Use of Gardening Programs as an Intervention to Increase Children's Ability to Delay Gratification

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Keywords. nature, preschool, self-regulation, sociohorticulture, Stanford Marshmallow Study

Abstract. **The purpose of this study was to examine the ability of preschool gardening programs to help children develop their ability to delay gratification. Children today face many opportunities for instant gratification, although the ability to delay gratification in early childhood has been linked to numerous benefits later in life. Opportunities to train children in the ability to delay gratification present educational challenges, in that it competes with other academic training needs, and it can be difficult to find programs that are interesting to young children. The population for this study was preschool children ranging in age from 2 to 6 years, with treatment and control groups drawn from different schools. Participants were tested individually and timed to determine their ability to delay gratification, with promises of larger rewards if the child could wait for 15 minutes. The results of this study did not identify a significant change in all children's ability to delay gratification after a gardening program. However, analyses showed that females appear to have responded more positively to the gardening treatment in their ability to delay gratification, whereas males in the control group benefited more from traditional school lessons.**

Gardens have long been researched and used to develop mental and physical benefits for children. For example, early educators like Rousseau (1712–78), 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). Since 1990, a resurgence of interest in school gardens has led to the establishment of thousands of school gardens and garden curricula designed specifically to meet subject standards on achievement tests (Williams and Dixon 2013). 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 (United States Whitehouse 2014; Williams and Dixon 2013). Benefits of school gardens are often presented through the scope of students' academic success using the garden as a teaching tool. Reviews of literature examining effects of garden-based learning in relation to academics have 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; Pigg et al. 2006; Williams and Dixon 2013).

Children's innate interest in nature and gardening provides an opportunity for educators to translate natural curiosity into achievement relating to lifelong learning (Louv 2008; Miller 2007; Rule 2007). The garden offers a setting 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). During a time when landscapes in urban environments are often built, 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 using a holistic approach to teaching and learning (Miller 2007; Swayamprakash 2021).

According to the American Academy of Pediatrics (2013), media is one of the most dominant forces in children's lives, usurping more time than being in school, and access to media is immediate as movies stream through home entertainment systems and devices, and laptops or smartphones access information instantly at virtually any location (Barak et al. 2021; Vaterlaus et al. 2021). Media use is the leading activity for children other than sleeping and can contribute to various risks and health problems, including sedentary behavior, poor sleep, obesity, and increased mental health concerns (American Academy of Pediatrics 2013; Nagata et al. 2020; Tremblay and Willms 2003; Vandewater et al. 2004).

Instant gratification and a feeling of entitlement are commonplace in the life of typical American youth (Renard 2005; Savina 2014). Although resisting an immediate interest for a future desire can present challenges for adults, it is particularly challenging for young children who are developing skills related to self-discipline and self-regulation. Self-discipline and self-regulation are mechanisms to be introduced early in a young person's life and include developing skills related to concentrating, 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; Mischel et al. 1989). Modern conveniences and technologies providing instant gratification are often similar, offering adults and children opportunities for indoor-based entertainment and activities (Pergams and Zaradic 2006; Renard 2005; Robison and Ridenour 2012). Interesting ways to train young people to delay gratification are needed. The ability to delay gratification in preschool can be a predictor of social, emotional, and academic competence, and has multiple implications later in life (Mischel et al.

Received for publication 19 Sep 2022. Accepted for publication 9 Dec 2022.

Published online 19 Jan 2023.

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https://doi.org/10.21273/HORTTECH05135-22

1989; Savina 2014). For example, 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, as well as parental responses of their children's concentration, competence, planning abilities, ability to cope with problems, and intelligence during adolescence. As a teenager, the ability to delay gratification was related to an increased ability to cope with stress, tolerate frustration, resist temptation, maintain self-control, pursue goals, and delay gratification (Mischel et al. 1989; Savina 2014).

Researchers (Mischel et al. 1989) expressed that although 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). Furthermore, >children who believed personal behaviors resulted in specific events demonstrated the ability to choose more valuable rewards over time (Strickland 1973). A longitudinal study examining preschoolers' ability to delay gratification 40 years later reported findings that confirmed significance and predictive validity 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 body mass index (BMI), and increased crime rates—all of which affect directly or indirectly an individual's general health (Donohew et al. 2000; Moffitt et al. 2011; Schlam et al. 2013). Taylor et al. (2002) suggested that an individual's ability to inhibit impulses while considering alternatives could surpass the desire for immediate gratification while promoting long-term goals. Early childhood variations in self-control predicted multiple factors such as health, wealth, and crime almost as well as intelligence and social class, and offered 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" (p 15001). Moffitt et al. (2011) suggested that early intervention programs to enhance self-control could reduce the growing number of costs associated with a number of risky behaviors, including health issues. An intervention program at the preschool level targeting risky behaviors through an increase in self-control is validated by combining the support of early intervention programs of Moffitt et al. (2011) targeting development of self-control with the findings of Casey et al. (2011) that confirm the predictive validity for delay ability in preschoolers transferring to behaviors in later life. The purpose of our study was to examine the ability of preschool gardening programs to help children develop their ability to delay gratification.

Materials and methods

Research design. A quasi-experimental nonequivalent group design was used for this study. This design was selected because campus populations were kept intact and thus not available for random assignment. The participating schools completed a pre-test and post-test for two measures and agreed to follow guidelines of the study relating to using (treatment) or abstaining (control) from any garden-type curriculum.

Sample. The population for this study was preschool children ranging in age from 2 to 6 years. The sample was drawn from schools that had no active garden onsite in the past year, but were interested in constructing a garden for educational opportunities. Treatment and control schools were selected with comparable school atmospheres and student demographics. Although the treatment schools self-identified as Montessori schools, the 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 that were willing to participate in the study.

Although specific demographics of the schools were not collected, they were matched as closely as possible through discussions with administrators and available public information. All treatment and control schools catered 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 geographic 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 demographics allowed for comparable data sets for this study.

This study focused on prekindergarten (pre-K) 3 years of age and pre-K 4 years of age classrooms. However, because of the progression methods within the treatment schools, there was a mix of ages in each classroom situation. There was one class of pre-K 3 years of age, which consisted of 12 students, and two rooms of pre-K 4 years of age, one with 12 students and the other with 14 students at the onset of the study.

Consent/assent. A packet was sent home to each student in the participating schools (treatment and control) that included a description of the study, a parental permission form for assent, and a seed packet as an incentive for returning the signed permission forms. In addition to parental permission, the researcher required participant consent during each assessment measure. If at any point the participants (children) were uncomfortable or unwilling to take part in any assessment, or demonstrated unease, they was asked if they would like to continue or be "all done/finished." All testing procedures were approved by the Texas A&M University Institutional Review Board (IRB Protocol No. 2010-0654) before study initiation.

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 bimonthly lessons/activities carried out by the researchers. 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.

Control schools. Two control schools were used for this study. These control groups agreed to abstain from participating in garden activities until completion of the study, and they continued with their previously established curriculum. Control school A enrolled 12 students at the time of testing and was conducted more along the lines of what would be expected in a public school setting, with more focus on classroom lessons and less on free play. Control school B was much larger than the other school and only certain teachers opted to be involved in this study. Each class was divided by year and consisted of about 15 students per classroom, with two to three classrooms per age group. Both schools had outdoor playgrounds and daily outdoor time, with space and time for a gardening curriculum in the future.

Instrumentation. Each participant was individually pre- and post-tested on measures of delay of gratification 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), 6 months is an appropriate time frame to control for this threat to internal validity.

Development of a script (Fig. 1), along with methodology measures for this study were based on previous research by Mischel and colleagues at Stanford University (Stanford, CA, USA) to assess delay of gratification in children (Mischel and Ebbesen 1970; Mischel and Metzner 1962; Mischel and Underwood 1974; Mischel et al. 1972, 1988, 1989). These studies, also known as the Stanford Marshmallow Studies, assessed various demographics of children's ability to wait to receive a greater reward vs. having a smaller reward immediately in different situations.

Methods from Mischel's studies were combined and adapted to focus on the specific age group of children for this study (2–6 years of age). 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. The delay of gratification script was modified to be appropriate for this study and administered by the researchers. To record timing measures for assessing delay of gratification, participants were video recorded and timed manually.

Treatment. A garden was built at the treatment site through a coordinated effort between school administrators, researchers, children, and school families. The enclosed garden was located next to the large playground, separated by a chain link fence and unlocked gate. The school garden consisted of a series of raised beds of different sizes, creating areas where children could work and reach easily. Trellis systems near the fence were included and had small beds around them, and a teepee structure was constructed using bamboo and cinder blocks.

The garden was planted primarily with annual vegetable crops and, occasionally, with annual flowers. Efforts were made to plant both seeds and transplants, a variety of edible plant parts, as well as short and longer season crops to offer a range of experiences for the students.

Researchers worked with children in the garden at least every other week doing basic activities such as watering, planting, harvesting, and pulling weeds. Once per month, researchers planned and conducted a larger activity around a lesson including topics such as plant life cycles, nutrition, and vegetable taste testing. Teachers were encouraged by researchers to use the garden as a teaching tool, but otherwise the incorporation of the garden into the curriculum was completely voluntary. Researchers noted evidence of use beyond the scheduled researcher activities, including extensions of garden ideas in the classroom upon visits, such as labeled plant photographs on walls, lessons that included garden produce harvests, and pictures drawn from student activities.

Testing environment. Participants were tested in a one-on-one environment agreed upon by the researchers and administrators at each school. The testing location was a classroom familiar to the participants, but 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. Participants were video recorded throughout the entire interaction, and most students remained unaware of the video recording. The researchers conducting the testing were the same individuals as those working with children in the garden.

Upon entering the evaluation room, participants were presented with a table that held assessment materials. 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.

Because of the age of participants, the researcher clarified that the reward was cookies and each participant was offered the choice of one cookie or two. The prewritten script was followed as closely as possible, although slight alterations could be made when dealing with each individual child because their responses contained great variation. In the instance that a child chose one cookie as the better reward, 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. When 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 their own to receive the larger reward or to ring the bell to signal the researcher's return, thus receiving the smaller reward.

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

First, we are going to do a short activity.

Let's see if you can ring this bell. I'll do it first and 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.

Fig. 1. Delay of gratification script written for the study of use of gardening programs as an intervention to increase children's ability to delay gratification.

A 15-min delay of the researcher's return was based upon previous timing in Mischel's studies (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. When 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. The researcher used manually recorded times to ensure consistency, and consulted video recordings to ensure proper timing if there was a question regarding when the bell was rung by the participants. 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 min. Times were converted into seconds.

Data collection and analysis. Raw data were entered into spreadsheet software (Microsoft Excel version 14.0; Microsoft Corp., Redmond, WA, USA) and analyzed using statistical software (IBM SPSS Statistics version 20; IBM Corp., Armonk, NY, USA). Statistical procedures included descriptive statistics, frequencies, paired *t* tests, and analysis of variance tests to determine differences between scores of pre- and post-tests for treatment and control groups.

Results and discussion

Demographics. A total of 67 valid measurements were collected with 34 (50.7%) from the treatment school and 33 (49.3%) from the control schools, and some participant loss in this study occurred primarily because students moved or left the preschool program for kindergarten. Participants used in data analysis included 10 males (29.4%) and 24 females (70.6%) from the treatment school and 18 males (54.5%) and 15 females (45.5%) from the control schools, resulting in an overall gender breakdown of 28 males (41.8%) and 39 females (58.2%).

Age varied from ~2.4 to 6.3 years for students at the pretest and 2.8 to 6.8 years for students at the post-test. Because ages varied between the groups and because every day allows learning and growth in a child's ability to process and control impulses (DeHart et al. 2004; Sala et al. 2014), the threat of maturation effects to internal validity were controlled for by implementing a 6-month pre- to post-test time frame (Gay et al. 2006). Regression analyses were also used to ensure a more robust statistical analysis. A simple linear regression determined that age was not a significant predicting factor for the time participants were able to delay gratification for either the pre- ($P = 0.058$) or post-test ($P = 0.347$).

Pre- vs. post-test comparisons. Pre- and post-test times were converted into seconds, with a delay of gratification goal time of 900 s (15 min). Paired *t* tests indicated that there were significant differences between the treatment group pre- and post-tests ($P = 0.003$; Table 1). The treatment school recorded average times of 426.15 s (7.11 min) for the pretest and 676.18 s (11.27 min) for the post-test, with an improvement of 250.03 s (4.17 min) over the course of the study. Paired *t* tests also indicated a significant difference in control groups between the pre- and post-tests. The control schools reported a pretest time of 347.36 s (5.79 min) and a post-test time of 630.15 s (10.50 min), with an improvement of 282.79 s (4.71 min).

It was expected that each group would show improvement over time, because kindergarten is a time of great change. Although the control group had a greater change over the course of the study, the treatment group had the greatest average time for delay of gratification at the end of study. However,

Table 1. Paired *t* test comparisons of both the control and treatment groups' average of delay of gratification pre- and post-test measures in seconds in the study of the effect of a school gardening program on children's ability to delay gratification.

Group	*n*	Mean[i]	Mean change	*SD*	df	*t* Value	*P* value
Treatment pretest	34	426.15	250.03	394.47	33	–3.194	0.003[ii]
Treatment post-test	34	676.18	—	363.63	—	—	—
Control pretest	33	347.36	282.79	327.78	32	–3.887	0.001[ii]
Control post-test	33	630.15	—	336.72	—	—	—

[i] All times are averages reported in seconds, with a possible range of 0 to 900 s.
[ii] Statistically significant at $P \leq 0.05$.

the treatment group had a greater time at the onset of the study as well. When comparing differences between control and treatment groups, no differences were found in comparisons of either the pre- or the post-tests (Table 2) on either test.

Although situations during testing aimed at consistency, observations of each testing situation revealed that participants from the treatment and control groups were taken from somewhat different settings (classroom vs. outdoor free play), which may have influenced results. A study by Calabrese (2001) examined the relationship between structured and unstructured physical activities and incidence of classroom behavior problems after each type of activity in preschool children. That study found that general disruptive behaviors and inappropriate verbal responses occurred with a significantly greater frequency after unstructured activity (Calabrese 2001). It is possible that the different mind-sets of participants as they entered testing facilities similarly affected students' ability to self-regulate, depending on their transition from an unstructured or structured environment.

In addition, the treatment school followed Montessori philosophies where teachers served as guides, not trainers, directing attention and observation (Montessori 1966). Children in a Montessori setting can 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.

Gender. No delay of gratification differences were found when using a split-plot analysis of variance test comparing males in the treatment group to those in the control group ($P = 0.582$) or females in the treatment group to those in the control group ($P = 0.552$). Therefore, control and treatment group scores were similar by gender from the pre- to the post-test. However, paired *t* tests were used to compare the pre- and post-tests of females in the treatment group and found significant differences in scores ($P = 0.011$). When similar paired *t* tests were used to compare the pre- vs. post-test scores of males in the treatment group, no differences were found in scores ($P = 0.145$). Alternatively, when paired *t* tests compared the pre- and post-tests of females in the control group, no differences were found in the ability to delay gratification over the course of the study ($P = 0.133$). However, during the same time, males in the control group saw a significant change in their ability to delay gratification ($P = 0.001$; Table 3). Past research demonstrated a variety of benefits from garden activities for both gender groups (Klemmer et al. 2005; Miller 2007; Ozer 2007). In our study, females responded more positively to the treatment, whereas males benefited more from traditional lessons within the control school.

It is notable that males in both treatment and control groups pretested with a considerably lower delay of gratification time compared with females. These measures are consistent with the findings of Mischel and Underwood (1974) 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 s (4.71 min) and 388.00 s (6.46 min)] compared with females in either school [236.42 s (3.94 min) and 156.53 s (2.61 min)], with the largest gain seen in males in the control school. Although 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 compared with 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 preschool settings and at the control school were more beneficial to males in this population compared with females.

Past studies also indicated differences in responses of males vs. females in a school gardening program, with females having more positive environmental attitudes and feeling a sense of

Table 2. Analysis of variance comparisons of the treatment versus the control group pre- and post-test measures of average of delay of gratification in seconds in the study of the effect of a school gardening program on children's ability to delay gratification.

Group	*n*	Mean[i]	Mean difference	*SD*	df	F value	*P* value
Pre-test	—	—	—	—	1	0.064	0.802
Treatment	34	426.15	78.79	394.47	—	—	—
Control	33	347.36	—	327.78	—	—	—
Post-test	—	—	—		1	0.195	0.660
Treatment	34	676.18	46.03	363.63	—	—	—
Control	33	630.15	—	336.72	—	—	—

[i] All times are averages reported in seconds, with a possible range of 0 to 900 s.

Table 3. Paired *t* test comparisons of males and females within control and treatment groups' average of delay of gratification pre- and post-test measures in seconds in the study of the effect of a school gardening program on children's ability to delay gratification

Group	*n*	Mean[i]	*SD*	df	*t* value	*P* value
Treatment male						
Pretest	10	383.10	389.91	9	–1.597	0.145
Post-test	10	665.80	370.18	—	—	—
Treatment female						
Pretest	24	444.08	403.28	23	–2.763	0.011[ii]
Post-test	24	680.50	368.82	—	—	—
Control male						
Pretest	18	296.00	330.78	17	–3.833	0.001[ii]
Post-test	18	684.00	312.00	—	—	—
Control female						
Pretest	15	409.00	324.43	14	–1.597	0.133
Post-test	15	565.53	364.36	—	—	—

[i] All times are averages reported in seconds, with a possible range of 0 to 900 s.
[ii] Statistically significant at $P \leq 0.05$.

their ability control what happens to the environment (Aguilar et al. 2008). Harvey (1989) found that both genders appeared to appreciate vegetation's role as a play object and adventure element. However, girls appreciated the role of vegetation more for food and ornamentation, which is often most emphasized in gardening programs like this one (Harvey 1989; Lineberger and Zajicek 2000).

Conclusion

This project focused on children ages 2.5 to 6 years, which is often referred to as the early-childhood developmental stage. Early childhood is a time for rapid growth in areas of cognitive, emotional, physical, and social development (DeHart et al. 2004; Savina 2014). During this stage, there is great fluctuation in a child's capacity for growth and development, when much depends on everyday interactions and opportunities (DeHart et al. 2004; Savina 2014).

A garden as an intervention for this stage is appropriate because of the flexibility of experiential activities. Seeding, transplanting, repotting, digging, raking, and watering are all activities that can be assigned depending on a child's physical or mental ability. DeHart et al. (2004) stated that, "Children continue to be active participants in their own development" (p 305), as they actively explore the world and progress from observing and describing events to attempting to explain them by searching for patterns and rules. Guided experiences in a garden are facilitated easily because children have preferred activities and will typically change tasks if something becomes too difficult.

No significant main effect was found in our study in comparisons between the treatment and control schools with regard to change in delay of gratification times from pre- to post-test. However, gender differences appeared to show that females respond more positively to the gardening treatment in comparison with males. The ability to delay gratification has been tied to better academic outcomes and increased cognitive and social competence later in life. Because 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, 1989), it is advisable to use strategies to influence this ability positively as early as possible.

Further research is needed to clarify the extent of the effect of gardening programs on the ability of children to delay gratification. It is recommended that our study be replicated with a larger sample size and in a single school district using a split of classes within grades for control and treatment groups, and a single room within each school delegated for testing measures, with more demographic information collected. It is recommended that future studies initiate the testing process with each child from a similar type of classroom situation to the testing room. It is recommended to use different incentives in any replication to ensure the specific incentive did not influence the study, because seeds were sent home with children in the control schools and they may have experienced the treatment informally at home. Last, a longitudinal study looking at the impact of gardening on children and their ability to self-regulate over time would be valuable.

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