2001; McFarland, 2011; Straker 2011).

While all motor skills are important, a study by Sortor and Kulp (2003) proposes a significant link between visual perceptual skill development and math and reading achievement in elementary school students. Hand eye coordination is a commonly used term to encompass a targeted concept, visual motor integration, defined by Beery (2006) as "the degree to which visual perception and finger-hand movements are well coordinated" (p. 12).

Increasing opportunities for exposure to natural environments creates a foundation for increasing multiple developmental milestones in youth. Taylor et al. (2002) suggests after spending breaks in green schoolyards, children may return to the classroom better able to pay attention, suppress disruptive impulses, and wait patiently for future breaks. In the introduction to their book *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*, Kahn and Kellert (2002) maintain that despite a lack of scientifically sound research, "It would not be too bold to assert that direct and indirect experience of nature has been and may possibly remain a critical component in human physical, emotional, intellectual, and even moral development" (p. vii).

Statement of Problem

Significant strides have been made in research examining children's interactions with gardens and the relation to healthy eating choices (Blair, 2009; Cabalda et al., 2011; Canaris, 1995; Lineberger and Zajicek, 2000; Ozer, 2007; Ratcliffe et al., 2011; Williams and Dixon, 2013). There has also been research exploring youthful interactions with a garden program impacting academic capabilities (Blair, 2009; Klemmer et al.,

2005; Ozer, 2007; Pigg et al., 2006; Williams and Dixon, 2013), as well as life skill development (Miller, 2007; Robinson and Zajicek, 2005; Williams and Dixon, 2013). However, research is lacking examining specific developmental relationships, such as a child's ability for self-discipline when interacting with nature (Kahn and Kellert, 2002; Taylor et al., 2002). This gap in youth garden research could be addressed through systematic examinations of specific youth development skills within the scope of a school garden program. Two particular skills of interest for this study are youth's ability to delay gratification and development of visual-motor integration.

Statement of Purpose and Objectives

The purpose of this study was to examine the effect of a school gardening program on children's ability to delay gratification and development of visual motor integration.

Objectives

Specific objectives for this study were:

1) To determine if participation in a school gardening program affected children's ability to delay gratification.
2) To determine if participation in a school gardening program affected children's visual motor integration.

The following hypotheses were tested:

H1: Preschoolers participating in a school gardening program will have increased ability to delay gratification when compared to children not involved in a school gardening program.

H2: Preschoolers participating in a school gardening program will have improved visual motor integration scores when compared to children not involved in a school gardening program.

Definition of Terms

For the purpose of this study the following terms were operationally defined:

Beery VMI: assessment tool used to assign scores to children's visual-motor integration abilities (Beery and Beery, 2006)

Delay of Gratification: "the ability to forgo an immediate reward in favor of a better reward at a later time" (Dehart et al., 2005, p. 349)

Gardening: "a process, a series of actions that produce visible products: flowers, vegetables, trees, shrubs, or lawns" (Lewis, 1996, p. 52)

Montessori School: A school with methods based on teachings of Maria Montessori who believed that all children want to learn, and learn best through spontaneous learning and student led discovery (Montessori, 1966)

Self-regulating: "Children's ability to direct their own activities, to adjust behavior to fit situations, and the ability to exercise effortful control (the ability to suppress strong behaviors)" (Dehart et al., 2005, p. 339)

Visual Motor Integration: "the degree to which visual perception and finger-hand movements are well coordinated" (Beery and Beery, 2006, p. 12)

Basic Assumptions

1) It was assumed participants' recorded measures for the delay of gratification exercises provided a representative measure of the participants' ability to wait for a preferred reward.
2) It was assumed participants completed the administered Beery-Buktenica Developmental Test of Visual-Motor Integration to best of their ability.

3) It was assumed participants were a representative sample of targeted study sample.

Limitations

Limitations for this study include the following:

1) Research conducted on humans will have extraneous factors that can influence outcomes of the study. For this study those factors included differences in testing rooms, the time of day the test was administered, and unequal measures of elapsed times between pre and post measures.
2) Due to correlational research's inability to control for all variables or to manipulate independent variables, causation cannot be suggested.
3) The sample for this study was relatively small and specific in that both schools were private pre-school programs.
4) This study was limited to children whose parents approved their participation, as well as the willingness of each student to participate during each testing section.
5) Age and gender were the only demographic variables for which data was collected for this study, which limited variables that could be controlled for during analysis.

Delimitations

1) This study was conducted at two private preschool programs to allow in depth observations and facilitation of the garden program by the researcher.
2) This study was delimited to children ages 2.5 to 6 years old.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this study was to examine the effect of a school gardening program on children's ability to delay gratification and development of visual motor integration. The following literature review will investigate research-based findings on the importance and significance of children's ability to delay gratification, the development of fine motor skills, the effect of interactions with gardening, and the benefits for children involved in school garden programs.

Self-Regulation and Delayed Gratification

Self-regulation is defined as the ability to direct or control oneself without outside influence (Ehrlich, 1980). Self-regulation from the standpoint of a child is defined as "children's ability to direct their own activities, to adjust behavior to fit a situation, and to exercise effortful control (DeHart et al., 2004, p. 339). Discipline can be defined as training that produces obedience, self-control, or a particular skill (Ehrlich, 1980). Utilizing components from these definitions, self-discipline can be described as a training that can produce self-control. Three forms of self-discipline presented by Taylor et al. (2002) include: concentration, inhibiting initial impulses, and the ability to delay gratification. Taylor et al. (2002) defined concentration as one's ability to control his/her mind from wandering while maintaining focus through distractions, frustrations, boredom, or fatigue; inhibiting initial impulses as one's ability to think past an immediate reaction, taking time to consider alternatives and repercussions of choices;

and delaying gratification as the ability to postpone immediate rewards in favor of a greater long term goal.

According to Siegler et al. (2006) in the educational text, *How Children Develop*, the ability to delay gratification in preschool can be a predictor of social, emotional, and academic competence illustrating the importance of emotional intelligence. Siegler et al. (2006) defined emotional intelligence as "a set of abilities that contribute to competence in the social and emotional domains" and includes abilities such as "being able to motivate one-self and persist in the face of frustration, control impulses and delay gratification, identify and understand one's own and other's feelings, regulate one's moods, regulate the expression of emotion in social interactions, and empathize with others' emotions" (p. 375).

Walter Mischel has completed multiple studies examining delay of gratification in children (Mischel and Ebbesen, 1970; Mischel and Metzner, 1962; Mischel and Underwood, 1974; Mischel et al., 1972; Mischel et al., 1988; Mischel et al., 1989). His longitudinal study exploring children's ability to wait for a larger reward showed positive significance between length of time delayed at a preschool age and future academic abilities (Scholastic Aptitude Test types), as well as parental responses in areas such as concentration, competence, planning abilities, coping with problems, and intelligence during adolescence (Mischel et al., 1989). Examples from parents of children who delayed gratification longer at a young age included increased ability to cope with stress, tolerate frustration, resist temptation, maintain self-control, pursue goals, and delay gratification as a teenager (Mischel et al., 1989). Mischel et al. (1989)

expressed that while associations remain speculative it, "seems reasonable…that children will have a distinct advantage beginning early in life if they use effective self-regulatory strategies to reduce frustration in situations in which self-imposed delay is required to attain desired goals (p. 936)."

A study by Strickland (1973) concluded that children who believed personal behaviors resulted in specific events demonstrated the ability to choose more valuable rewards over time, and that the ability to delay gratification is likely connected to behavior-reinforcement contingencies. Behavior-reinforcement contingencies can be explained by B.F. Skinner's theory of operant conditioning where behaviors have been positively reinforced through favorable outcomes in past experiences (Siegler et al., 2006). A longitudinal study examining preschool behavioral and neural correlations of delay of gratification 40 years later, reported findings that confirm significance and predictive validity of delay ability in preschoolers for behaviors in later life, specifically impulse control abilities (Casey et al., 2011).

Impulsive decision-making has been tied to negative outcomes such as sexual risk-taking, elevated BMI, and raised crime rates, all of which directly or indirectly affect an individual's general health (Donohew et al., 2000; Moffitt, 2011; Schlam et al., 2013). Taylor et al. (2002) suggests that an individual's ability to inhibit initial impulses while considering alternatives can surpass desire for immediate gratification while promoting thoughts for long-term goals. A 30 year longitudinal study including 1,000 individuals reported that early childhood variations in self-control can predict multiple factors such as health, wealth, and crime almost as well as intelligence and social class,

and offers a greater insight into opportunities for targeted interventions (Moffitt et al., 2011). In preparation for the study looking at the neural basis of self regulation, Casey et al. (2011) reviewed previous literature and concluded that "higher delay ability promotes the development of better social-cognitive and emotional coping in adolescence and buffers against the development of a variety of dispositional physical and mental health vulnerabilities in middle age, such as high BMI, cocaine/crack use, features of borderline personality disorder, anxious overreactions to rejections, and marital divorce/separation." Moffitt et al. (2011) suggested that early intervention programs to enhance self-control could reduce the growing number of costs that are associated with a number of risky behaviors including, but not limited to, health issues. An intervention program at the preschool level targeting risky behaviors through an increase in self-control is validated by combining Moffitt et al.'s (2011) support of early intervention programs targeting development of self-control with Casey et al.'s (2011) findings that confirm the predictive validity for delay ability in preschoolers transferring to behaviors in later life.

Visual Motor Integration

Visual motor integration is the degree to which visual perception and finger-hand movements are well coordinated (Beery, 2006). This terminology is similar to eye-hand coordination, commonly referred to fine motor skills. According to a study examining the relationship between visual-motor coordination, eye-hand coordination, and the quality of handwriting, Kaiser et al. (2009) reflected that though similar, the terms visual-motor integration and eye-hand coordination are slightly different in that eye-

hand coordination needs more visual control (example: to trace items). Fine motor skills can be defined as the coordination of muscles, bones, and nerves to produce small precise movements (United States National Library of Medicine, 2014). The U.S. National Library of Medicine (2014) maintains that children develop fine motor skills over time through a combination of repetition and teaching. In order to acquire fine motor control, children must have awareness and planning abilities, adequate coordination and muscle strength, as well as normal sensation (U.S. National Library of Medicine, 2014). Proper maturation of the nervous system in conjunction with these variables allows development of fine motor abilities, including examples such as controlled scissor work, writing and drawing tasks, folding and stacking abilities, and zipper control (U.S. National Library of Medicine, 2014).

Visual-motor integration as a fine motor skill has been linked to academic success in fields such as handwriting, math, and reading (Grissmer et al., 2010; Lahav et al, 2013; Sortor and Kulp, 2003), as well as emotional health and self-esteem (Bart et al., 2007; Lahav et al., 2013). Grissmer et al. (2010) conducted a study examining data from three longitudinal data sets with motor function measurements, finding that fine motor skills were a strong and consistent predictor of later achievement in academic settings. In a study investigating academic achievement in relation to performance on a visual-motor integration measurement, Sortor and Kulp (2003) concluded visual perceptual skills are factors significantly related to achievement in math and reading. Rule and Stewart (2002) reported the nature of fine motor skill activities along with the way children were instructed to complete them were important factors in increased performance. This study

reported teachers' notice of students' enjoyment in specified activities were outside of traditional fine motor skill development work, while children spoke with enthusiasm about using their imaginations and addressing the challenging work (Rule and Stewart, 2002).

Deficiencies in visual motor integration can attribute to delay of basic learning skills associated with normal educational development (Sortor and Kulp, 2003). Lahav et al. (2013) reported that self esteem and social performance may be tied to motor difficulties, including visual motor skills, and stated that, "The association between motor function and emotional status is well established and improvement of motor function can promote emotional health." In a study looking at the predictive abilities of kindergarten motor scores on later school adjustment, Bart et al. (2007) reported academic and social failures caused by motor inadequacies may cause a child to lose self-confidence becoming anxious and withdrawn at school. Bart et al. (2007) also postulated poor visual motor measures could be related to increased frustration, difficulty sustaining attention, and poor overall achievement, supporting tendencies for disruptive behaviors in the classroom.

History of School Gardens

Early educators like Rousseau (1712–1778), Pestalozzi (1746–1827), Froebel (1782–1852) and Montessori (1870–1952), recognized the "importance of a garden as a dynamic resource for scientific observations and outdoor investigations (Johnson, 2012, p. 582)." However, garden instruction was mostly implemented in areas of conservation and sustainable development (Johnson, 2012). According to a review of literature by

Sally Kohlstedt (2008), the school gardening movement between 1890-1920 could be characterized as growing "a better crop of boys and girls." School gardens at this time were initially an expression of the nature study movement where sciences where introduced into schools in varying degrees and capacities throughout the United States (Kohlstedt, 2008). School gardening during this time period was believed to offer benefits including stimulating children's interest, illustrating academic lessons, aesthetics, practicality (learning to farm), cooperation, and civic responsibility (Kohlstedt, 2008). Although school gardens were growing in numbers during this period, becoming common, they experienced rapid growth upon the creation of the United States School Garden Army (1917) when they numbered in the hundreds of thousands (Kohlstedt, 2008; Division of Agriculture and Natural Resources, University of California Division of Agriculture and Natural Resources, 2015). Students who enlisted to help grow food for the war became known as "Soldiers of the Soil" and were reported to number over several million by November of 1917 (University of California Division of Agriculture and Natural Resources, 2015).

During the 1920's, the school gardening movement basically disappeared from the public view, though local school gardens persisted, with a slight resurgence during WWII (Kohlstedt, 2008). Throughout the years, classrooms became internalized, focusing more heavily on technology, transitioning available outdoor time to include recess, time spent on athletic fields and occasional field trips (McGaughy, 2013). A greater focus on knowledge gain and testing benchmarks narrowed the scope of teaching, and gardens in schools experienced decline.

A review of literature examining the impact of garden-based learning on academic outcomes between 1990 and 2010 reports that since 1990, a resurgence of interest in school gardens has led to establishment of thousands of school gardens and garden curricula designed specifically to meet subject standards on achievement tests (Williams and Dixon, 2013). During this time, Alice Waters created the Edible Schoolyard Project (1995) which has developed into a model of experiential education for garden based learning (edibleschoolyard.org/our-story). This organization became popular quickly and has served as a source of information for many interested in promoting garden based learning programs and healthful eating practices.

Movements in the United States have continued since then and include books, websites, initiatives, and coalitions. Richard Louv published his book, *Last Child in the Woods: Saving our Children from Nature-Deficit Disorder* in 2005. This book contributed to public interest in interactions between children and nature and subsequently spurred the formation of the national Children and Nature Network (Williams and Dixon 2013). Children and Nature Network's mission statement follows: "The Children and Nature Network is leading the movement to connect all children, their families and communities to nature through innovative ideas, evidence-based resources and tools, broad-based collaboration and support of grassroots leadership." (Children and Nature, 2014a). As of June 2, 2014, the home page of their website reported 118 regional campaigns, 193 Nature Clubs for Families, and 903 *Let's G.O.!* (Get Outside) events (Children and Nature, 2014b). In 2007, a national No Child Left

Inside Coalition was formed, advocating the need for schools to devote more resources and attention to environmental education (No Child Left Inside, n.d.).

In 2009, when Michelle Obama planted the White House Kitchen Garden, she again brought children and gardens into the spotlight, eventually spawning the Let's Move! initiative that validated the resurgence in public interest and growth for school gardens (Williams and Dixon, 2013; U.S. Whitehouse Briefing Room, 2014). Organizations supporting school gardening are becoming more noticeable and offering funding opportunities for schools, which in turn creates opportunities to further school garden attention, implementation and success.

A recent popular press article attacking the effectiveness of school gardens and accusing garden programs of robbing students of effective learning experiences has garnered a response from supporters and advocates of school gardens (Flanagan, 2010). Although the Center for Ecoliteracy composed a well-written public piece in rebuttal, it acknowledges that while academic and other benefits of school gardens have been statistically demonstrated, there is still the need for a "robust body of peer-reviewed quantitative controlled studies on the topic" (Center for Ecoliteracy, 2014).

Benefits of Active and Passive Interactions with Plants

The emotional connection to plants, through landscapes, memories, and associations can be created through active or passive encounters with natural environments (Lewis, 1996; Louv, 2005). Lewis (1996) stated that only with completion and synthesis of multiple studies was he able to realize the appeal of gardening

(communing with nature) exists not so much in the plants but in the feelings they generated. In his book Green Nature Human Nature (1996) Charles Lewis comments,

> "It is the split second during which we feel before we know that provides insight into a different way of knowing, one that is intuitive rather than cognitive. Human vision is personal, intimately bound up with all that has ever happened to us." (p. 6-7).

He posits that gardening includes two spheres, the physical and mental, whose combination is completed through experiences resulting from their interaction. While the physical, plant centered view of gardening is incomplete, the mental garden is filled with feelings of anticipation, concern, jubilation and emotions that truly ignite the process gardening encompasses (Lewis, 1996). These interactions of feelings, activities, and memories associated with plants enable an individual to translate a simple action such as walking through a park or stopping to pull up weeds into a meaningful experience. This meaningfulness can be seen in a study including 303 older adult respondents who gardened for leisure that revealed these seven motivational factors for gardening: intellectual, stimulus-avoidance, friendship building, social interaction, physical fitness, skill-development, and creativity (Ashton-Shaeffer and Constant, 2008).

As early as 1995, Stephen Kaplan reported that, "Evidence pointing to the psychological benefits of nature has accumulated at a remarkable rate in a relatively short period of time" (Kaplan, 1995, p.169). An article by Relf (1992) was adapted for publication in the book, *Horticulture as Therapy: Principles and Practice*, and laid groundwork for the examination of people and their interactions with plants, providing

examples of studies suggesting multiple benefits of both active and passive exposure to nature. Passive interactions like viewing green spaces through windows led to reporting of benefits including: reduced stress (Ulrich and Parson, 1992; Ulrich and Simons, 1986), increased positive feelings while reducing fear and anger (Ulrich, 1979); lower perceived job pressure (Kaplan et al., 1988); decrease in reported sickness at work and in prison (Kaplan et al., 1988; Moore, 1982; West, 1985); and shortened hospital stays after surgery with less medications and negative patient comments (Ulrich, 1984).

In *Horticulture as Therapy*, Relf (1998) describes a community as a group of people sharing similar interests and values. Green spaces within communities have been associated with an increase in community pride, aesthetic benefits, improvement of the physical environment, perceived safety, neighborhood socialization and community empowerment, as well as neighborhood satisfaction (Bonham, 1991; Fried, 1982; Gorham et al., 2009; Kaplan, 1985; Okvat and Zautra, 2011; Shaffer and Anderson, 1985). While communities are often viewed as traditional neighborhoods or retirement villages, they can also include any differentiated groups of individuals like office complexes or schools.

Reports of a more positive quality of life have been linked to both passive and active experiences with nature (Waliczek et al, 1996; Waliczek et al., 2005). A nationwide sample including over twenty thousand of the adult Danish population reported that distance of their home from a green space affected their level of health and health-related quality of life (Stigsdotter et al., 2010). Similar quality of life results were reported in a study by Sommerfeld et al. (2010), which found adults over the age of 50

who considered themselves gardeners to self-report an increased quality of life over those who did not classify themselves as gardeners.

In addition to the multitude of human benefits derived from simple exposure to green spaces and nature, there are also considerable benefits from an active perspective. These benefits are those where an individual is actively participating with nature and encompass a range from harvesting cut flowers and mowing the yard, to planning and/or planting a producing garden (container or in ground). A benefit of gardening that was highlighted in Rahm's (2002) study of an inner city youth gardening program was that active participation by students allowed youth to be the creators, not merely consumers, of the science curriculum. This form of participation and emergence of learning opportunities supported inquiry and exploration that enticed youth to take an active role in their journey toward scientific literacy (Rahm, 2002). Another study examining the relationship between nature and self discipline suggested that after breaks in a green schoolyard, children may return to the classroom better prepared to pay attention, suppress disruptive impulses, and wait patiently for future breaks (Taylor et al., 2002).

One unarguable active benefit of gardening is healthful physical labor. Shoveling compost, building raised beds, standing and bending to harvest, watering, and weed control are all physical activities that can help with healthy lifestyles. The Compendium of Physical Activities was created as a resource to estimate and classify energy costs of various physical activities (Ainsworth et al., 2011). According to the 2011 update of the Compendium, gardening activities can range from light (< 3.0 METs) to vigorous ($\geq$ 6.0 METs), with general gardening rated at a moderate (3.0-5.9 METs) effort level

(Compendium of Physical Activities, 2011). Each MET (Metabolic Equivalent) reported is based on published research, frequently an average of studies reporting similar testing conditions (Compendium of Physical Activities, 2011). Ashton-Shaffer and Constant (2008) reported physical fitness was the leading motivational factor for older adults when selecting gardening as a leisure activity. A study by Park and Shoemaker (2008) established that garden tasks using both the upper and lower body required at least moderate intensity levels while upper body only activities still provided adequate measure of activity for health benefits.

Benefits of School Gardens and Children's Interactions with Nature

Benefits of school gardens are often presented through the scope of students' academic success utilizing the garden as a teaching tool. Reviews of literature examining effects of garden based learning in relation to academics has demonstrated consistently positive impacts on both direct and indirect academic scores, especially at the elementary level (Danforth et al., 2008; Klemmer et al., 2005; Ozer, 2007; Williams and Dixon, 2013). Specific subjects highlighted across academic studies include: science, language arts, mathematics, social studies, and writing (Klemmer, et al., 2005; Pigg et al., 2006; Williams and Dixon, 2013).

In the review of literature by Williams and Dixon (2013), a summated reporting of previous research concludes school gardens have a multitude of purposes other than academic including: "(a) personal, social, physical, and moral development that also address self-concept, self-esteem, and motivation; (b) positive environmental attitude and empathy; (c) increased food literacy and healthy eating habits; and (d) school

bonding, parental involvement, and formation of community" (p. 212). The National Gardening Society published a book, The Growing Classroom: Garden Based Science (Jaffe and Appel, 2007), that includes a graphic depicting how a garden program can branch into multiple academic disciplines offering various learning opportunities in each specific discipline. An example from this graphic of pathways would be: beginning at the core or center of the garden with a garden program, taking a language arts pathway, branching off of the main path to focus on handwriting through written expression, and finally familiarizing students with first and final drafts through meaningful practice. See (Appendix A) for full graphic, reprinted with permissions from National Gardening Association.

Examples of research utilizing hands on garden based activities reported an increase in positive environmental attitudes (Aguilar et al., 2008; Skelly and Zajicek, 1998; Waliczek et al., 2001), as well as that interactions between a child and garden can lead to an improved attitude toward knowledge and consumption of fruits and vegetables, and an increase in dietary diversity (Cabalda et al., 2011; Koch et al., 2006; Lineberger and Zajicek, 2000). In a dissertation examining the REAL School Gardening Program's utilization at 5 school districts in the Dallas/Fort Worth area by McGaughy (2013), teachers reported spending approximately 25 hours on garden components each week. These components consisted of "planning teaching strategies (4.54 hours), garden maintenance (6.43 hours) educating youth in the garden (8.28 hours) and educating youth in the classroom using garden concepts (6.32 hours)" (McGaughy, 2013, p. 78). By ranking of most common to least, teachers responded that primary uses for their

school garden were: academic, social development, campus beautification, therapeutic, and recreational (McGaughy, 2013). “The top six types of school gardening activities selected included: outdoor gardening, vegetable gardening, raised bed gardening, perennial gardening, windowsill gardening, and butterfly gardening” (McGaughy, 2013, p. 78).

In a review of literature regarding school gardens, Ozer (2007) created a social-ecology conceptual framework for proximal and distal effects of school garden programs (Figure 1, used with permissions from the Journal of Health Education and Behavior). This framework represented positive effects of formal curriculum in gardens at the student level to include proximal effects of engaging in academic topics, nutritional knowledge gain, and environmental awareness, while student level distal effects reached as far as improving nutritional intake, lowering disease risks, increasing academic performance, and increasing ecological conversation practices (Ozer, 2007). School level effects of formal curriculum utilizing a garden at the proximal level included development of peer relationships and academic performance due to cooperative group instruction, and the potential improvement in aggregate academic performance as a distal level effect (Ozer, 2007).

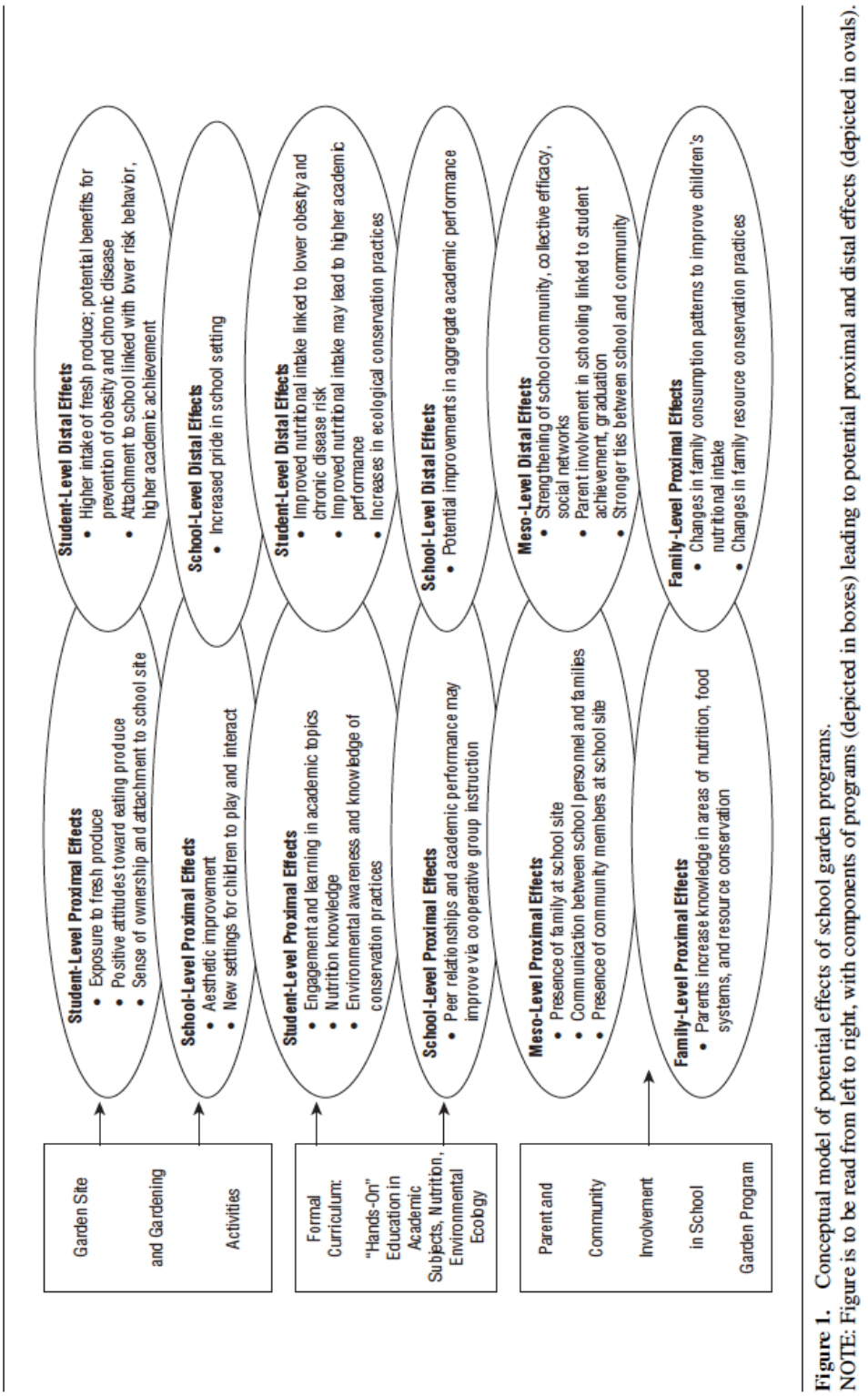

Figure 1. Conceptual model of potential effects of school garden programs.
NOTE: Figure is to be read from left to right, with components of programs (depicted in boxes) leading to potential proximal and distal effects (depicted in ovals).

Figure 1. Social-ecology conceptual framework for proximal and distal effects of school garden programs created by Ozer (2007, p. 852).

A study by Taylor et al. (2002) was able to systematically document a link between nature and less cognitive forms of self-discipline, specifically impulse inhibition and delay of gratification. In this study, participants were grouped according to green space viewed from windows in a housing development in Chicago, Illinois where children ranged in age from 7 to 12 years of age (Taylor et al. 2002). Authors suggested findings from this study combined with a previous study provided evidence that attentional restoration may be an important and universal benefit of nature for children (Taylor et al. 2002). Erbay and Omeroglu (2009) reported that the addition of green space to pre-school educational institutions positively influenced the physical environment, suggesting these areas be increased for a quality educational atmosphere. Rahm (2002) designed a youth gardening study to focus on individuals changing forms of participation (not possession of knowledge) that stressed an inseparability of person and context. In this study, the garden program was found to support a diversity of learning opportunities, some embedded in the framework of activities, while others emerged throughout various experiences and interactions in the garden (Rahm, 2002).

Research has shown children have an innate interest in nature and gardening providing an opportunity for educators to translate natural curiosity into positive attitudes and achievement relating to lifelong learning (Louv, 2008; Miller 2007; Rule 2007). The garden offers excellent settings for optimum learning relationships described as something waiting to be discovered, a lack of fixed rules, and an interaction that is changing and adapting daily (Mendizza and Pearce, 2004). Involving young children in experiences with the natural world allows them to develop a sense of wonder and build a

foundation for future academic concepts while utilizing a holistic approach to teaching and learning (Miller, 2007). The constant growth and development of a garden provides a fresh perspective with each new visit. Rule (2006) proposed emotion attached to memory, and connecting nature with childhood experiences, fosters a curiosity and interest, which in turn translates into sustained positive attitudes regarding learning and science. Edward O. Wilson (1993) suggested the natural world is the most information-rich environment people will ever encounter.

CHAPTER III

METHODOLOGY

Statement of Purpose and Objectives

The purpose of this study was to examine the effect of a school gardening program on children's ability to delay gratification and development of visual motor integration.

Objectives

Specific objectives for this study were:

1) To determine if participation in a school gardening program affected children's ability to delay gratification
2) To determine if participation in a school gardening program affected children's visual motor integration

Sample Population

The sample population for this study was preschool children ranging in age from 2 to 6 years. The sample was drawn from schools in Bryan/College Station, Texas that had no active garden on site in the last year, but were interested in constructing a garden for educational opportunities. Treatment and control schools were selected with comparable school atmospheres and student demographics. Control group schools were matched as closely as possible to the treatment group based on teaching methodologies, age of children served, and interest in a garden program upon study completion. The interest in a garden program was important to ensure alignment of teaching interests

between control and treatment groups. All schools selected for the study were private tuition-based preschool programs.

Although specific demographics of the schools were not collected they were matched as closely as possible through discussion with administrators and available public information. All treatment and control schools were catering to the same early school populations, serving children who could have been in a basic childcare center but were placed in a formulated learning environment. All schools had developed curricula and methods geared toward knowledge acquisition. The schools were within the same geographical zone, a metropolitan area driven by employment from a major state university. Discussions with administrators and parents throughout the course of the project revealed that student composition in schools included numerous parents involved in higher education, specifically graduate students and professors. Similarities of school foundations allowed for comparable data sets for this study.

The treatment school demonstrated a willingness to invest teacher time and financial resources into creating and sustaining a garden program, with researcher assistance. The treatment school for this study was Brazos Valley Montessori School. This Montessori school enrolled children beginning at 9 months, and had specific classroom environments for children through 5 years of age. As a Montessori school, there was not a traditional age breakdown to delineate student class level, this was done by individual student abilities. As students achieved benchmarks and showed signs of being prepared for the next step, there were transitioned into the next level classroom. This study included three different class levels in testing, but focused on what would be

equivalent to the traditional Pre-K 3 and Pre-K 4 classrooms. However, it is important to note that because of the progression methods in this school, there would be a mix of ages in each classroom situation. There was one class of Transition or Pre-K 3, which consisted of twelve students, and two rooms of Pre-K 4 (Montessori and Discovery), one with twelve and the other with fourteen at the beginning of testing. Every student in the treatment school that had a class involved with garden activities received consent forms to take home that contained a seed packet as an incentive for returning the signed permission forms. Other incentives for the treatment school included supplies to build and establish a garden onsite, the researcher as a contact person for the duration of the study, and bi-monthly lessons/activities carried out by graduate students in the Texas A&M Growing Minds Research Program.

The control group agreed to abstain from participating in garden activities until completion of the study. These activities did not include day-to-day life science lessons that were incorporated in established curriculum. Control schools for this study included Montessori School House and Longmire Learning Center. Montessori School House provided a half-day preschool program available for children ages 2.5 to 6 years. This Montessori program enrolled twelve students at the time of testing and was conducted more along the lines of what would be expected in a public school with more focus on work and less on free play. Longmire Learning Center enrolled children ages 2-5 in an educational childcare environment with a focus on learning skills and creating an environment that would allow students to transfer easily into a traditional school system when they reached kindergarten age. This center was much larger than the other two and

only certain teachers opted to be involved in this study. Each class was divided by year and consisted of about fifteen students with 2-3 classrooms per age division.

Seed packets were sent home with each student in consent form packages that included a description of the study. The control schools were offered $500 for participation in the study, to be used for garden supplies or garden related materials upon completion of research measures.

After discussion with school administrators, the researcher presented an outline of this study to the treatment school during a parent night school meeting. This allowed questions and concerns to be addressed and adjustments to be made prior to study implementation. Discussions were held at the control schools with school administrators, but no direct contact was made between the researcher and school parents. The following week permission packets were sent home with each child above the age of two and contained: the study description, permission forms, and incentive seed packets. Parents of participants were asked to read and sign parental permission forms for each child attending the school who was able to participate in the study. In addition to parental permission, the researcher required participant consent during each assessment measure. If at any point the participant (child) was uncomfortable or unwilling to take part in any assessment, or demonstrated unease, he/she was asked if he/she would like to continue or be “all done/finished”. All testing procedures were approved by the Institutional Review Board (IRB) prior to study initiation (Protocol Number 2010-0654).

This study gathered data from 102 participants in 3 schools (Table 1). Fifty-five permission forms were returned from the treatment school, resulting in 39 valid

responses for Beery VMI scores and 34 valid responses for delay of gratification measures. Two control schools were used for a combined total of 47 permission forms with 40 valid responses for Beery VMI scores and 33 valid delay of gratification measures. Mortality in this study was primarily due to students moving or leaving the preschool program for Kindergarten.

Table 1. Permission forms returned for treatment and control groups in the study on the effect of a school gardening program on children's ability to delay gratification as well as examine the influence of a school garden program on children's visual motor integration.

	Treatment School	**Control Schools**	
	Brazos Valley Montessori	***Montessori School House***	***Longmire Learning Center***
Permission Slips Returned	55	9	38
Beery VMI	39	9	31
Delay of Gratification	34	7	26

Research Design

Quasi-experimental nonequivalent group design was used for this study. This design was selected since campus populations were kept intact, thus not available for random assignment. The participating schools completed a pretest and posttest for two measures and agreed to follow guidelines of the study relating to utilizing (treatment) or abstaining (control) from any garden-type curriculum.

Instrumentation

This study utilized a combination of evaluation measures to assess variables of interest. Pre and posttests were utilized to measure student ability to delay gratification

and hand-eye coordination. The researcher administered both pre and posttests at treatment and control schools.

Timing of Instrumentation

Each participant was individually pre and posttested on measures of delay of gratification and hand-eye coordination with a testing interval of less than 6 months to control for maturation effects. Maturation effects refer to the normal development of a child, and according to Gay et al. (2006), six months is an appropriate time frame to control for this threat to internal validity.

Delay of Gratification

Development of a script (Appendix A), along with methodology measures for this study were based on previous research by Walter Mischel and colleges at Stanford University to assess delay of gratification in children (Mischel and Ebbesen, 1970; Mischel and Metzner, 1962; Mischel and Underwood, 1974; Mischel et al., 1972; Mischel et al., 1988; Mischel et al., 1989). The delay of gratification script was modified and adapted for this study from Mischel et al.'s (1972) delay of gratification contingency instructions and administered by the researcher. Methods from Mischel's studies were combined and adapted to focus on a specific age group of children (2-6 years). Rewards for the delay of gratification portion of this study were established in conjunction with school administrators to ensure appropriate and acceptable reward options (cookies) for students participating. In order to record timing measures for assessing delay of gratification, participants were video recorded and timed manually.

Testing Environment for Delay of Gratification

Participants were tested in a one on one environment agreed upon by researcher and administer at each school. The testing location was a familiar classroom as removed from classmate activity as possible. The testing room required an area for the researcher to be seated outside of direct participant vision. Specific school policies at all participating schools dictated that the researcher remain in the room during testing, and in one school the researcher was required to keep participants in a direct line of sight.

Testing Procedure for Delay of Gratification

Upon entering the evaluation room, participants were presented with a table that held assessment materials. Video recording was constant and most students remained unaware of the action. Each participant was allowed the opportunity to select their preferred chair at a table that was set with a bell on a coaster and a dome covering the cookie rewards, also on coasters. The student first played a short game with the bell by following prompts from the test administrator: one ring, two rings, three quick consecutive rings, one loud ring and stopping the noise by touching the outside of the bell. The purpose of this exercise was to engage each child allowing them to become comfortable in the room and interacting with the bell. This activity also provided students an opportunity to explore something new (the bell) so it could be discounted as a major distraction after testing began. After completion of the bell exercise, the researcher removed the dome, uncovering two coasters: one with one mini chocolate chip cookie, the other with two.

Due to the age of participants, the researcher clarified that the reward was cookies and each participant was offered the choice of one cookie or two. Please refer to Appendix A for complete delay of gratification script. While the script was followed as closely as possible, slight alterations could be made when dealing with each individual child as their responses contained great variation. In the instance that a child chose one cookie, the administrator broke a second cookie in half with the resulting adaptation of one cookie for the full reward, or one-half of a cookie if the time limit was not reached. Once a reward was chosen, instructions were repeated by the researcher then repeated again with the participant filling in answers to ensure comprehension. Each participant was instructed to wait for the administrator to return on his/her own to receive the larger reward, or ring the bell to signal the researcher's return, thus receiving the smaller reward.

The length of time for delay of researcher's return was based upon previous timing in Mischel's studies, and was 15 minutes (Mischel and Ebbesen, 1970; Mischel et al., 1972). After clarification of participant understanding, the researcher left the child's range of sight and started the manual timer. Once the timer began, the researcher responded to questions only when necessary and similarly to the following examples: "This is my work over here. I need you to stay over there," "you have to pretend like I am not here," "it's your choice," and "yes"-to "may I go to the bathroom?".

Scoring for Delay of Gratification

The researcher utilized manually recorded times to ensure consistency, and consulted video recordings to ensure proper timing if a there was a question regarding

bell ringing. The timer was started when the researcher arrived at the established out of sight waiting location and was stopped as soon as a student rang the bell or the timer reached 15 minutes. Times were entered into Microsoft Excel and were converted into seconds, before moving to SPSS for data analysis. Correlational coefficients were examined to determine the strength of relationship within each objective.

Visual Motor Integration

Visual motor integration was evaluated using the Beery-Buktenica Developmental Test of Visual-Motor Integration 5th Edition (short form) (Beery and Beery, 2006). The Beery-Buktenica Developmental Test of Visual-Motor Integration (Beery VMI) was initially developed in 1967 to measure children's visual-motor integration. The Beery VMI was intended to focus on identifying children who may have learning deficiencies in the area of visual perception and finger-hand movement coordination. Other appropriate uses of the Beery VMI include the ability to test effectiveness of educational and other interventions as well as being used as a measurement tool for advancing research through testing and comparison. The test asks participants to imitate or copy a developmental sequence of geometric forms using the provided booklet and pencil, or black ballpoint pen, to examine visual-motor integration. Multiple forms of the Beery VMI are available and used for various groups, but the selected short form is utilized for children 2 to 7 years of age and consists of 21 items. Researchers have found the Beery VMI to be a reliable predictor for achievement, especially in lower grade levels before youth learn to compensate for learning deficiencies (Beery and Beery, 2006).

The Beery VMI has been standardized five times between 1964 and 2003, the latest of these standardizations led to the creation of the current version of Beery VMI (the fifth edition), which focuses on early childhood. Authors report the average overall reliability of the instrument as 0.92. Content validity, the degree to which a test measures its intended content area (Gay et al., 2006), was reported at 0.96. Geometric forms are utilized as opposed to alphabetic or numeric forms to avoid gender, socioeconomic, and cultural barriers.

Beery VMI Administration

Instructions for the Beery VMI are fairly straightforward. For this study the researcher sat down with each student individually walking them through the procedure. A number two pencil was used, although erasing was not allowed for scoring accuracy. Students were encouraged to keep the booklet straight in front of them while working, and the testing administrator was to do the same during the copying portion of the workbook. The researcher instructed the students to do the best they could on both the easy and the hard ones, and were watched to ensure that no forms were skipped. These general directions were administered to each participant as researcher did all testing on a one-on-one basis. All participants regardless of age began with the imitation exercise. The imitation exercise called for the participant to copy (imitate) the researcher for the first three geometric forms in the testing booklet. Once those forms were completed, the participant advanced to the portion of the booklet where geometric shapes were provided for unassisted visual copying. If a participant was unable to complete the imitation portion, he/she was directed to the booklets blank boxes used for the marking and

scribbling portion of assessment. The marking and scribbling assessment allowed the participants the freedom to mark on the page without following specific rules or guidelines. Once markings were made, participants were allowed to return to the imitation portion of the test booklet. As dictated by the Beery VMI testing administration guide, participants were allowed to work as far in the testing booklet as they wanted. Although participants were asked if they would like to continue working or be "finished with this work" after incorrectly copying three consecutive figures, most enjoyed the activity and chose to continue working.

Beery VMI Scoring

Visual motor integration data was scored using the Beery-Buktenica Developmental Test of Visual-Motor Integration Administration, Scoring, and Teaching Manual. Pre and posttest booklets from all schools were combined and shuffled for random scoring to reduce possible bias.

Raw scores ranged from 0-20 and were transformed to standardized scores utilizing scoring criteria dictated in the instruction manual. Standard scores for Beery VMI have a mean of 100 with a standard deviation of 15 for all age groups and are based on means for raw score distributions. Scores are age specific down to two months with 15 or more days in the birthdate month rounded to a higher month.

Scoring for the Beery VMI is based on score no score criteria, where one point is awarded for each imitated or copied item up to three consecutive failures. Each geometric figure must meet criteria such as: participant's first attempt, internal and/or external angle requirement, length of lines, correct axis, and continuity of pencil strokes.

If there is doubt about specific criteria being met, the form was scored as meeting criteria-or receiving a point. Sometimes a participant realizes that they are not copying a form correctly and may make multiple attempts. For this situation the first attempt was identified and scored using context clues from other geometric forms or test administrator notations. The test manual was heavily utilized as a resource as it provided multiple score and no score examples for each geometric form and descriptive text emphasizing form requirements.

Beery VMI Data Analysis

Raw data was entered into Microsoft Excel (Seattle, Wash.) for reference and data transformation, then transferred and analyzed using the Statistical Package for the Social Sciences (SPSS) (Chicago, IL). Statistical procedures included descriptive findings, frequencies where applicable and multiple ANOVAs to determine differences between scores of pre and posttests for treatment and control groups.

The researcher who administered the test booklets as well as a secondary researcher scored instruments to check inter-rater reliability on standardized scores. Inter-rater reliability was assessed utilizing a two-way mixed model, consistency type, average measures Intra-Class Correlation (ICC) (Hallgren, 2012). The ICC (3,2) analysis revealed a correlation in the excellent range, ICC=0.955 (Cicchetti, 1994; Hallgren, 2012), indicating a high degree of agreement between VMI scorers for this study. The standardized scores from the two researchers were then combined and averaged to use in data analysis.

CHAPTER IV

RESULTS

This chapter will present, analyze, and outline data collected from this study in order to examine the effect of a school gardening program on children's ability to delay gratification and development of visual motor integration.

Objectives

Specific objectives for this study were:

1) To determine if participation in a school gardening program affected children's ability to delay gratification.
2) To determine if participation in a school gardening program affected children's visual motor integration.

The following hypotheses were tested:

H1: Preschoolers participating in a school gardening program will have increased ability to delay gratification when compared to children not involved in a school gardening program.

H2: Preschoolers participating in a school gardening program will have improved visual motor integration scores when compared to children not involved in a school gardening program.

Sample

Although 102 permission forms were returned for the study, only 91 individuals completed at least one testing measure, 44 from the treatment school and 47 from the control schools. Male participants totaled 40, with 14 from the treatment school and 46

from the control school. Female participants from the treatment school numbered 30, while there were 21 from the control schools for a total of 51 female participants. Further age and gender breakdown of demographics for individual objectives are included within each subheading. Demographic information beyond age and gender was not collected and is a limitation of the study.

Delay of Gratification

Demographics for Delay of Gratification

Eighty-two participant times were gathered during the pretest phase and 72 times were gathered at posttest, resulting in 72 possibilities for measurement: 36 from both the treatment and control schools. However, due to timer malfunctions and/or inability to confirm times, five participants were removed from analysis resulting in 67 valid responses (34 from the treatment school and 33 from the control schools). Final statistical analysis was conducted with 10 males and 24 females from the treatment school and 18 males and 15 females from the control schools, resulting in an overall gender breakdown of 28 males and 39 females for the delay of gratification measure.

Total age breakdowns are explained in Table 2 for both treatment and control groups. Although the treatment school age range contains the oldest participant in the groups, the larger standard deviation demonstrates that average age in the control group is older than the treatment group by about one month. In the final analysis, the treatment school has a younger population when compared to the control schools by more than 2.5 months. Developmentally, this is important because each moment of every day allows learning and growth in a child's ability to process and control impulses. The preschool

years are a continuation of active participation in a child's own development where he/she explores his/her world and searches for patterns and rules, while actively constructing understandings and learning how to use various strategies for self control (DeHart et al., 2004; Sala et al., 2014). However, age was controlled for within each group through timelines for testing administration, allowing comparisons to be made on changes within each group.

Table 2. Age breakdown for delay of gratification measures for pre and posttest overall, and for treatment and control groups in the study of the effect of a school gardening program on children's ability to delay gratification.

	n	Range in years	Average years	SD (in months)
Pretest				
Overall	82	2.42-6.25	4.16	9.878
Treatment	36	2.42-6.25	3.92	10.106
Control	46	2.66-5.75	4.33	9.236
Posttest				
Overall	72	2.80-6.75	4.50	9.599
Treatment	36	2.80-6.75	4.40	10.214
Control	36	3.00-5.80	4.61	8.888

Although the threat of maturation effects to internal validity were controlled for by implementing a six month pre-posttest time frame (Gay et al., 2006), regression analyses were also run to ensure a more robust statistical analysis. A simple linear regression was run to see if age was a predicting factor for the time participants were able to delay gratification. Regression analysis reported $p=0.058$ for the pretest and $p=0.347$ for the posttest, demonstrated that age was not a significant factor for predicting participants' ability to delay gratification.

Statistical Analysis for Delay of Gratification

A split plot analysis of variance (ANOVA mixed design) was run in SPSS to compare the change in time between the pre and posttest measure in regards to treatment and control schools (Table 3). Pre and posttest times were converted into seconds with a delay of gratification goal time of 900 seconds, or 15 minutes. No significant main effect ($F=0.761$; $p=0.094$) was found when comparing the treatment and control schools regarding the change in delay of gratification times from pre to posttest.

Table 3. Average of delay of gratification pre and post measures in seconds by treatment and control group in the study of the effect of a school gardening program on children's ability to delay gratification.

	n	Pretest	Posttest	F	*P*
Treatment	34	426.15	676.18	0.761	0.094
Control	33	347.36	630.15		

[z]Difference in "n" for table 2 and 3 is from non-completion of both pre and post measures to use in data analysis.

The treatment school recorded average times of 426.15 seconds (7.11 minutes) for the pretest and 676.18 seconds (11.27 minutes) for the posttest, with a gain of 250.03 seconds (4.17 minutes). The control schools reported a pretest time of 347.36 seconds (5.79 minutes) and a posttest time of 630.15 seconds (10.50 minutes) with a gain of 282.79 seconds (4.71 minutes). While not statistically significant, pre and post measures at the treatment school were slightly greater than the control schools, meaning students at the treatment school were able to delay gratification, on average, for a greater length of time when compared to the control schools both before and after the intervention. However, the improvement in control schools time (4.71 minutes) between the pre and posttest was larger than that of the treatment school (4.17 minutes).

While this information does not support the hypothesis for this study, it could be the result of lower pretest times allowing for more improvement in posttest times. Analysis of qualitative observations revealed that participants from the treatment and control groups were taken from different settings for testing (classroom vs outdoor free play), which was a limitation of this study. A study by Calabrese (2001) examined the relationship between structured and unstructured physical activities and incidence of classroom behavior problems following each type of activity in preschool children. This study found that general disruptive behaviors and inappropriate verbal responses occurred with a significantly greater frequency following the unstructured activity (Calabrese, 2001). It is possible that the different mindsets of participants as they entered testing facilities similarly affected students' ability to self regulate depending on their transition from an unstructured or structured environment.

Additionally, the treatment school followed Montessori philosophies where teachers served as guides, not trainers, directing attention and observation (Montessori, 1966). Children in a Montessori setting are able to choose the work they prefer while being allowed flexible time to concentrate and focus until completion of activity (Montessori, 1966). This freedom of choice at the treatment school may have allowed students to be more comfortable with the cause and effects of their decision-making processes.

Statistical Analysis for Gender and Delay of Gratification

When exploring gender differences and delay of gratification in treatment and control schools through a split plot analysis of variance, no significant differences were

found in change of times from pre to posttest for males (F=0.311; p=0.582), or females (F=0.360; p=0.552) (Table 4). Therefore, neither males nor females in either group performed at a posttest level significantly higher than pretest in the delay of gratification exercise.

Table 4. Average delay of gratification pre and post measures in seconds organized by gender as well as treatment and control group in the study of the effect of a school gardening program on children's ability to delay gratification.

	n	Pretest[z]	SD	Posttest[z]	SD	Difference[y]	F	*P*
Male							0.311	0.582
Treatment	10	383.10	389.91	665.80	370.18	282.70		
Control	18	296.00	330.78	684.00	312.00	388.00		
Female							0.360	0.552
Treatment	24	444.08	403.28	680.50	368.82	236.42		
Control	15	409.00	324.43	565.53	364.36	156.53		

[z]All times are averages reported in seconds with a possible range from 0 to 900.
[y]Difference is calculated by subtracting the pretest score from the posttest score where the difference equals the increase in average length of time in seconds each group was able to delay gratification.

It is notable that males in both treatment and control groups pretested with a considerably lower delay of gratification time when compared to females. These measures are consistent with Mischel and Underwood's (1974) findings that females demonstrated a greater duration of waiting time for delay of gratification. However, males in both treatment and control schools showed larger gains (282.70 seconds or 4.71 minutes and 388.00 seconds or 6.46 minutes) when compared to females in either school (236.42 seconds, 3.94 minutes and 156.53 seconds, 2.61 minutes), with the largest gain representing the males in the control school (Figure 2).

Since emotional regulation includes the capacity for control and direction of emotional expression to maintain behavior in the presence of strong emotions, emotional growth and development affects formation of social skills (DeHart et al., 2004). In a

study by Sala et al. (2014) behavioral strategies were believed to be reactions that were action based in order to manage an emotion, while social strategies consisted of engaging someone else to help manage an emotion. Although preschool is a time where both behavioral and social strategies are introduced and quickly assimilated by children (Sala et al., 2014), it is likely that most children have had previous experience with someone intervening to help control emotions (social strategy), while behavioral strategies may still be unfamiliar. This would mean that the social strategy preferred by preschool females (Sala et al., 2014) was unavailable to them in this particular testing situation, reflecting an unequal growth to males, in time of delayed gratification.

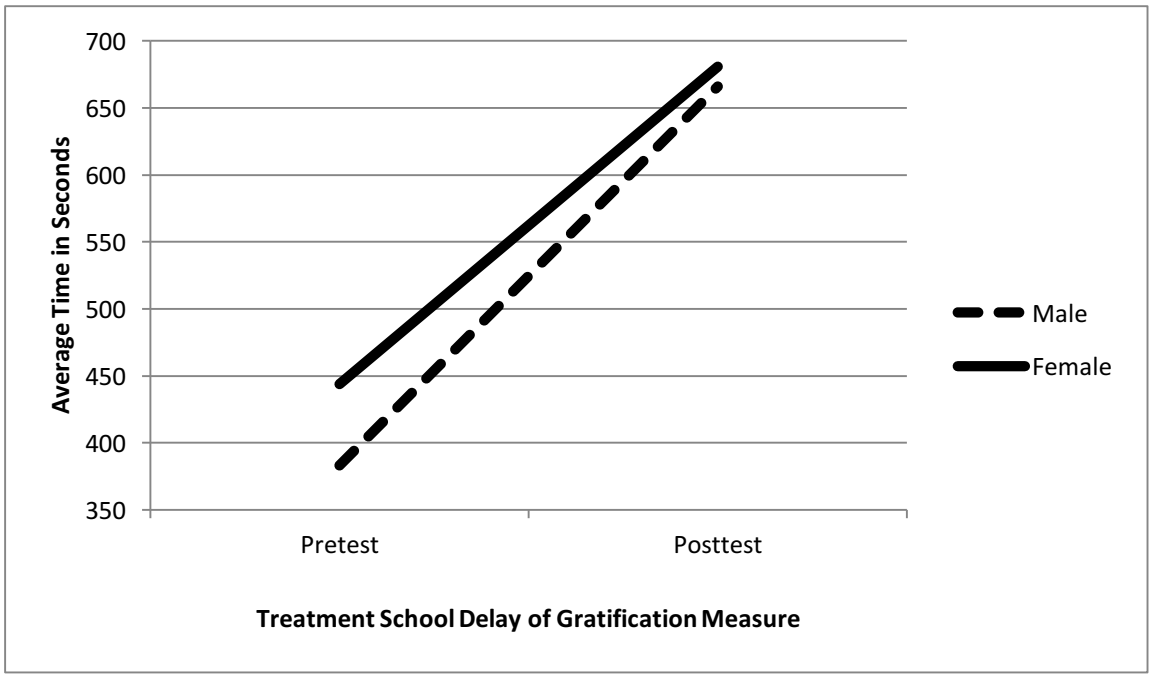

Figure 2. Pretest and posttest average time in seconds by gender for delay of gratification in treatment school in the study of the effect of a school gardening program on children's ability to delay gratification.

Even though females at the treatment school recorded higher average times for ability to delay gratification on both pre and posttests (444.08 seconds vs 383.10 seconds

and 680.50 seconds vs 665.80 seconds), treatment males average gain from pre to posttest (282.7 seconds) was larger when compared to females (236.42 seconds). The larger gain from the male population at the treatment school caused the posttest times for delay of gratification to be similar between male and female. The difference between male and female times on the pretest was 60.98 seconds, while the difference on the posttest was 14.7 seconds. This trend is interesting when compared to control schools gender posttest difference (118.47 seconds), because the male and female times in the treatment group exhibit similar capabilities to delay gratification at the end of the study. It could be that by implementing an intervention that is new to both genders, both are required to learn and implement new self-regulatory strategies. Research observations of the treatment group during garden work time included notations of students asking to carry out specific activities. Sometimes these requests could be granted at that time; some were worked into the next day's activity, and sometimes the request might be completed after every student had an opportunity to work in the garden at least once. It is likely that self-regulatory strategies would improve if the outcome is desirable to the student, and the ability to personalize activities is a benefit of the flexibility and adaptability in a garden. These results are in line with previous research demonstrating a variety of benefits from garden activities for both gender groups (Klemmer et al., 2005; Miller, 2007; Ozer, 2007).

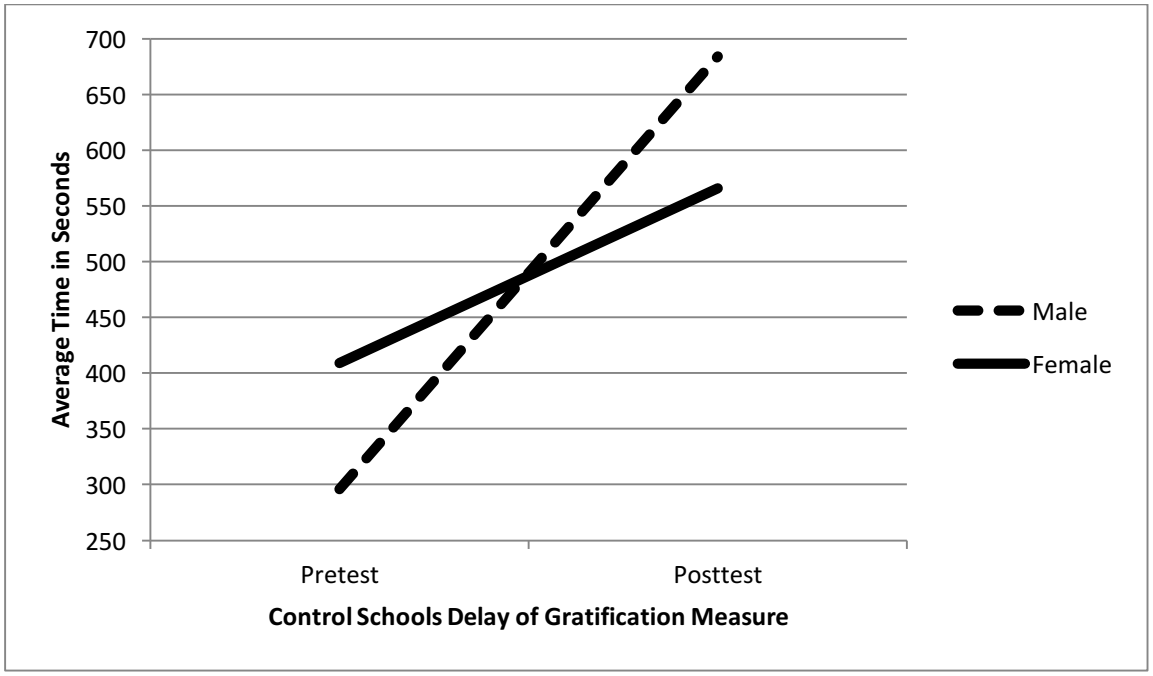

Figure 3. Pretest and posttest average time in seconds by gender for delay of gratification in control schools in the study of the effect of a school gardening program on children's ability to delay gratification.

Average delay of gratification times for males at control schools reflected a similar pattern as the treatment school, where a larger gain in time was recorded over females throughout the course of the study (388.00 seconds vs 156.53 seconds). Interestingly, an inverse outcome is demonstrated in regards to difference in gender scores within the control schools. While the pretest times show a greater ability to delay gratification of 113 seconds for females, the posttest reports males demonstrated a 118.47 second advantage over females (Figure 3). While both genders improved, the average improvement time over the course of the study for males was almost 2.5 times that of females. Preschool years are reported to deliver rapid growth in student self-regulating strategies (Siegler et al. 2006). Siegler et al. (2006) noted that although males typically demonstrate lower self-regulation levels when compared to females, this could

be a result of biology as well as parental influences. Parents may believe in socializing males and females differently, allowing males to take more risks while giving females more opportunities to learn impulse control strategies (Siegler et al., 2006). It is possible that strategies implemented by teachers in the more traditional pre-school settings were more beneficial to males in this population when compared to females.

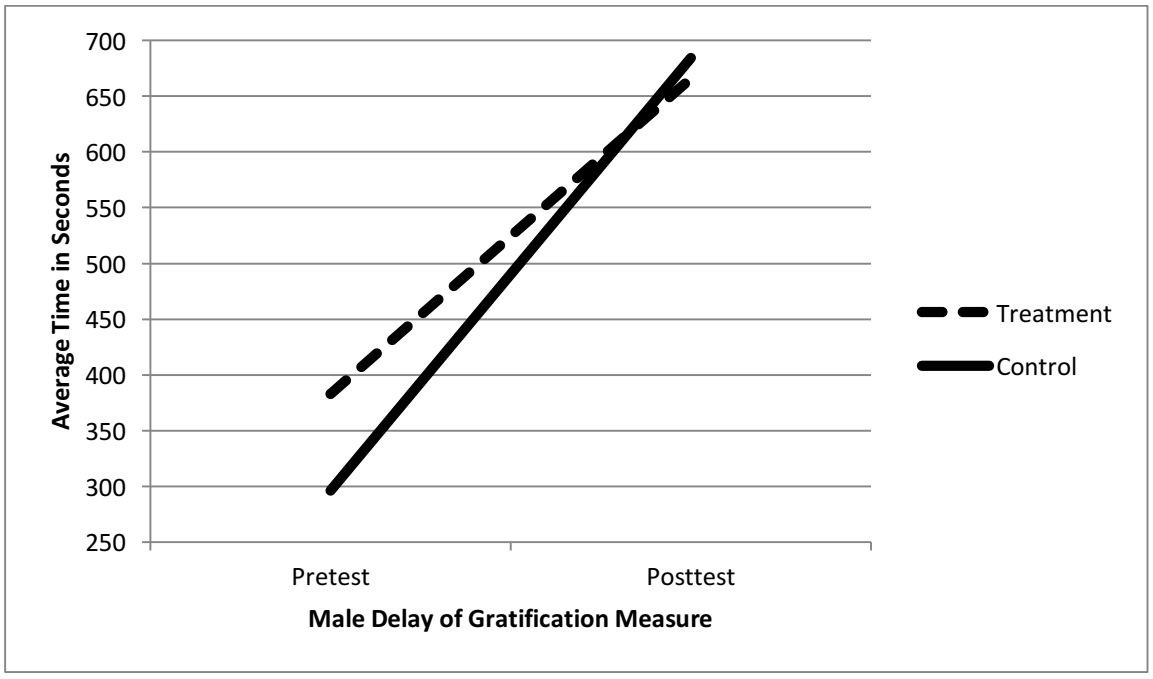

Figure 4. Male pretest and posttest average times in seconds for delay of gratification in treatment and control schools in the study of the effect of a school gardening program on children's ability to delay gratification.

Males in the treatment school recorded average times of 383.10 seconds (6.39 minutes) for the pretest and 665.80 seconds (11.10 minutes) for the posttest, with a gain of 282.70 seconds (4.71 minutes) over the course of the study. Males in the control school's recorded average times on the pretest of 296.00 seconds (4.93 minutes) and 684.00 seconds (11.40 minutes) on the posttest, representing a gain of 388.00 seconds

(6.46 minutes) (Figure 4). Although males at the treatment school started out with a higher average pretest measure (6.39 minutes vs. 4.93 minutes) for ability to delay gratification, the control schools posttest averages (11.40 minutes) surpassed the treatment average (11.10 minutes) and represented a gain of almost 6.5 minutes compared the treatment school gain of 4.71 minutes.

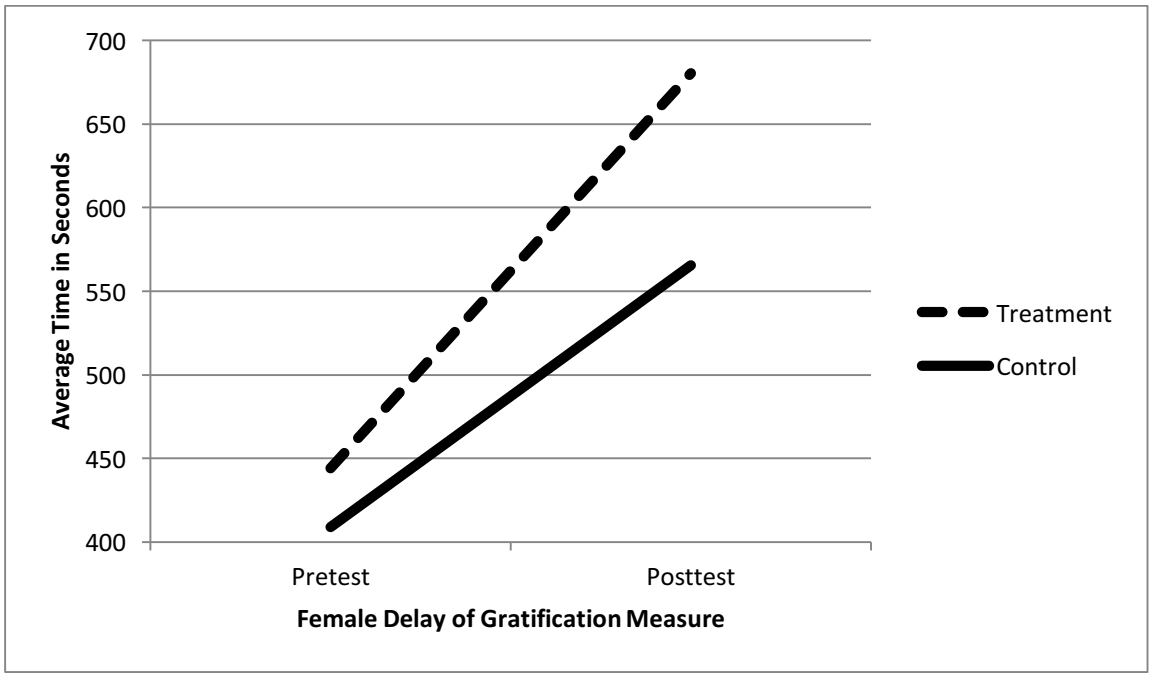

Figure 5. Female pretest and posttest average times in seconds for delay of gratification in treatment and control schools in the study of the effect of a school gardening program on children's ability to delay gratification.

The female students in the treatment school recorded a pretest average time of 444.08 seconds (7.40 minutes) and a posttest average time of 680.50 seconds (11.34 minutes) with a gain of 236.42 seconds (3.94 minutes). Females from the control schools reported average times on the pretest of 409.00 seconds (6.82 minutes) and 565.53 seconds (9.43 minutes) on the posttest, representing a gain of 156.53 seconds (2.61 minutes) (Figure 5). Females at the treatment school were able to delay gratification

longer on pre and posttest measures, as well as increase at a greater capacity when compared to females at control schools. This trend demonstrated a larger growth in the female treatment group when compared the female control group, but due to the small data set no inferences can be made. Perhaps future studies with more data and observations would allow for distinctive patterns to emerge, helping to explore the possibility that females might respond to gardening as an intervention to enhance self-regulatory strategies.

Of the 67 valid responses (34 treatment, and 33 control), frequencies were calculated for pre and posttests to examine the number of participants who reached the time goal of 15 minutes (Table 5).

Table 5. Frequency of participants included in statistical analysis reaching the 15 minute delay of gratification mark for pre and posttests at treatment and control schools by gender in the study of the effect of a school gardening program on children's ability to delay gratification.

	Pretest n	%[z]	Posttest n	%[z]
Male				
Overall	5	17.9	17	60.7
Treatment	3	30.0	6	60.0
Control	2	11.1	11	61.1
Female				
Overall	12	30.8	24	61.5
Treatment	9	37.5	18	75.0
Control	3	20.0	6	40.0

[z]Percentages calculated by taking the number of students in the specified group and gender who waited the required 15 minutes and dividing by the overall number of students in that group and gender who were tested.

These numbers support Mischel et al.'s (1989) statement that, "The child's spontaneous understanding of effective self-regulatory strategies also was found to develop in a clear age related sequence (p. 937)." Therefore, what is seen is the expectation; that as time progresses testing will reflect an increase in students who are

able to employ strategies that will help them to delay gratification, or self-regulate, the desired 15 minute time period for the larger reward.

While the percentage of males in the treatment and control groups to reach the post goal time were similar (60% and 61%), the females in the control group reported 40% completion compared to 75% in the treatment group (Table 5). The gap between females in the two groups is an opportunity for further exploration. Perhaps a garden program presents opportunities for females to connect with nature and/or a way to increase their use of a variety of self-regulation strategies.

When an analysis of variance was run to compare the total number of students who reached the goal of 15 minutes at pretest and the number of students who reached the goal at posttest, no significant difference (P=0.784) between control and treatment groups was found. Therefore, there was no significant difference between the groups regarding the change of students who reached the goal time. Although statistical analysis was performed on this data, it should be noted that the small sample size is reflective of a pilot type study and caution should be used with interpretation and extrapolation of results.

In a percentage comparison of students reaching the time goal for treatment and control schools without gender influences, substantial increases for both groups were seen (Figure 6). In the treatment group, 12 students (39.25%) reached the goal time at pretest and 24 (70.59%) at posttest. Only two students (one male, one female) who reached the pretest goal time did not reach the goal time at posttest, and 14 of the 24 students reaching the posttest goal time had not done so initially.

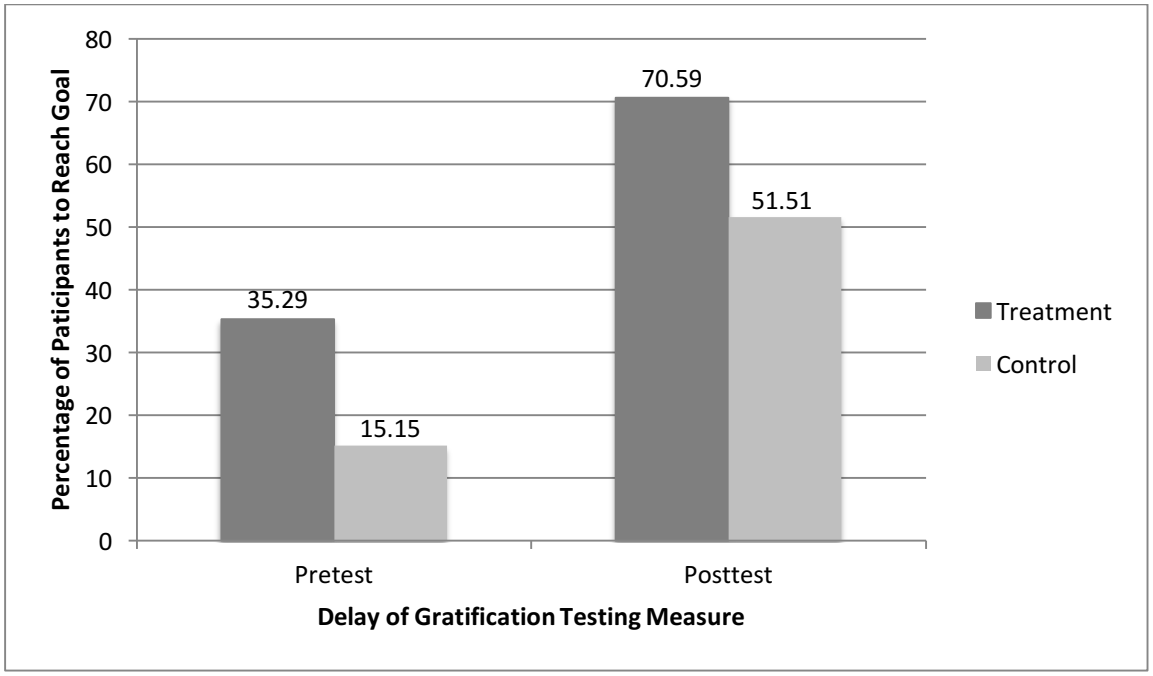

Figure 6. Percentage of students in treatment and control schools who reached the goal time of 15 minutes at both pre and posttesting in the study of the effect of a school gardening program on children's ability to delay gratification.

Control group participants reaching the 15 minute time goal for pretest totaled 5 (15.15%), while the posttest total was 17 (51.51%). Similar to the treatment group, two students (one male, one female) at the control schools who reached the goal during pretest did not at posttest. While these participant numbers are small, the trends and frequencies are interesting and open questions for future investigation.

Visual Motor Integration

Demographics for Beery VMI

The Beery VMI measures gathered 88 participant scores during the pretest section of the study and 81 scores at posttest, resulting in 81 possible scores for analysis and a response rate of 80.4%. Age breakdowns for control and treatment groups are provided in Table 6.

Table 6. Age comparison of Beery-Buktenica Visual Motor Integration for the overall sample, treatment and control groups during pre and posttest time periods in the study of the influence of a school garden program on children's visual motor integration.

	n	Range in Years	Average Years	SD (in days)
Pretest				
Overall	88	2.03-6.32	4.07	339.38
Treatment	42	2.03-6.32	3.73	361.01
Control	46	2.75-5.88	4.38	279.03
Posttest				
Overall	81	2.51-6.82	4.48	336.30
Treatment	40	2.51-6.82	4.22	363.68
Control	41	3.12-6.25	4.72	283.91

Maturation effects are normal changes/gains attributed to growth and development that could account for subject improvements on testing during the course of an experiment, posing a threat to internal validity (Tuckman, 1999). Although the threat of maturation effects to internal validity were controlled for by implementing a six month pre-posttest time frame (Gay et al., 2006), the Beery VMI also controls for effects of age through scoring procedures (Beery and Beery, 2006). Beery VMI scores are age specific down to two months, with 15 or more days in the birthdate month rounded to the next month.

Statistical Analysis for Beery VMI

Pre and posttest raw scores ranged from 0-20 and were transformed to standardized scores utilizing scoring criteria dictated in the instruction manual. Standard scores for Beery VMI have a mean of 100 with a standard deviation of 15 for all age groups and are based on means for raw score distributions (Beery and Beery, 2006). A split plot analysis of variance (ANOVA mixed design) was run in SPSS to compare the change in scores between a pre and posttest measure in regards to treatment and control

schools. No significant main effect (F=1.764; p=0.188) was found when comparing the treatment and control schools regarding the change in VMI scores from pre to posttest (Table 7).

Table 7. Average of Beery-Buktenica Visual Motor Integration pre and posttest standardized scores by treatment and control group in the study examining the influence of a school garden program on children's visual motor integration.

	n	Pretest	Posttest	F	*P*
Treatment	39	98.62	100.37	1.764	0.188
Control	40	110.14	107.87		

Due to the age specific standardized scoring procedures for the VMI, any change in scores is notable. In the instance that a group maintained the same average score from pre to posttest, the interpretation is that the group improved their visual motor integration at a constant rate reflective of their age. A constant score of 100 would reflect age appropriate development and systematic improvements of visual motor integration consistent with the aging process (Beery and Beery, 2006).

Although there is no significant difference between the treatment and control school averages, the treatment school showed an improvement in scores of 1.75, meaning the treatment group raised their average score to the Beery VMI standardized average of 100. The control school scores decreased by 2.27 points, meaning that while the control schools scores were still above average, student visual motor integration did not maintain consistent ability levels. Since control school scores were above a standardized average it could be that it was not possible to maintain an elevated score as scores will trend toward the standardized average as students age. Results of this study are similar to a larger scale study in a public urban school district where the effect of an

Extension garden curriculum on visual motor integration was explored in preschool and kindergarten students (Baker et al., 2015). Measurement was taken with the Beery VMI-short form, and control group scores were reported to decrease while treatment group scores maintained a level that reflected consistent capabilities (Baker et al., 2015). Similarities between the smaller and larger scale studies are important as they demonstrate strength with the consistent findings, even if the findings are not significant.

When exploring gender and Beery VMI in treatment and control schools through a split plot analysis of variance, no significant differences were found in pre-posttest averages for females (F=0.010; p=0.919). However, significance was found in average scores for males (F=5.22; p=0.028), meaning the change in score from pretest to posttest was statistically significant between the control and treatment groups. Standardized scores for males in the treatment group showed substantial improvement while scores for males at the control schools decreased (Table 8).

Table 8. Average of Beery-Buktenica Visual Motor Integration pre and posttest standardized scores by gender and school in the study examining the influence of a school garden program on children's visual motor integration.

	n	Pretest	SD	Posttest	SD	F	*P*
Male						5.22	0.028*
Treatment	12	88.96	17.83	98.13	14.40		
Control	23	108.28	15.07	105.22	11.71		
Female						0.010	0.919
Treatment	27	102.91	15.57	101.37	11.98		
Control	17	112.65	13.72	111.47	12.27		

*Statistically significant at $P \leq 0.05$

All groups pretesting above average reflected a decrease in scores for posttest measures. Scores for females in both the treatment and control schools decreased, reflecting a minimal change in scores and demonstrating a consistent aptitude for their

age. Male scores in the control group decreased by an average of 3.06 points, while male treatment school scores increased by 9.17 points, approaching the 15 point standard deviation for the measure. Additionally, males in the control group showed the largest decline in scores (3.06 points). While the sample size is small, this trend could suggest that males may be more likely to respond to a physical activity such as gardening to learn motor skills like visual motor integration.

A review of literature by Hinkley et al. (2008), concluded that while physical activity behaviors of preschool children are multidimensional, males are typically more active than girls, and a study by Rate et al. (2004) found boys to participate in significantly more moderate-to-vigorous physical activity and vigorous physical activity when compared to girls. Utilizing these different physical activity levels to channel learning experiences may be a way to reach and teach a specific cohort. Gender results from this intervention support Bardid et al.'s (2013) recommendation that early motor skill programs implement, or at least consider, gender specific approaches. However, results from this study also reiterate the suggestion by Baker et al. (2015) that a gardening program may be an effective way to maintain a certain level of visual-motor integration capabilities.

Qualitative Insights

Qualitative records provided information that the treatment school enrolled several children whose first language was not English. This was not the case in control schools where the researcher did not encounter any language barriers during interactions

with participants. Testing procedures were chosen that accounted for language barriers when feasible in order to examine the intervention as clearly as possible.

Delay of Gratification

The treatment group was always taken into a classroom for testing during outside free play and occasionally while garden activities were being conducted. In contrast, participants at control schools were occasionally taken from outdoor play, but were more frequently taken from typical classroom lessons into another smaller classroom for testing. Therefore, students in the treatment group were called from a free play situation for testing, while students in control groups were relocated from a classroom environment for testing. When testing at the treatment, Montessori school, the researcher or teacher simply called out names, and/or asked for whoever was ready for their turn. However, in the control schools, comments such as, “follow directions” and “do good” or “pay attention” were often given when the student left for the testing location. Differences in the style of teacher interactions and leading instructions could have an influence on student perceptions of personal choices and decision-making processes, especially since testing was done in an environment where teachers are perceived to set the rules.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter discusses research implications, presents conclusions, and offers recommendations for future research investigations for this research. The purpose of this study was to examine the effect of a school gardening program on children's ability to delay gratification and development of visual motor integration.

Objectives

Specific objectives for this study were:

1) To determine if participation in a school gardening program affected children's ability to delay gratification.
2) To determine if participation in a school gardening program affected children's visual motor integration.

Discussion of Results

This project focused on children ages 2.5-6 years, which is often referred to as the early childhood developmental stage. However, this age range may also be referred to as the preschool years (DeHart et al., 2004) or the Piagetian preoperational stage (Siegler et al., 2006). Early childhood is a time for rapid growth in areas of cognitive, emotional, physical, and social development (DeHart et al., 2004). During this stage there is great fluctuation in a child's capacity for growth and development where much depends on everyday interactions and opportunities (DeHart et al., 2004).

When examining children's growth and development in conjunction with an educational variable it is imperative to realize the integration of multiple factors.

Cognitive development provides children the ability to realize their full potential of emotional development, including emotional regulation. Emotional regulation is the capacity to control and direct emotional expression to maintain organized behavior in the presence of strong emotions, and to be guided by emotional experiences. Emotional growth and development along with cognitive growth impacts the formation and development of social skills (DeHart et al., 2004, p 348). Developmental categories should be viewed as interactive and dependent on one another, reflecting varying rates of maturation for every child.

Development does not include distinctly separate classifications; therefore, it is difficult to address learning through interventions aimed at enhancing growth and development without including the entire system. However, a garden as an intervention for this stage is appropriate due to the flexibility of experiential activities. Seeding, transplanting, repotting, digging, raking, watering, etc. are all activities that can be assigned depending on a child's physical or mental ability. DeHart et al. (2004) states that, "Children continue to be active participants in their own development (p. 305)," actively exploring the world as they progress from observing and describing events to attempting to explain them by searching for patterns and rules. Guided experiences in a garden are easily facilitated as children have preferred activities and will typically change tasks if something becomes too difficult. However, if a student is prone to aggression or excessive energy, the garden provides an opportunity for a teacher or parent to assign him/her with a task that requires extra focus and determination.

Delay of Gratification

Specific to objective one, determining if participation in a school gardening program affected children's ability to delay gratification, no significant main effect was found. Although no significant main effect was found in this study between the treatment and control schools in regards to change in delay of gratification times from pre to posttest, there were interesting trends that offer insights into avenues for further exploration.

Average pre and post time measures at the treatment school were greater when compared to the control schools, meaning students at the treatment school were able to delay gratification, on average, for a greater length of time than the control schools both before and after the intervention. A portion of this could be contributed to the Montessori teaching philosophy the treatment school utilized, where teachers serve more as guides, not as trainers. According to Montessori (1966), working with growing things is an important part of the extended Montessori environment. While for some schools this means spending outside time with nature, a garden is often utilized in Montessori settings. Following Montessori teachings, especially practical life activities, students at the treatment school are likely to have more experiences with decision-making and outcomes on a day-to-day basis (Gilder, 2012). In conjunction with the Montessori philosophy of teacher as guide, this freedom of choice may have allowed the treatment group more confidence when weighing their options regarding a smaller reward sooner, or a larger reward later. However, it is noteworthy that one of the control schools also followed this philosophy and changes in their pre and posttest averages were not

reflective of the changes seen in the treatment school. This difference further highlights the need for future studies to explore this possibility.

Exploring gender differences and delay of gratification between control and treatment groups in this study showed no significant differences, but again revealed trends.

- Females had higher average times at the pretest for delay of gratification measures at both treatment and control schools when compared to males.
- Females and males at the treatment school posttested with average times only 14.7 seconds apart, closing the gap of the female advantage of 60.99 seconds at pretest.
- Gender averages at control schools maintained a similar range between times at pretest (113.0 seconds), and posttest (118.47); but females reported greater times at pretest and males higher at posttest.
- Males at treatment and control schools concluded the study with similar average scores at posttesting (18 seconds difference).

While this sample size is small, it could suggest that implementing a garden program as an intervention may be an effective way to encourage females to utilize skills/strategies they may not rely upon in a traditional classroom setting. A study by Aguilar et al. (2008) noted that garden activities increased positive environmental attitudes in females. It is possible the garden allowed females the opportunity to strengthen strategies Sala et al. (2014) discussed, with focus on the behavioral (action based) strategies over their preferred social (outside intervention) strategies. It stands to

reason that the combination of creating a more positive environmental attitude (Aguilar et al., 2008) and gaining confidence in personal behavioral strategies (Sala et al., 2014), could provide females with a sense of connection and autonomy that increases their ability to delay gratification. Additionally, genders at the treatment school reporting similar average times at posttest, in conjunction with the very different control group results, may imply that the garden as an intervention could have the ability to close gaps in attention levels, providing teachers with a classroom of students who are prepared for similar lengths of lessons.

When examining percentage of males and females able to reach the goal time of 15 minutes, the treatment school reported higher than average numbers for both males and females at pretest, and for females at posttest. Posttest measures reported 75% of females in the treatment group were able to delay gratification, compared to 40% of females in the control groups. These disproportionate percentages show increases from pretest numbers (37.5% and 20%), but demonstrate a much larger gain for the treatment group suggesting that females may have benefited from the garden program in relationship to waiting for a reward. Posttest percentages for males were extremely close (60% and 61.1%), suggesting that gardening as an intervention did not have an effect relating to delay of gratification for the male population in this study.

A study by Mischel and Underwood (1974) explored patterns of thinking in preschool children during a delay of gratification task and found that females waited significantly longer than males across all conditions, though statistical significance was not found within any single condition. Mischel and Underwood's (1974) research lends

support to this study demonstrating that preschool females may be more likely to respond to delay of gratification interventions. Taylor et al.'s (2002) research examining connections between nature and self-discipline offers support regarding the use of a garden as an intervention through results that show significantly positive relationships between nature and all tested self-discipline measures. An increase in performance was shown for females over males when exploring naturalness of view (nature outside window) and ability on tests of concentration, impulse inhibition, and delay of gratification (Taylor et al. 2002). Taylor et al. (2002) and Mischel and Underwood's (1974) studies strengthen the trend shown in this study regarding females' positive response to a garden as an intervention and open possibilities for future research to further explore the relationship of females and natural interventions related to self-discipline.

Additional considerations include qualitative records reporting multiple instances where participants were required to delay gratification, or wait for a reward. One significant instance was when students at the treatment school were waiting for their turn to work in the garden with the researcher. Students were admitted to the fenced in garden in groups of 3-5 to do small tasks with one-on-one supervision while other students were engaging in outdoor free play. Very quickly, a large number of students congregated around the gate vying to be in the next group to enter the garden. This escalated into pushing and crying as time went on. The researcher reacted by telling students they would be allowed to enter in the order in which they arrived *and* only if behaving appropriately. Without instruction, the group lined up and sat on a border

opposite of the garden gate to wait until it was their turn to enter. Some children came and went; some stayed even after their turn; some went to play as soon as their turn was done; and others played until they were called for their turn. This has significance because the task students were waiting to do was interesting enough for them to master what they could be doing immediately (playing elsewhere), and wait for what they wanted to do (work in the garden). Ironically, once each group was in the garden, there were times they had to wait again to take turns completing an activity (like harvesting greens with pruning shears), which was done one at a time to ensure safety. These instances highlight the broadness of a garden program, which offers multiple teaching opportunities to delay gratification beyond initial expectations. It is also helpful that many of these situations take place outside of a classroom making life skills more relatable to "real world" experiences.

The ability to delay gratification has been tied to better academic outcome and increased cognitive and social competence later in life (Mischel et al., 1988; Mischel et al., 1989). A study examining ninth grade students by Donohew et al. (2000) revealed that impulsive decision makers are more likely to engage in risky behaviors including alcohol and marijuana usage as well as elevated sexual risk taking. Since longitudinal research has provided support for predictive validity of delay of gratification for future quality of life (academic and social competencies) (Mischel et al., 1988; Mischel et al., 1989), it is advisable to employ strategies to positively influence this ability as early as possible.

Visual Motor Integration

Objective two for this study was to determine if participation in a school gardening program affected children's visual motor integration, meaning the degree to which fine motor skills and visual perception are coordinated (Beery and Beery, 2006). Although no significant main effect was found when comparing treatment and control schools' change in VMI scores from pre to posttest, when exploring gender, significance was found in average change in scores for males. Only males in the treatment group reported a rise in average score on the visual motor integration measure, from 88.96 to 98.13. Since scores for VMI are controlled for age, an increase in average score reveals growth beyond what was typical for a specific person at a specific time. However, these scores are also standardized and while they represent a significant increase, the increase simply brings them close to the standardized average of 100 points.

When observing results from this study, it should be considered that one control school utilized pencil and paper lessons that were similar to the geometric forms on the VMI booklet as an integral part of their curriculum. These lessons included the repetition of phrases to accompany specific pencil motions. Familiarity with the forms and strategies learned for writing skills likely influenced the control groups above average performance. Review of research observations and qualitative records showed reports of students verbalizing these strategies as they began working in the VMI test booklet. Simple figures (straight lines, circle, square, etc.) where students were able to employ familiar phrases were completed quickly and easily, however, when figures became more complicated, student confidence and ability decreased rapidly.

One difference in this study compared to many previous research studies was that it tested all students, not only students who were thought to have visual motor control difficulties. While interventions are utilized to improve skills of those with motor skill challenges, a study by Ratzon et al., (2009) demonstrated that a 3 month intervention could significantly improve visual motor skills of children in the early school years, even those who had not been identified as having problems. This finding is important as it demonstrates activities promoting fine motor skill development, like gardening, can be beneficial to all students, not just those who have identified challenges (Ratzon et al., 2009).

According to Rule and Stewart (2002) teachers should include carefully constructed and coached activities that focus on fine motor skill development and challenge students but spark their imaginations as well. Although males in the treatment group for this study improved without constructed and coached fine motor activities, the elevated scores of the control schools who implemented directed activities for fine motor skill development support these structured lessons. However, if the garden intervention was combined with specific fine motor skill activities like counting or separating seeds, it is feasible that the score would improve in a treatment group at a higher rate.

The importance of visual motor integration has been demonstrated to influence a variety of academic achievements including: readiness in handwriting, as well as math, reading, and written expression (Carlson et al., 2013; Kaiser et al., 2009; Sortor and Kulp, 2003), making it an important stepping stone in early childhood education. A study by Carlson et al. (2013) emphasized that visual motor coordination (fine motor

control) does not appear to be significantly related to achievement, but that visual spatial integration (visual information processing integrating with fine motor control) is likely to be driving academic achievement. A meta-analysis of physical activity interventions for preschoolers found the most successful interventions, "(a) to be provided in the early-learning environment, (b) directed by teachers, (c) to incorporate environmental changes, (d) to promote unstructured activities or free play, and (e) to provide outdoor play time" (Gordon et al., 2013, p. 293). While this research was examining physical activity, physical activity includes the use of fine and gross motor skills, which reflects a variable in this study. An early childhood garden program can provide all five attributes found in the meta-analysis for a successful preschool intervention program. Implementation of a garden program in an early childhood education program allows an interesting way to provide visual motor integration opportunities to all students better preparing them for academic success in later years.

Conclusions and Practical Applications

The following conclusions were made from this research:

1) Results from this study indicated that a garden program could provide benefits to all participants; males in the treatment group improved in visual-motor integration and females in ability to delay gratification.
2) Results from this study showed a trend relating to a garden program's possibility to increase females' ability to delay gratification, providing a basis for further investigation.

3) Results from this study indicated that a garden program positively influenced males' fine motor skill development.
4) Results from this study help create a foundation for future studies to build upon regarding the utilization of a garden program to enhance preschool academic skills.
5) Results from this study in conjunction with literature that promotes the importance of physical activity in preschool programs (Jones et al., 2003; Williamson, 2013) provides opportunities for future research exploring a garden program as an academic as well as physical activity program to promote healthy living.

Grissmer et al. (2010) state, "Building stronger theories and knowledge about the interrelationships among attention, fine motor skills, knowledge of the world, and the potential causative mechanisms that might link them to later achievement can result only in better design and increased power of efficiency of interventions."

DeHart et al. (2004) notates that between the ages of 2 ½ and 5, children in industrialized cultures experience a "dramatically expanding world…and are propelled by a natural curiosity to explore" (p. 336). According to Kaplan (1995), "All too often the modern human must exert effort to do the important while resisting distraction from the interesting" (p. 170). By utilizing the garden as a teaching tool, it becomes both interesting and important creating an ideal location to engage children and increase important learning opportunities. Supporting an effective use of a garden program in early education, a thesis by McGaughy (2013) recounted, "The majority of respondents

reported youth in the garden at least once a week, which included grades pre-kindergarten though fifth. Respondents reported a total of 744 classrooms using the school garden with first grade and kindergarten having the highest number of classes participating in gardening activities" (p. 79). McGaughy's (2013) study demonstrates the usage of gardening activities, while Grissmer et al. (2010) suggested that, "the focus of interventions should shift from a primary emphasis on changing the direct math and reading instructional environment to interventions that build better foundational skills of attention and fine motor skills and a better understanding of the world outside schools" (p. 1016). This again provides support for gardens as an intervention since gardens provide an environment that makes a wide range of learning opportunities possible.

According to Mendizza and Pearce (2004), an optimum learning relationship is one that is the most effective for children and adults to transcend individual limitations, discovering and perhaps mastering new patterns or possibilities through connection, interaction, and interdependence (p. 5). Creation of this experience provides a setting for *Flow*, defined by Csikszentmihalyi (1997) as "the sense of effortless action they feel in moments that stand out as the best in their lives" (p. 29). Csikszentmihalyi states that, "When goals are clear, feedback relevant, and challenges and skills are in balance, attention becomes ordered and fully invested" (p. 31). Imbedded in daily garden activities and observations are opportunities for students/children to wait (delay gratification), actively work (find and gross motor skills), and learn a variety of life skills, all while exploring a natural environment preschoolers find interesting.

According to DeHart et al. (2004), growth enhancing experiences during early childhood are an investment in a child. While many interventions at this stage tend to boost test scores temporarily, the more lasting benefit is student empowerment, development of a greater self-esteem, more positive attitude toward education, and a stronger belief in themselves as able learners (DeHart et al., 2004). DeHart et al. (2004) report that a high quality preschool intervention program would include long-term participation where children would have the ability to select personalized learning activities in an environment rich with materials (p. 364). Experiential learning opportunities abound in a garden, which is a constantly evolving year round program. Beyond actual hands-on garden activities there is strategic thinking involved when planning and ordering seeds or plants, which opens dimensions beyond the physical garden for personalized learning. Rule and Stewart (2002) reported that, "activities that teachers described as most valuable were those that incorporated cognitive skills such as finding likeness and differences, matching and sorting, or science content such as learning about animals." Several of these skills would add directly or indirectly in visual motor integration, while others appeal to student interest in subject, translating into more control for delaying gratification, and opportunities for all would be available in a garden program.

Recommendations for Further Research

The following recommendations for additional research were made:

1) It is recommended that this study be replicated in a single ISD utilizing a split of classes within grades for control and treatment groups, and a single room within each school delegated for testing measures.
2) It is recommended that each group or individual being tested should be called from a similar type of classroom situation to the testing room.
3) It is recommended that this study be replicated with an increase in sample size.
4) It is recommended that this study be replicated with all possible demographic information gathered from parents and students, including a question regarding gardening at home.
5) It is recommended that this study be replicated in a larger academic setting with different rewards offered for the delay of gratification section. For example, one big marshmallows and two small cookies; or two small cookies and two large stickers would be used as rewards for delay of gratification.
6) To further explore the variable of visual motor integration, it is recommended that this study be replicated in larger academic settings with a control group, a treatment group that gardens, and a treatment group that gardens specifically including garden activities that focus on fine motor skill development.

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APPENDIX A

Delay of Gratification Script

Script written and utilized for Delay of Gratification Measure in the study on the effect of a school gardening program on children's ability to delay gratification as well as examine the influence of a school garden program on children's visual motor integration.

Hi __participant name___, do you want to do some work in your classroom with me?

First we are going to do a short activity.

Lets see if you can ring this bell. I'll do it first then you can do it. (1 ring, 2 rings, 3 quick rings, 1 and stop noise)

That was fun, thanks for working with me.

Let's see what is under here.

Oh look, it's cookies. (Yes it's cookies)

Would you rather have one cookie or two?

You want _____, ok. I have some work to do on the other side of the room.

If you wait until I come back by myself you can have _____ cookies.

But, if you don't want to wait, you can ring the bell and I will come back.

If you ring the bell, you get _____ cookies.

So if I come back on my own you get ____ cookies. But if you ring the bell I will come back and you can have _____ cookie(s).

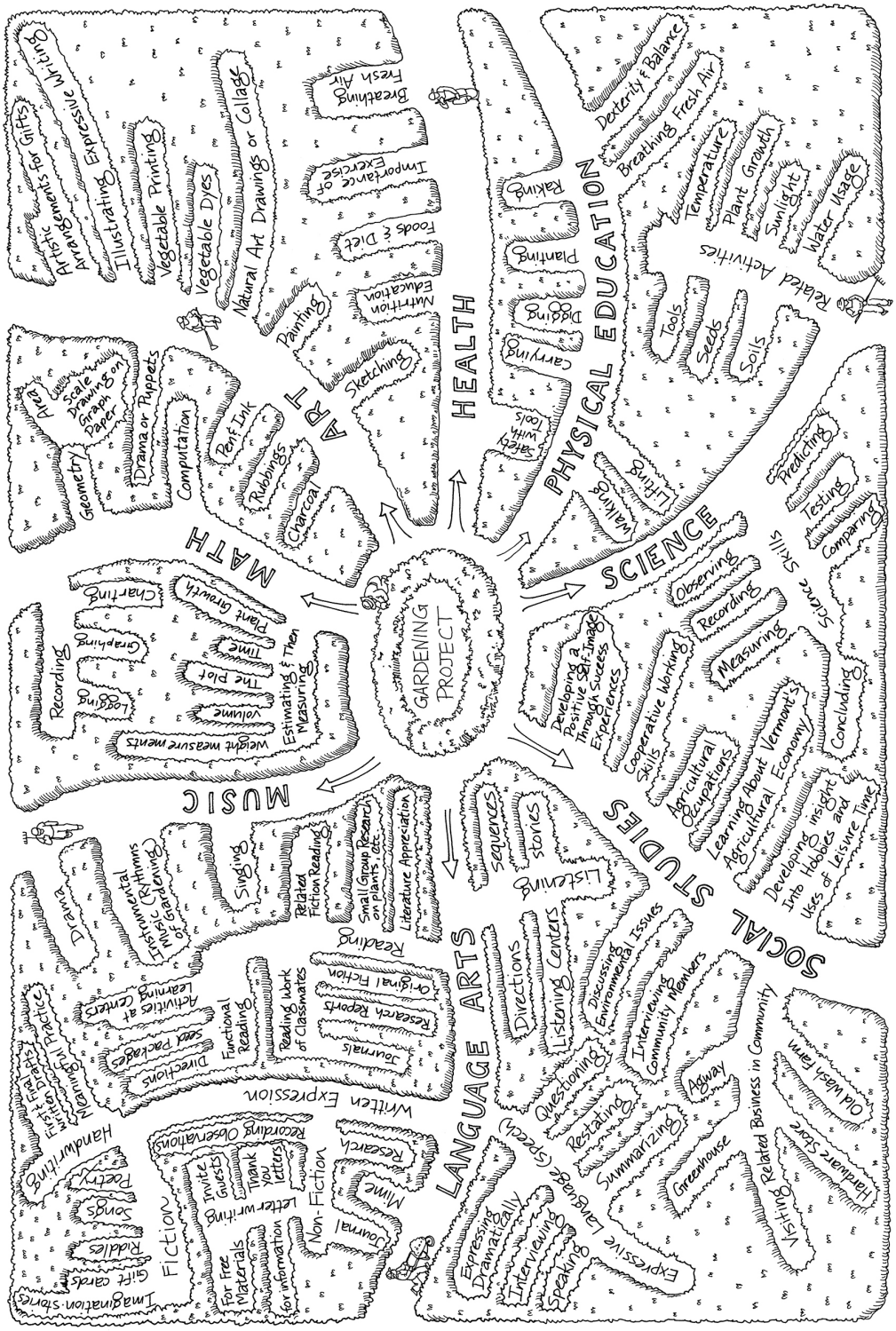
Can you tell me, what do you get if you wait for me to come back all by myself?

But if you want me to come back, how do you let me know?

If you ring the bell and bring me back, what do you get?

Ok, you wait here and I will go do my work.

APPENDIX B



NGA PATHWAYS FIGURE Reprinted with permission from Jaffe and Appel (2007)

APPENDIX C

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