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# The Negative Effects of Growing up in Poverty on Brain Development and What Teachers Can Do to Level the Playing Field

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# THE NEGATIVE EFFECTS OF GROWING UP IN POVERTY ON BRAIN DEVELOPMENT AND WHAT TEACHERS CAN DO TO LEVEL THE PLAYING FIELD

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## Abstract

This literature review was conducted to answer two questions. What are the negative effects of growing up in poverty on brain development and how can teachers level the playing field? The following chapters highlight the areas of the brain most effected by poverty, the functions of those specific areas, along with the negative side effects that come with having underdeveloped portions of the brain. Some of the negative side effects include impulsivity, lack of decision-making, weakened working memory, and difficulty with reading comprehension. Subsequently, there will be specific interventions that can aid in bridging the gap between low-income and middle- to upper-class students accompanied by when those interventions should be implemented. The earliest and possibly most important of the interventions is high-quality childcare and preschool. At the elementary level, the strongest interventions are those that focus on social emotional learning. At the secondary level, mentoring, teacher expectations, and consistent strong leadership tend to make a lasting difference. Lastly, the research will show what teachers can do to support low-income students in the classroom. Maintaining high expectations for all learners is one of the most important actions a teacher can take to boost the students who are suffering from the negative effects of poverty on brain development.

Table of Contents

# CHAPTER I: INTRODUCTION

## Children Living in Poverty

In the United States there are tens of millions of children living at or below the federal poverty line. Empirical studies have documented children living in poverty experience more family tumult, violence, less social support, separation from families, and less cognitive stimulation than middle- and upper-class peers (Hanson et al., 2013). Children living in poverty are also less likely to have adequate access to technology, high-speed internet, and age-appropriate toys and books than their wealthier contemporaries (Hanson et al., 2013).

All of these environmental factors join together to create an atmosphere of chronic stress. Chronic stress is a term coined by researches to illustrate the compounding factors that create an atmosphere where brain growth can be stunted. Children growing up under these circumstances have increased rates of learning disabilities, behavior problems, along with mental and physical health issues that can continue through adulthood (Evans et al., 2019; Hanson et al., 2013).

The lack of brain development has been evident in children as young as 4 years old. The specific regions of the brain that showed the largest disparity between poor and non-poor children were the frontal and parietal lobes (Hanson et al., 2013) as well as the amygdala and hippocampus (Pavlakis et al., 2015). Researchers noted that the smaller volume in this brain tissue correlated with greater behavior problems in the pre-school years (Hanson et al., 2013). These regions control planning, impulse control, and

attention, therefore, the smaller the volume, the more difficult it is for the child to make well thought out choices.

## Historical Context

Up until the 1970s higher education was accessible to more Americans than it is today. Over the past 40 plus years, however, that accessibility has shifted excluding those who occupy the lowest income bracket. Access to education has been the great equalizer amongst classes, therefore, the growing disparity has left those living in poverty be stagnated and somewhat trapped in that economic status (Papay et al., 2013).

A variety of solutions to this problem have been proposed and implemented over the years including income-based preschool programs that are provided to the community through school districts or scholarships to low-income families to high-quality private programs (Blair & Raver, 2014; Barnett, 1993; Campbell et al., 2012; Norwalk et al., 2012; Papay et al., 2013; Slaby et al., 2005).

Other solutions have proposed social emotional curriculum being implemented in elementary schools which engage the parts of the brain that are so often underdeveloped in children living in poverty (Blair & Raver, 2014; Cavadel & Frye, 2017; Evans et al., 2019; Nix et al., 2016). Focusing on the arts and literacy have also shown to be beneficial in boosting development of children living in low-income homes (Brown et al., 2017; Cavadel & Frye, 2017; Nix et al., 2016; Norwalk et al., 2012; Kennedy, 2016; VanTassel-Baska & Stambaugh, 2006). Without such interventions the separation of

class will continue to grow, causing the negative effects of growing up in poverty to be an unbreakable generational curse.

## Leveling the Playing Field

Outside of home, children spend the most amount of time at school. Considering the influential nature of a student-teacher relationship, teachers can have a profound impact on the life of a student. In order for that impact to be fully realized, teachers need to have research-proven strategies to implement in the classroom that will ignite brain development for the most vulnerable students.

Research surrounding high-quality childcare followed by high-quality preschool is promising. Children who have participated in these programs see benefits that last through adulthood (Barnett, 1993; Campbell et al., 2012). Other programs that have seen positive outcomes are those that teach self-regulatory skills to young children (Bierman et al., 2010; Nix et al., 2016). Interventions such as literacy programs and classes focusing on the arts have produced results showing great benefit for children living in poverty (Brown et al., 2017; Norwalk et al., 2012; VanTassel-Baska, 2006). Knowing what to implement, when, and how, will help teachers bridge the gap between children growing up in poverty and the middle- and upper-class children.

## Key Terms

The key terms for this literature review are “amygdala,” “hippocampus,” “frontal lobe,” “parietal lobe,” “gray matter,” “working memory,” “self-regulation,” “social emotional learning (SEL),” “chronic stress,” and “socioeconomic status.” Definitions are as follows.

The amygdala is an almond-shaped mass located in each cerebral hemisphere of the brain and is involved in experiencing and perceiving emotions, including fear. The hippocampus is the part of the brain that is the center of emotion, memory, and the autonomic nervous system.

The frontal lobe is located directly behind the forehead and is responsible for behavior, learning, personality, and voluntary movement. The parietal lobes are at the top of the head and are in charge of the reception and connection of sensory information. Gray matter is the darker tissue of the brain that is made up mainly of nerve cell bodies and branching dendrites.

Working memory is what humans utilize to store and retrieve short-term memories as well as perceptual and linguistic processing. Working memory can greatly affect one's ability to learn and grow even into adulthood.

Self-regulation is a term used to refer to an individual's ability to deal with emotions and stressful situations while maintaining an age-appropriate level of self-control. Social emotional learning is the term educators use for lessons and/or curriculum that focuses on decision making and mindfulness. Self-regulation can be significantly impacted by high-quality social emotional curriculum.

Chronic stress is a term coined by researchers when referring to compounding factors that lead to an environment filled with unrest that is seemingly never ending. Chronic stress can have long-term physical and mental issues. The mental side effects will be addressed in the following chapter.

Socioeconomic status refers to the social standing or class of an individual. It combines education, income, and occupation. The lower the socioeconomic status the more significant the impact on brain development.

## Research Questions

All of the research that has been done on brain development leads to the guiding research questions for this these. How does growing up in poverty negatively affect brain development? And because I am an elementary teacher my follow-up question is: What can teachers do to level the playing field for these children?

# CHAPTER II: LITERATURE REVIEW

## Literature Search Procedures

To acquire the literature for this thesis, searches of Academic Search Premier, EBSCO MegaFile, Education Journals, ERIC, and PsycARTICLES were for publications from 1990-2019. This list was reduced by focusing on published empirical studies from peer-reviewed journals that highlight brain development and teacher best practices for children living in poverty. The key words used in these searches contained "brain development," "effects of brain development in poverty," "parts of the brain most effected by poverty," "working memory and poverty," "attention deficits and poverty," "teacher best practices for children in poverty," and "interventions for children in poverty." The composition of this chapter is to examine the literature on the effects of growing up in poverty on brain development, interventions, and best practices in four sections in the following order: Negative Effects of Poverty on Brain Development; Importance of Early Intervention; Specific Intervention Strategies; and Importance of Effective Teacher/Leaders.

## Negative Effects of Poverty on Brain Development

Speculation has fueled many studies pertaining to the effect poverty has on brain development. Researchers have found that those effects can be measured by focusing on specific parts of the brain. Those areas are the amygdala, hippocampus, frontal cortex, and parietal cortex. These regions control certain aspects of behavior such as attention, working memory, and stress response, which effect multiple aspects of daily life. The negative effects growing up in poverty has on these areas of the brain

are just a few reasons children developing under those circumstances struggle to succeed. Let us begin by focusing on the amygdala (Pavlakis et al., 2015).

Generally speaking, the amygdala tells its person when to be afraid and when to feel stress. Children growing up in low-income homes experience an elevated hypothalamic-pituitary adrenocortical (HPA) axis activity (Evans & Kim, 2007). This high level of HPA hinders the function in that it does not allow for proper communication of fear and stress. This broken communication between the amygdala and the rest of the brain manifests in an inability to handle environmental demands (those at home and school) successfully (Evans & Kim, 2007). Having the skills to deal with distractions at school is a large part of being a successful student.

While the amygdala plays a role in fear and stress response, the hippocampus is what aids the memory function of the brain. The memory function allows an individual to recall old memories as well as make new ones. Working memory is a specific form of memory that the hippocampus is responsible for, which aids a student to store and recall directions given for an assignment. It also helps the individual make sense of a story that was read. Several studies that have been done using an MRI to measure brain density have shown that children who have been raised in a lower socioeconomic household have had lower density in the hippocampal region than those who would be considered middle class (Hanson et al., 2019). One study found that long-term exposure to chronic stress through childhood poverty effected working memory into adulthood (Evans et al., 2009). This study indicated that the longer a person lived in poverty, the more adverse effects would be evident later in life (Evans et al., 2009). In childhood,

lower density means working memory suffers causing the child to strain to remember directions or maintain comprehension while reading, making school more difficult (Pavlakis et al., 2015).

The final regions of the brain on which we will focus will be the frontal and parietal lobes. The frontal lobe plays a role in working memory alongside the hippocampus. It also plays a significant role in problem solving, emotional expression, language, and judgment to name a few. The frontal lobe gets credited for determining an individual's personality. On the other hand, filters the sensory experiences that are encountered throughout the day, most notably the visual sense (Hanson et al., 2019).

One study suggests that children growing up in poverty experience smaller gray matter in both the frontal and parietal lobes. This study also suggests that, due to smaller volumes of gray matter, the regions of the brain that communicate with the frontal and parietal lobes, namely the hippocampus, are hindered to such a degree that the outward behavior of the child living in chronic poverty is marked by an inability to self-regulate when compared to middle and upper class peers (Hanson et al., 2019).

Another study suggests that the failure to self-regulate as a child due to smaller gray matter in the aforementioned areas can follow the child into adulthood. These adults have difficulty maintaining attention on that which is important and are more easily distracted by external stimuli. While in school, this could look like a student being distracted by seemingly everything around him. As an adult this could look like an individual grappling with prioritizing tasks at a job or simply having flexibility when life does not go as planned (Evans & Fuller-Rowell, 2013).

Overall, brain development has been shown through neuroimaging as early as infancy for babies born into homes of lower socioeconomic status. In a study done on infants between 178 and 300 days old, researchers found that those living in low-income households had lower frontal lobe power during testing procedures than the middle-income group (Tomalski et al., 2013).

Similar results were found in another study performed on both infants and children. This study found that while overall gray matter was less dense in children coming from low-income households, specific regions of the brain proved to be particularly sensitive to poverty which was previously discussed. As the infants aged into preschool, researchers found that brain volume between the children coming from low-income households versus the middle-income homes grew. Additionally, researchers noted that smaller volumes of brain tissue were linked to greater behavior problems during the preschool years (Hanson et al., 2013).

The lack of healthy brain development that children growing up in poverty face can also negatively affect the child's ability to attend to a given task. The inability to attend was shown in a study completed on a group of children living on the streets of Ecuador. They were given two tests that assessed intelligence and reasoning. They scored significantly lower on both assessments than their peers coming from middle income homes on measures of executive function. Executive function, in part, enables a person to focus on a task (Pluck et al., 2018).

A more specific study focusing just on attention in preschool-aged children was completed in 2018 on a group of students in a Head Start program in Oregon.

Researchers found that the greater number of risk-factors the child was experiencing (poverty, single-parent home, low maternal education) the greater the attention deficits the child exhibited. This group of children also had a more difficult time suppressing stimuli that would distract them from the teacher during a lesson (Guiliano et al., 2018).

Looking at the entire picture, the negative effects growing up in poverty can have on brain development is significant. Between an underdeveloped amygdala, hippocampus, and frontal and parietal lobe as well as less overall gray matter in the brain, a child growing up in poverty faces many hurdles. All hope is not lost, however, because early intervention can have positive lasting effects that set a child on a trajectory of success. First, the importance of specific early interventions will be examined.

## Importance of Early Intervention

The earliest intervention a society could stage is high quality childcare. Most recent data suggest that nearly 20% of children in the United States are currently living in poverty. As examined above the effects of poverty can be seen in the developing brain as early as infancy, so providing high quality childcare for the infants and toddlers that are living in these low-income households is the first and best form of intervention.

The first study to be examined is one that was conducted in 65 childcare classrooms serving low-income populations across Texas and Florida in the United States. The classes were divided into three groups in order to gain data on two different curriculums that centered around social emotional learning strategies. One group was the control group where the daily structure was unchanged. The second group

implemented Responsive Early Childhood Curriculum (RECC) while the third group employed RECC+ which included an added piece that helped children learn how to manage their own behavior (Landry et al., 2013).

Before executing this study, researchers made common observations throughout the 65 classrooms. These observations aided in creating baseline data which included little evidence of daily schedules, lesson plans, predictable routines, or the implementation of learning activities. The goal in training the teachers in the RECC and RECC+ classrooms was to not only improve upon the baseline observations but also enhance responsive teacher-child interactions as well as responsive teacher behaviors (Landry et al., 2013).

In order to accomplish this, teachers in the RECC and RECC+ classrooms attended professional development during a 6-week period in the spring where they could practice implementing the curriculum before the study began. After that four more training sessions throughout the school year. They also had access to a coach who provided weekly support to the staff (Landry et al., 2013).

First, the teaching behaviors that were observed in both the RECC and RECC+ classrooms were significantly favorable over the control group. In short, comparing post-teacher behaviors from the baseline data, the RECC and RECC+ classrooms went from implementing virtually nothing to executing a full-blown curriculum in one year (Landry et al., 2013).

Second, the data that was collected from the students participating in the study was remarkable. While there were no significant differences between the RECC and

RECC+ classroom results, there were notable discrepancies between them and the control rooms. The results are as follows.

In regard to emotional understanding, the toddlers in the intervention groups scored higher in expressive, receptive, and situational emotion tasks than the toddlers in the control rooms. Teacher-child relationship quality was higher in both the RECC and RECC+ rooms than in the control groups. The intervention groups showed more change pertaining to social competence over the year compared to the control rooms who showed no change over time (Landry et al., 2013).

Another study that is worth noting is one that was focused on entire families. Hundreds of low-income families were selected to participate in the New Hope project. While participating in this study these family's monthly incomes were increased by $125.89 on average depending on income and household size. Families were granted this supplemental income for two years. Researchers conducted a five-year follow-up to determine how this income effected their lives in several different ways (Huston et al., 2005).

Most notably are the effects the participation in this study had on the children in these households. Researchers looked at academic performance, competence (beliefs, values, efficacy), and social behavior. The children in the New Hope project showed positive impacts in all areas when compared to the control participants. When speculating on why these results were found there was one observation worth mentioning. The supplemental income gave the families the extra funding needed to pay for high quality childcare. Participants in the New Hope project spent significantly

more time in center-based care than did the control group children. While partaking in these center-based programs the children were better prepared for kindergarten which, in turn, provided them with a more successful start in school (Landry et al., 2005).

A similar study was conducted on families that included childcare assistance for participants. This was an exceptionally large study with 10,238 children between the ages of birth to twelve years involved in the data. Researchers worked with existing welfare programs to supplement income for these families. Supplemental income could only be spent on specific needs, one of which was childcare. The children participating in the experimental group spent much more time in center-based programs than did the control group children who mainly attended home daycares. The children who experienced the center-based care also experienced early school achievement in the elementary years when follow-up data was collected (Duncan et al., 2011).

The next step in early intervention for children growing up in poverty beyond high-quality childcare is attending a high-quality preschool. The following will review how excellent preschool programs make a positive impact on children growing up in low-income households and how participation in these programs can set these children on the path to success.

The first study to be highlighted was one that was completed in Massachusetts on a group of eighth-grade students. During the 2002-03 and 2004-05 school years Papay, Murnane, and Willett collected data on 155,000 first-time eighth grade students attending public schools across the state. Their data showed that the low-income students who had spent the most years in the Massachusetts public school system

outperformed their low-income peers who had transferred in from other districts (Papay et al., 2013). Most significantly, however, the researchers emphasize the gaps that exist between low-income and higher-income students. One such gap was the graduation rate between the two groups. Ninety-five percent of the higher-income students in this study went on to graduate high school while only 75% of the low-income students graduated (Papay et al., 2013). The first conclusion to be made by Papay and company was that early intervention, namely preschool, is key for our low-income children to close the achievement gap (Papay et al., 2013). Closer examination of a few programs will follow.

The Abecedarian Project was one that was created to house a childcare center and preschool in one facility. For the purpose of this research the preschool will receive the main focus. The families who were served by this center were all low-income households. Children attending this center could start as early as six weeks-old and continue attending until they were old enough for kindergarten. Recruiting for this study began in 1972 and ended in 1977. In all, 105 children participated throughout the eight-year project. The study that will be referenced is the 30-year follow-up on the children who attended this preschool program (Campbell et al., 2012).

The Abecedarian Project implemented a curriculum to "develop age-appropriate language, cognitive, socioemotional, and gross and fine motor skills" (Campbell et al., 2012, p. 1034). After participation in the childcare and preschool programs half of the original sample size went on to continue receiving interventions for the first three years of elementary school as well (Campbell et al., 2012).

Thirty years later, researchers reconnected with 101 of the original 105 children who participated in the Abecedarian Project in order to evaluate specific life circumstances. Researchers collected data on years of education, graduation rate, total income, employment, job prestige, earned income, use of public assistance, head of household, criminal behavior, marriage and children, mental health and social adjustment, substance use, and health status (Campbell et al., 2012).

First, the average years of education for the treatment group was 13.46 whereas the control group averaged 12.31 years. Second, 89% of the treatment group earned either a diploma or GED with 82% of the control group earning the equivalent. Expanding on that data, 83% of the treatment group earned a diploma while only 72% of the control group did the same. Likewise, 23% of the treatment group went on to earn a bachelor's degree or higher compared to only 6% of the control group. Two individuals from the treatment group had earned a graduate degree with two others working towards one while zero individuals from the control group earning a graduate degree (Campbell et al., 2012).

Moving on to the following data, researchers found that the average total income did not differ significantly between the two groups. However, when looking at employment, 75% of the treatment group worked full time when only 53% of the control group held down a full time job. Job prestige only slightly favored the treatment group with no reliable differences being found for head of household. Conversely, persons in the control group were six times more likely to receive public assistance at least 10% of the time during the seven years leading up to the follow-up study. Criminal

activity was virtually identical between the two groups while parenthood saw more positive outcomes. The average age of birthing the first child for the treatment group was nearly two years older than the control group. Roughly one quarter of each group was married at the age of 30 when the follow-up study was completed. Substance abuse and mental health were found to be almost equal between the two groups. Lastly, 69% of the treatment group rated themselves in excellent or very good health with 59% of the control group giving themselves the same rating (Campbell et al., 2012).

All this to say, the high-quality early childhood education these people received was associated with the positive outcomes that were found 25 years later. After determining the participants' family, community, and school influences researchers were able to point to the early, high-quality, intensive education each one received as a key to success later in life. Putting this program's value into a monetary sum, when the participants were 21 years-old the Abecedarian Project was estimated to have saved the public $2.50 for every dollar that was spent making this a worthwhile investment (Campbell et al., 2012).

Using a cost-benefit analysis of another project focused on enhancing early childhood education is exactly what founders of the Perry Preschool program had in mind. Barnett (1993) looked at the individuals who participated in the Perry Preschool 25 years after completing the program. Although this study is old, the benefits are worth examining as the data collected is never obsolete.

Individuals who participated in this study were born between 1958 to 1962. In all, there were 123 African American children all coming from low-socioeconomic

households who were chosen to randomly be assigned to either the control or treatment groups. The Perry Preschool consisted of daily 150-minute classes on weekday mornings accompanied by weekly 90-minute teacher visits to each student's home. Each school year lasted 30 weeks from October to May with teacher to student ratio being 1 to 6. All teachers were licensed public school teachers upon entering the program. Surprisingly, the curriculum that was implemented was not mentioned by name, just that the teachers taught with a Piagetian approach and executed a well-implemented plan (Barnett, 1993).

At the time of the follow-up research, Barnett was able to contact 117 of the original 123 participants. The data points that he highlights are similar to that of the Abecedarian Project and are as follows: 1) the cost to run the program, 2) childcare provided by the program, 3) elementary and secondary education, 4) adult education, 5) higher education, 6) employment compensation, 7) crime and delinquency, and 8) public welfare (Barnett, 1993). All dollar amounts are valued at the U.S. General Accounting Office 1992 recommendations (Barnett, 1993).

The cost to run the Perry Preschool was estimated at $12,356 per child which is quite expensive considering that number would be just under $20,000 in the year 2020. Perry Preschool also offered extended care hours when necessary charging $1.50 per hour which added up to be about $738 more per child throughout the duration of the program (Barnett, 1993).

Elementary and secondary education were examined under the lens of cost reduction per child in regard to special education services and years of schooling needed

to graduate high school. The students who attended Perry Preschool were less likely to require special education and more likely to graduate high school on time translating to a savings of $6,872 per child over his/her elementary and secondary educational careers (Barnett, 1993).

Adult education was analyzed next by determining the individuals who had not completed high school by the age of 19 and required adult education courses to complete a GED. The cost of the courses was calculated per person at $283 (Barnett, 1993).

Post-secondary education was next on the list. Researchers took into consideration whether a two- or four-year degree was being earned or had already been achieved by age 27. The participants in the program were more likely to go on to higher education than those in the control group. This caused Barnett (1993) to consider the increased cost of education by the increase in participation giving a value of $868 per person.

Employment compensation benefits were determined subsequently in two phases. The first phase was established by examining earnings and fringe benefits through the age of 27 with the second phase being a projection of earnings and fringe benefits from the age of 28 to 65 years of age. The first phase was calculated to be $14,498 per person while the second phase was projected to be $15,833 per person. These earnings and fringe benefits were concluded to be total effects of participation in the Perry Preschool (Barnett, 1993).

Close examination of police and court records indicated a reduction in juvenile delinquency and crime for individuals from Perry Preschool. The effects of the preschool program were again calculated in two phases for victim and criminal justice system costs. Phase one was up to age 28 and phase two was 28 years-old and beyond. Costs were determined by criminal justice system cost per arrest by type of crime including incarceration and probation if required. "The preschool program was estimated to reduce the present value of crime costs (victim and criminal justice system) by $49,044 per person through age 28" (Barnett, 1993, p. 505). The value of the projected cost savings in terms of victim and criminal just system expenses beyond age 28 was $21,337 (Barnett, 1993).

Welfare costs were again separated into two phases. The first phase was through age 27 while phase two was, again, a prediction of age 27 and beyond. The effects of the preschool program were valued at $2,193 per person for phase one and $460 per person beyond age 27. Societal gains were less fruitful as direct savings were ultimately $219 per person for phase one and $46 per person for phase two due to the way in which welfare and Medicaid were distributed (Barnett, 1993).

Taking each data point into consideration, the cost-benefit analyses of the Perry Preschool was calculated at $108,002 of gains beyond preschool compared to the $12,356 it took to put each child though the program. The net value of the high-quality preschool program was over $95,000. The benefit-cost ratio for this study is 7:1 which is quite remarkable for a government program (Barnett, 1993).

One school district in Salinas, California, took note of the positive effects that high-quality preschool programs have on children from low-income families and instituted a program of their own. Back in 1999, the superintendent of Salinas City School District surveyed the staff who taught the primary grades in the district what he could do to bolster education. They answered with resounding unity that they wanted to see a preschool program in each of the elementary buildings. Thus began a study involving the children in this district who attended the preschool program versus those who did not (Slaby et al., 2005).

No mention was made of the specific curriculum that was implemented, just that it encompassed oral language, academics, motor-skill development, as well as social-emotional development. Teachers recorded the progress on students in each of these areas three times a year for five years, starting in preschool and ending in third grade. Parent involvement at the preschool level was also required with two parents representing each of the classrooms on a Parent Advisory Committee that met once a month (Slaby et al., 2005).

Because this study was used to measure academic gains, those were the only results shared from this study. Of the children participating in the Salinas City School District preschool program, 75% of the students were living in poverty. The students in the program were compared to two control groups. The first control group was children who did not attend preschool and were living in poverty while the second control group included a broader sample of all students who did not attend preschool (Slaby et al., 2005).

Standardized assessments began in second grade in both English Language Arts (ELA) and Mathematics. Twenty-four percent of the students who attended preschool scored proficient and above on the ELA exam compared to only 9% of students in group one and 10% from the second group. The results for math were even more promising with 50% of the preschoolers testing proficient and above compared to 34% from group one and 31% from group two doing the same (Slaby et al., 2005).

The effects of the preschool program were seen on these standardized assessments in third grade as well. Eighteen percent of the preschoolers tested proficient and above on the ELA exam compared to 14% from group one and 10% in group two. In mathematics, 41% of the students who participated in the preschool program tested proficient or above compared to 35% in group one and 28% in group two. By the end of this study eight elementary schools in the Salinas City School District added preschool programs that serve the community. While the social-emotional data was not shared in the results, the academic gains alone provide enough evidence that high-quality preschool programs better prepare students from low-income homes to be successful beyond preschool years (Slaby et al., 2005).

Another, more recent, preschool worth examining is the Head Start REDI (Research-based Developmentally Informed) program. The classrooms that participated in this study were located in Pennsylvania and served a population of which 70% were living in poverty. 356 children were recruited in their final year of Head Start and were then followed into elementary school through grade three. At the end of the study, researchers were able to accumulate data on 325 children from the original sample size

due to families leaving the area and/or dropping out of the study. Students in the Head Start REDI program were compared to children who attended Head Start (business-as-usual) (Nix et al., 2016).

In the Head Start REDI program, teachers focused on four evidence-based elements honing language-emergent literacy skills and social-emotional functioning. These elements were taught using sound games and centers for language/literacy skills. The social-emotional aptitudes were taught using the PATHS (Promoting Alternative Thinking Strategies) curriculum which focuses on "social competencies, emotion regulation, and control of aggressive impulses" (Nix et al., 2016, p. 313).

In order to be fully equipped to teach these skills successfully teachers were trained extensively along with weekly meetings with a REDI coach. REDI coaches spent three hours per week in the classroom with the teachers and one hour per week meeting with teachers. The Head Start, kindergarten, first-, second-, and third-grade teachers who taught students from the study rated them in three areas at the end of each school year: social behavior, learning behaviors, and interpersonal relationships (Nix et al., 2016).

Social behavior was broken into two categories with the first being social competence. Students who participated in the Head Start REDI program compared to Head Start were more likely to fall in the high-increasing developmental trajectory with 33% of REDI students compared to 21% of Head Start as usual. The second social behavior category that was measured was aggressive-oppositional behavior.

Participants from the REDI program, 53%, were more likely to follow the low-decreasing trajectory than the business-as-usual group, 37% (Nix et al., 2016).

Likewise, learning behaviors was also broken down into two categories. First, researchers looked at learning engagement and found that students who participated in the REDI program were more likely to follow the high-stable trajectory than their counterparts with 43% of the treatment group versus 29% of the control group aligning with this classification. Second, researchers observed ratings on attention problems. Children in the REDI program were more likely to follow the low-stable trajectory in this category, which is a good thing, with 36% of them qualifying for this rating and 26% of business-as-usual students landing here (Nix et al., 2016).

Lastly, researchers gathered data on interpersonal relationships which were also divided into two classifications. Classification number one was student-teacher closeness. Once again, students who participated in the REDI program were more likely to fall in the high-stable trajectory with 54% versus the business-as-usual children at 40%. Classification number two was peer-rejection which found 72% of REDI participants landing in the low-variable trajectory as opposed to 60% of the control group (Nix et al., 2016).

Although Head Start has a long history of getting children ready for kindergarten successfully, Head Start REDI had even better results by adding the social-emotional component that so many children are missing. One study said it best when the authors wrote, “The magnitude of the benefit of being in Head Start REDI compared to Head Start as usual on children’s optimal developmental trajectories is comparable to the

magnitude of the benefit of not smoking or maintaining a healthy weight on preventing heart attacks" (Yusuf et al., 2004).

## Specific Intervention Strategies

Knowing which interventions are the most beneficial for our students living in poverty will guide childcare centers, preschool programs, curriculum writers, and policymakers on what to implement on behalf of our future. The following are a number of interventions that have been documented for this very reason.

The teaching of self-regulatory skills often gets pushed to the side to make more time for the core subjects. In doing this, our children are missing out on vital abilities necessary for life both in and beyond school. One study conducted by Blair and Raver looked into the cognitive effects the teaching of self-regulation and executive function had on a group of children.

Twenty-nine schools representing twelve school districts agreed to participate in the study implementing a curriculum labeled Tools of the Mind. In the end there were 79 classrooms involved in the study. Forty-two of those were placed in the treatment group and 37 were in the control group. Fifteen percent of the schools were considered high poverty (75% or greater receiving free/reduced lunch), 50% were considered low poverty (less than 25% of students receiving free/reduced lunch), and the remaining schools ranged from 27%-68% of the student body receiving free/reduced lunch (Blair & Raver, 2014).

Blair and Raver recruited six children from each classroom to be the representative sample for the two-year study. In Year 1, they had 229 students

representing the treatment classrooms and 167 students representing the control classrooms. In Year 2 they had 214 from treatment rooms and 149 from control classes (Blair & Raver, 2014).

Teachers of the treatment classes were trained in Tools of the Mind for the two years that the curriculum was implemented and had access to a coach as well. Control teachers went on teaching as they had done in the past. Tools of the Mind is a curriculum that is designed to teach children self-regulatory skills in kindergarten through intentional make-believe play and teacher-supported social interactions with peers. It is also designed to encourage academic learning by focusing on self-regulation, specifically how to respond in stressful situations (Blair & Raver, 2014).

In order to establish a baseline date between the treatment and control students, Blair and Raver found that there were no differences in all assessed variables in the fall of kindergarten in both years of the study. The spring of those same years, however, resulted quite differently (Blair & Raver, 2014).

Blair and Raver noted differences between the groups in the areas of working memory, reaction time, attention, processing information, stress response, and academic progress. The first five areas listed showed significant growth in the students from the treatment classrooms when compared to the control students. Academic progress also showed encouraging results deserving closer observation (Blair & Raver, 2014).

Academic progress was measured in a number of ways. Researchers looked at math, reading, vocabulary, and reasoning as indicators of academic gains through

kindergarten. What Blair and Raver found was that the greatest gains on all variables were seen in the high poverty schools with the exception of vocabulary. Overall, the students in the treatment classrooms, regardless of income level, made gains over the control students in every area. Differences in reading ability were even seen through spring of first grade for the students in Year 2 of the study. In short, Tools of the Mind had obvious effects on social-emotional learning and, more surprisingly, academic gains that were not taught through this curriculum but were found to be the positive residual effects of an intervention concentrated on teaching self-regulatory skills (Blair & Raver, 2014).

A different curriculum that was implemented by teachers and studied by researchers is called PATHS, which stands for Promoting Alternative Thinking Strategies. This study is unique in that researchers followed the implementation of this curriculum over a three-year period. Additionally, children who were labeled with the worst behavior problems in kindergarten were selected to be part of a smaller intervention group called Fast Track within the treatment classroom. This intervention group involved weekly parenting support classes, small-group social skills interventions, academic tutoring, and home visits. The implementation of PATHS in the classroom began simultaneously with Fast Track (Greenberg et al., 2010).

The sample size consisted of 36 elementary schools in three areas across the United States. There were twelve schools in Nashville, Tennessee, twelve in Seattle, Washington, and twelve in rural central Pennsylvania, Six schools in each area were chosen as the treatment schools and six were appointed as control schools in order to

make equal comparisons across the sites. Altogether, there were 2,937 children who participated in this study (Greenberg et al., 2010).

Nashville and Seattle each had three urban districts that were part of the study. These urban settings served transient populations making retention difficult for researchers. In Nashville, only 30.9% of the original 1,560 children were present at the end of the three-year study. Similarly, in Seattle, only 41.6% of the initial 1,825 children participated in all three years. Conversely, rural Pennsylvania utilized three small school districts that retained 75% of the original 1,696 students throughout the study (Greenberg et al., 2010).

The mean percentage of schools serving free/reduced lunch was 57%, with Pennsylvania being the lowest at 39% and Nashville being the highest at 78%. Ethnic minority was determined to average at 36% again with Pennsylvania being the lowest and Nashville being the highest. The mean reading percentile was found to be 45$^{th}$ with Nashville falling in the 32$^{nd}$ percentile and Pennsylvania coming in at the 57$^{th}$. There were no significant differences between the control and treatment schools in these areas (Greenberg et al., 2010).

PATHS was implemented from first to third grade. There were 57 lessons that were taught in first grade, 46 in second, and 48 in third. In each grade there were some new lessons that were created specifically to coincide with the parent and social skill training that was happening in the Fast Track small groups. Teachers in the treatment classrooms attended a two-day training workshop and received weekly meetings and observations from the project staff (Greenberg et al., 2010).

Looking at the lessons across all three grade levels, about 40% of them focus on understanding and communicating emotions. These lessons teach "young children to recognize the internal and external cues of affect and to label them with appropriate terms, as a basic step toward self-control," (Greenberg et al., 2010, p. 160). In order to accomplish this, teachers taught feeling words along with situations when that feeling would likely be felt. They also distinguished feelings from behaviors followed by appropriate versus inappropriate behavioral responses. Children were encouraged to evaluate how they felt at the beginning and end of the day as well as after recess and lunch (Greenberg et al., 2010).

Positive social behavior was the emphasis of 30% of the lessons across all three grades. During these lessons, the students were taught how to make and maintain friendships, using good manners, taking turns, sharing, expressing your viewpoint, and listening to others (Greenberg et al., 2010). In first and second grade these lessons were reinforced by practicing the objective. In third grade the lessons were taught in small student-led groups.

The final 30% of the lessons taught self-control and other social problem-solving skills. These two components were integrated using the Control Signals Poster (CSP). The CSP was modified from the Yale-New Havern Middle School Social Problem-Solving Program stoplight. The CSP has a red light signaling "Stop-Calm Down," a yellow light reminding students to "Go Slow-Think," and finally a green light signaling "Go-Try My Plan" (Greenberg et al., 2010, p. 160). At the bottom of the poster there is a reminder for the students to evaluate how well their plan worked.

Teachers implementing the PATHS curriculum were encouraged to reference the lessons throughout the day during appropriate situations when students could see the benefit of utilizing skills that were taught that day. For problems that could not be solved between students, PATHS classrooms had a mailbox where students could submit problems they needed help solving. These problems would get discussed with a teacher during a designated time (Greenberg et al., 2010).

The greatest outcomes for this three-year study were evident at the end of third grade. Students who attended the intervention schools "had significantly lower problem levels at Grade 3 and less of an increase in problems than did children in the control schools," (Greenberg et al., 2010, p. 163). The students who qualified for the Fast Track program due to severe problem behaviors in kindergarten showed the most growth in the area of aggression problems (Greenberg et al., 2010).

One interesting result was how the intervention schools that held a student body with about 50% or less requiring free/reduced lunches saw the most positive growth between first and third grade in social competence and aggressive behaviors. Sadly, the schools serving the high-poverty populations (over 75% of students needing free/reduced lunch) did not see the growth that was hoped for. However, there was no way to report if the teachers in the intervention schools were teaching with fidelity which is something that would need to be amended if this study were to be replicated (Greenberg et al., 2010).

While Tools of the Mind and PATHS sought to teach self-regulatory skills, another study looked at how those skills already in existence can protect the individual

from the negative effects of growing up in poverty. Evans and Fuller-Rowell enlisted 241 children (roughly half female and half male) to participate in the study. Approximately half of the sample grew up below the U.S. federal poverty line while the other half would be considered middle class. All participants lived in the rural Northeast United States and were assessed at ages 9, 13, and 17 (Evans & Fuller-Rowell, 2014).

At age nine, participants were tested on self-regulatory ability using a delayed gratification protocol. At ages nine and 13 individual's chronic stress was evaluated followed by a working memory test at age 17. Results indicated that the participants who spent the most time living in poverty had elevated chronic stress along with worse working memory as a 17-year-old (Evans & Fuller-Rowell, 2014).

However, Evans and Fuller-Rowell also found that the children who performed well in the self-regulatory test also scored higher on the working memory assessment as a 17-year-old. Self-regulation requires a developed prefrontal cortex in order to function properly which in turn increases working memory. Researchers concluded that children who have greater self-regulatory skills are better at focusing on what is important while not being sidetracked by outside stimuli thereby insulating them from many of the negative effects of growing up in poverty (Evans & Fuller-Rowell, 2014).

Two specific interventions that can help children from low-income homes achieve success both during school and after graduation come from the same study. These interventions pertain to high school students during their secondary school experience and when planning what to do after school. These interventions are parent involvement and mentoring.

A study that was conducted in Birmingham, UK, looked closely at students who attended an all-male high school. This school was named Metropolitan Beacon School for the sake of anonymity. It was one that drew students from all over the area based on test scores from Grammar School. The boys who attended Metropolitan Beacon School had to achieve high grades in order to be accepted and then maintain those grades in order to stay at the school through graduation (Collins et al., 2015).

Metropolitan Beacon School had students attending from a variety of neighborhoods, socioeconomic statuses, and ethnicities. The goal of Collins, Collins, and Butt was to determine if social mobility was taking place versus social reproduction in terms of boys from lower-income homes moving up to the middle or upper class after graduation. The hope for the boys at this school is that they would be accepted into a good university then go on to a fruitful career that would boost them into a higher class (Collins et al., 2015).

The sample size for this study was 625 boys who attended Metropolitan Beacon School. This group was divided into three smaller groups based on the academic achievement determined by current grades. Those three subgroups were labeled high, medium, and low achievement. Students were then mapped out around the area using color-coding to reveal where the bottom 30% lived (Collins et al., 2015).

Data revealed that the lowest achievers fell into three categories. First, the boys who lived furthest away from the school performed worse on tests than did those who lived close. Second, boys who came from an ethnic minority produced worse grades than their white classmates. Third, the boys who lived in low-income neighborhoods did

not succeed equally with the students who came from middle- and upper-class areas of the city (Collins et al., 2015).

As revealed in the questionnaires done by the students themselves, the boys defined their own potential either by where they lived or what their friends planned on doing after high school. After analyzing this finding, Collins, Collins, and Butt suggest that these specific low-achieving students have a mentor assigned to them while at Metropolitan Beacon School. Specifically, a mentor who is also a former student from the program and/or boys who are at the end of their secondary education mentoring those who are just beginning. The second recommendation is to increase communication between the school and parents, offering tips on how to support their sons while in school. The hope in accomplishing these goals would be to move people up the class ladder (Collins et al., 2015).

Focusing on literacy skills while children are still very young is an intervention suggested by Norwalk, DiPerna, Lei, and Wu in a study conducted on preschoolers. The purpose of this study was to determine if there are differences in literacy skills amongst preschoolers from low-income households and then decide how best to meet the specific needs in order to move these students to be reading at grade level (Norwalk et al., 2012).

In this study, researchers recruited participants from the last year of a 3-year study of students enrolled at a Head Start program in the Northeast United States. The children used for data were the 4-year-olds in their final year of preschool. The total

number of participants was 166 children all coming from low-income homes (Norwalk et al., 2012).

Researchers found that the preschoolers could be separated into three groups according to reading ability, which is as follows. Group one was labeled *low skill* having the lowest average scores on EARLI (Early Arithmetic, Reading, and Learning Indicators) literacy tasks which are "alphabet recitation, expressive vocabulary, letter naming, letter sounds, segmenting, and sound deletion" (Norwalk et al., 2012, p. 173). Group two was labeled *high skill* with the highest mean scores, and group three was titled *mixed skill* because these children had the greatest variability across the EARLI literacy tasks (Norwalk et al., 2012).

After analyzing these results, researchers decided that the best action teachers can take to accurately assess students early one. Norwalk et al. suggest the best time for this is during the preschool years. Once teachers and support staff know where the holes are for each student, they can teach to the needs of the individual child. Also, students who are coming from a preschool program who have gone through literacy assessments can have that information go with them to kindergarten, so appropriate interventions can be put in place immediately (Norwalk et al., 2012).

All of this is especially important for students coming from poor homes because they often come to school with deficits in language and early literacy skills, putting them at a higher risk for future failure. Intervening with knowledge about where the specific deficits are for each child is what teachers can do to get these students at the same level as their peers (Norwalk et al., 2012).

Another literacy intervention developed to boost children growing up in poverty is called Project Athena. The goals of this project are four-fold: 1) "To implement, refine and extend research-based language arts curricular units of study in grades 3-5" (VanTassel-Baska & Stambaugh, 2006, p. 59), 2) "To develop and implement professional training models for teachers, administrators, and broader school communities" (VanTassel-Baska & Stambaugh, 2006, p. 59), 3) "To develop and implement instrumentation sensitive to low-socioeconomic learners for the purpose of identification and assessment of learning" (VanTassel-Baska & Stambaugh, 2006, p. 59), and 4) "To conduct research on short-term and longitudinal student learning gains, as well as the mechanisms that promote the institutionalization of innovation through scaling up" (VanTassel-Baska & Stambaugh, 2006, p. 59).

Project Athena had a random sample of 2,113 students, 39 experimental and 38 control teachers participate for three years. The curriculum was developed at the College of William and Mary with the intent that it would benefit students attending Title I schools, encouraging each of them to utilize higher-order thinking skills in regard to literacy (VanTassel-Baska & Stambaugh, 2006).

The curriculum consists of 24 lessons taught over a period of three months in grades three, four, and five. The lessons include a focus on the following goals: "develop literary analysis and interpretations skills, develop persuasive writing skills, develop linguistic competency, develop listening and oral communications skills, develop reasoning skills, and develop a conceptual understanding (i.e., concept of change)" (VanTassel-Baska & Stambaugh, 2006, p. 60).

Project Athena participants are assessed on a pre-post test model that tests growth in the areas of "critical thinking, general reading comprehension, specific curriculum-based proficiency and literary analysis and persuasive writing, and state proficiency in language arts" (VanTassel-Baska & Stambaugh, 2006, p. 62). The experimental teachers were assessed twice a year by observers who were looking for fidelity in teaching the curriculum as well as the use of differentiated instruction to promote higher level thinking and problem solving (VanTassel-Baska & Stambaugh, 2006).

Data was collected two years into this project with the following results. Students in the experimental classrooms did markedly better than the control students in critical thinking and comprehension. Results between genders were minimal, meaning both boys and girls performed well in the experimental group. Experimental students from all abilities and ethnicities showed significant gains. Teachers in the experimental classrooms scored substantially higher on the regularity and effective use of differentiated instruction. Experimental teachers in the second year of the project showed considerably greater use of differentiated strategies over first-year experimental teachers (VanTassel-Baska & Stambaugh, 2006).

Conclusions from these results are that developing literacy skills in children growing up in poverty is possible when done using a "high-powered curriculum" taught with fidelity by highly trained teachers. This encourages students to be engaged in and take ownership of their own learning as opposed to simply teaching low-level skills that

develop uninterested learners who simply go through the motions (VanTassel-Baska & Stambaugh, 2006).

Another program that supports literacy development for impoverished children is Write to Read. This four-year study conducted in low-income schools in Ireland showed the effects of a curriculum focused on intrinsic motivation, engagement, and self-confidence as integral parts of strong literacy achievement.

In Ireland, a large literacy gap exists between children attending disadvantaged versus non-disadvantaged schools. Write to Read was written for elementary schools serving children ages 4- to 12-years-old with an emphasis on "motivation, engagement and literacy" for the entire school (Kennedy, 2018, p. 717). Data shared in this paper was drawn from three schools participating in the study. One small school with less than 100 students, one large school with more than 250 students, and one medium school with somewhere between 100-250 students (Kennedy, 2018).

Data collected during this study was done so using interviews, questionnaires, focus groups, and video recorded lessons from teachers, students, principals, and parents. Data was also gathered from standardized test results.

Professional development was provided for teachers participating in Write to Read. Each school also had a mentor coach who visited once every two weeks during Year 1, once a month during Year 2, and less often during Years 3 and 4 "as schools took more ownership of the change process" (Kennedy, 2018, p. 720).

Interestingly, Write to Read is not a packaged curriculum to be followed with fidelity. It is one that is written with a framework of flexibility, encouraging teachers to

use it and make it their own based on the needs of the students. What this curriculum did provide was a framework for how daily literacy lessons should be taught as well as direction on the systematic approach regarding word-identification, spelling, comprehension, and writing strategies (Kennedy, 2018).

In order to increase reading enjoyment, teachers were encouraged to provide reading level appropriate texts of interest (provided through funding from the study) to the students along with time to read in class. This was the result of teachers and principals noting the scarcity of high-quality, age-appropriate books available in each class during Year 1 of the study. Once these texts were placed in classrooms, every child interviewed, save one, during a focus group could name a favorite title and/or author and also claimed to be reading at home just for fun or before bed (Kennedy, 2018).

Autonomy support and relevance were implemented by teachers by sharing control in the classroom in several areas surrounding literacy. This was done in order to increase "intrinsic motivation, participation, and enthusiasm for learning" (Kennedy, 2018, p. 721-22). Students and teachers worked together to make small flexible reading groups that were ability-mixed based on text selection and interest. Students then had a choice in how they responded to the text (Kennedy, 2018).

Multiple reading strategies were taught to children pertaining to making sense of the text. Students were then instructed to choose the strategy best suited for the situation in order to comprehend what was being read. In addition to comprehension, the reasoning behind providing strategy choice was to increase behavioral engagement to persevere through challenging texts (Kennedy, 2018).

Furthermore, students were given time each day to discuss books being read during small group reading. In fact, group members were given time to read the book before meeting so that the instructional small group time could be used for high-quality student-led discussions with teachers present to help deepen the conversation if necessary. Teachers noted that "even children who were reluctant readers began to engage more as they witnessed the conversations and involvement of their more able peers" (Kennedy, 2018, p. 724).

Allowing students time to read the text before meeting in a small group meant that these same students were formulating discussion topics and questions to bring to the group. By providing the time and space to accomplish this task, teachers were promoting self-efficacy amongst the group. Teachers noticed the biggest difference amongst students who typically struggled with writing, noting that these students had found a way to participate with their group because they were not being held back by writing inabilities (Kennedy, 2018).

The findings of these four-year study are five-fold. First, providing professional development for the teachers participating in this study was of utmost importance. These sessions supported teachers in creating a systematic literacy plan that was student-centered, whole school-oriented, and classroom specific. Professional development also helped teachers solidify knowledge in the systematic approach of teaching literacy (especially in the younger grades) (Kennedy, 2018).

Second, allowing students to choose their small group by choosing the text communicated the importance of reading for pleasure in order to enhance other

abilities. "Providing choice of book and daily time for reading and space for interpretation, dialogue and construction of meaning opened the door for many children who for the first time began to see reading as a pleasurable activity worth investing time in" (Kennedy, 2018, p. 726).

Third, students benefited from this approach regardless of reading level. However, students in the lowest percentile of the classes benefited the most. Those lower students showed the most growth in "language and articulation of reading strategies" when reading more challenging texts (which were chosen because the student was interested in it and not because it was assigned to them) (Kennedy, 2018, p. 727).

Fourth, these mixed-ability groups could be successful because of the support provided by learning-support teachers or what we would consider Title 1 teachers. Groups were kept small, so all students would have time to participate in the high-level discussion with a trained, licensed teacher present (Kennedy, 2018).

Last, teachers found that the more they recorded themselves teaching and then took time to reflect on that lesson, the better they taught in the future. Researchers encouraged teachers to focus on the "nature and quality" of interactions during a lesson in order to increase engagement (Kennedy, 2018, p. 727).

More research indicating literacy is of utmost importance for children living in poverty was conducted in Argentina. Ninety children participated in this study. All of them came from low-income homes with 38% of them living in extreme poverty. Extreme poverty outside of Buenos Aires consists of "overcrowding, lack of drinkable

water, plumbing and/or natural gas networks, and a lack of waste disposal systems" (Diuk et al., 2019, p. 75). The goal of this study was to determine the differences in literacy performance between children from low socioeconomic backgrounds. The results are then utilized to put educational suggestions forth as a means to level the playing field.

All 90 participants were placed into three groups based on reading ability. Group one was the reading difficulties (RD) group, with 30 children (14 were girls). Group two was the chronological age (CA) group, with 30 children (18 were girls). Finally, group three was the reading age (RA) group, with 30 children (18 were girls) (Diuk et al., 2019).

Now for the rhyme and reason on grouping the participants. The 30 students who were placed in the RD group were determined to be reading at least three years below his/her chronological age. The mean chronological age for this group was ten years three months while mean reading age was 6 years three months old. Students in the CA group were matched with those in the RD group, however, those in the CA group had no significant reading delays with a mean age of 10 years two months. Children in the RA group were matched with children in the RD group because they were reading at the same level but were younger. The RA group's average age was 6 years three months (Diuk et al., 2019).

All participants were put through a battery of tests and are as follows. Reading was assessed using high-frequency words, medium- and low-frequency words, and pseudoword reading (or what we would call nonsense words). Spelling was assessed

using 31 real words (11 high-frequency, 10 medium-frequency, 10 low-frequency) and 20 pseudowords. Phonological sensitivity was determined by assessing syllable tapping, phonological identification, and phoneme segmentation. Rapid automatized naming was assessed using letter knowledge and vocabulary. Lastly, memory was tested using a digit span task (Diuk et al., 2019).

Participants were tested in each one of these areas during six half-hour sessions in a quiet room while at school. Tests were administered by a trained educational psychologist who was trained extensively for this research. Results are shared in two comparisons. The first is the RD group versus the CA group. The second is the RD group compared to the RA group.

The first comparison looking at the RD group data against the CA group data revealed that the children in the RD group "performed significantly worse on almost all tasks" than the CA participants. The only areas in which no differences were found were the syllable identification task, initial phoneme recognition, and expressive vocabulary. In no category did the RD group outperform the CA students (Diuk et al., 2019).

The second comparison between the RD and RA groups revealed mixed results. No differences were found in syllable tapping, phoneme segmentation, phonological memory tasks, and vocabulary tests. Overall, the RD children only displayed shortfalls in phonemic segmentation and letter-sound knowledge (Diuk et al., 2019).

Researchers suggest that the difficulties experienced by the RD children compared to the RA group are a "result of the interaction between their cognitive and

linguistic vulnerabilities and suboptimal education opportunities" (Diuk et al., 2019, p. 90-91). Likewise, when compared to the CA group the RD students knew just as many letter names, however, showed a deficit in letter sounds. This suggests that the RD students have no problem acquiring "verbal-visual associations" but do, however, experience inadequate educational experiences (Diuk et al., 2019, p. 91).

The main educational takeaway for teachers is the importance of teaching "grapheme-phoneme correspondences and phonemic awareness" (Diuk et al., 2019, p. 91). In doing this, children will experience growth in the areas necessary for greater reading accuracy (Diuk et al., 2019). The earlier these teaching practices are put into place the more success the student will experience.

The last intervention that will be reflected on is how the arts can positively influence children from low-income households. Brown, Garnett, Anderson, and Laurenceau conducted a study involving children living in poverty and how participating in the arts effected cortisol levels, which are an indication of a hormonal reaction to stress (Brown et al., 2017).

Cortisol is a hormone that can easily be measured using simple saliva samples. Cortisol levels peak 20-25 minutes after the onset of acute stressors (Brown et al., 2017). Studying and observing effects cortisol has on one's healthy functioning is integral for our children living in chronic stress due to prolonged exposure to poverty (Brown et al., 2017).

Participants for this study were 310 children ages 3-5 attending a Head Start preschool in Philadelphia, Pennsylvania between 2008-2012. 79% of the families were

poor and 100% of them were low-income. These children were randomly assigned to participate in varying art and homeroom classes throughout the week. A cortisol baseline was established by taking a saliva sample in the morning with a later sample being taken after an arts or homeroom class. These samples were gathered at the beginning, middle, and end of the school year (Brown et al., 2017).

This study incorporated music, dance, and visual arts taught by highly credentialed teachers within the Head Start program. Both the music and dance teachers held bachelor's degrees in their respective areas as well as teaching licenses. The visual arts teacher held a master's degree in visual arts along with her teaching license. The homeroom teachers all held bachelor's degrees and certification in early childhood education (Brown et al., 2017).

Each arts teacher merged various cultures into what they were teaching to offer a diverse experience for their students --One that would reflect the world around them. All classes ran around 45 minutes in length and integrated a mix of "individual, small group, and large group activities; fine and gross motor activities; and free versus teacher-directed activities" (Brown et al., 2017, p. 1371). Lead and assistant teachers accompanied their group of students to each class in order to keep the student to teacher ratio low.

Results indicated that while lower cortisol levels were found after both homeroom and arts classes, the levels were the lowest after an arts class. The results also revealed that these levels were more evident as the year went on, implying that the more the arts were experienced by the participants, the greater the effects were on

decreasing stress levels. Lowering cortisol levels can play a significant role in the healthy development of the prefrontal cortex, frontal lobes, hippocampus, and amygdala. All of these areas of the brain impact decision-making and cognitive skills that play a large part in determining success in school (Brown et al., 2017).

## Importance of Effective Teachers and Leaders

Within the schools or childcare centers where children living in low-income households are receiving his/her interventions, there must be strong, consistent teachers and leaders. The following studies examine this form of leadership and its effect on the student's academic experience.

The first studied analyzed how teacher expectations disproportionately affect high school students from poor households. Sorhagen (2013) conducted a study starting with students in first grade and ending with those same student's high school performance than comparing that performance to the first-grade teacher's academic expectations for that child.

Sorhagen recruited participants from 24 hospitals across the United States at birth in 1991. The final number of mother-infant dyads who met all criteria for participation was 1,273. Of those dyads, 24% were ethnic-minorities, 10% of the mothers had less than high school education, and 14% of the mothers were single parents. Assessments of the children were done at 6, 15, 24, 36, and 54 months-old then again in 1$^{st}$, 3$^{rd}$, and 5$^{th}$ grades with a final assessment taken at 15 years-old. Assessments consisted of observations of families and school settings, parent and teacher behavior reports, and standardized test results (Sorhagen, 2013).

One positive result from this study was that teachers did not have misperceptions of a student's ability that was tied to the child's ethnicity. Sorhagen stated, "there was no evidence that teachers' misperceptions of abilities were influenced by a student's membership in multiple stigmatized groups" (Sorhagen, 2013, p. 470). What did seem to impact the way a teacher viewed a student's academic ability was tied to how well the child exhibited self-control and the gender of the child. For example, teachers had a tendency to overestimate the language skills of the female students (Sorhagen, 2013).

One negative result from the study was that high school students whose first-grade teachers underestimated their academic abilities "performed significantly worse on standardized tests of math, reading comprehension, vocabulary knowledge and verbal reasoning than would have been predicted on the basis of their early test scores" (Sorhagen, 2013, p. 472). The opposite was found to be true as well. When a child's academic abilities were overestimated by the first-grade teacher, they performed better than early test scores had predicted. In conclusion, the misperception of a child's academic abilities can have an effect on the child's academic performance 10 years later (Sorhagen, 2013).

Another study that focused on leadership in a rural Missouri school district examined how it affected its low-income student body. Horst and Martin looked at the expectations, teacher best practices, consistency, and student-teacher relationships that were made a priority in a low-income K-8 school (Horst & Martin, 2007).

In this study, researchers focused on one K-8 rural Missouri school in which the principal was also the superintendent of the district. The superintendent/principal had worked in the district for more than ten years and had deep roots in the community. Most parents had attended this school as children (sometimes even the grandparents had attended the school as well) and, as such, were deeply invested in the school. For anonymity's sake the school is referred to as Twin Lake School and the superintendent/principal is called Mrs. Hudson (Horst & Martin, 2007).

Horst and Martin first wanted to know what qualities Mrs. Hudson must need to possess in order to achieve consistent success. They concluded that she held herself, the staff, and the students to high expectations, she kept up with educational research and communicated that knowledge with the staff, and she performed the observations for her staff giving honest, thorough feedback (Horst & Martin, 2007).

Next, researchers wanted to know what processes Mrs. Hudson employed to lead teaching and learning. They found that she instituted ongoing reading assessments on all students in order to establish a baseline of data, which then accumulated as the student moved up in grade levels. Teachers were then expected to develop interventions for the students who were below grade level. Retired teachers were brought in to work with those students who were struggling to read at grade level. Mrs. Hudson also brought in MAP testing for use as another source of data for teachers to determine needs of the students. Lastly, she and her staff chose field trips specifically to broaden the student's experiences that would most likely not happen at home because of the income level of the families (Horst & Martin, 2007).

The third question researchers wanted to answer was what structures Mrs. Hudson "implemented that lead teaching and learning" (Horst & Martin, 2007, p. 37). Three structures were put in place by Mrs. Hudson that helped accomplish this goal. First, she introduced the Placement Alternative Classroom (PAC), where students who were having difficulty behaving in the classroom would go when they were having a difficult day. Before, the school would send them home or even suspend them for a few days. The PAC allowed students to receive counseling, reflect on what happened and what needed to change, and then complete the work they missed with a licensed staff member present to answer questions. The second structure Mrs. Hudson founded was a pre-school room in the building to start teaching those young children the rules and routines while forming positive relationships with them. Lastly, Mrs. Hudson formed a schedule with input from the staff that reserved blocks of time dedicated to the core subjects (Horst & Martin, 2007).

The fourth question researchers sought to answer was how Mrs. Hudson encouraged collaboration amongst the staff. She decided to form two groups of teachers. One was composed of the elementary staff, while the other was made up of middle school teachers. These groups were called Pods with one teacher leader in each group who would present data along with communication from the district to the rest of the group (Horst & Martin, 2007).

The final question researchers wanted to answer was how Mrs. Hudson encouraged collaboration with the community and board of education. The school operated with an open-door policy welcoming parents and other family members to eat

lunch with their students. Because of the long history of the school in the community, many members would attend school events to show support for the student body. Mrs. Hudson also kept communication with the board open, so the members had confidence in the goings on at Twin Lake School (Horst & Martin, 2007).

Another study that touches on teacher expectation, relationship, and consistency is one conducted by Lekwa, Reddy, and Shernoff from Rutgers University. Lekwa and company used the Classroom Strategies Assessment System (CSAS) to measure teachers' use and effectiveness of behavior management and evidence-based instruction. They also observed student engagement by using the Cooperative Learning Observational Code for Kids (CLOCK) (Lekwa et al., 2018).

The participants in this study were from the Northeastern part of the United States. There were 107 children ranging from kindergarten to 5$^{th}$ grade across 11 elementary schools in one district with high levels of poverty. This study was carried out during the fall semesters of 2015 and 2016 (Lekwa et al., 2018).

Observers were looking for three things while in the classroom: 1) "Discrete counts of defined teacher behaviors recorded during classroom observation (Strategy Counts)," 2) "Rating Scales of Instructional Strategies and Behavior Management Strategies completed by observers immediately following observations," and 3) "Classroom Environment Checklist (e.g., presence of class schedules, rules, physical arrangement)" (Lekwa et al., 2018, p. 111).

Strategy Counts consisted of four instructional strategies: "summarizing concepts, providing opportunities to respond, academic praise, and corrective

feedback" (Lekwa et al., 2018, p. 111). The Instructional Strategies Rating Scale included five elements: "adaptive instruction, student directed instruction, direct instruction, promoting students' thinking, and academic performance feedback" (Lekwa et al., 2018, p. 111). Lastly, the Behavior Management Strategies were made up of four areas: "proactive methods, directive, praise, and behavior corrective feedback" (Lekwa et al., 2018, p. 111). Observers made comments or counts under observed frequency and recommended frequency for each lesson (Lekwa et al., 2018).

Results indicated that the more the classroom teacher utilized effective behavior management strategies, "such as directives and corrective feedback," the longer a student stayed actively engaged in a lesson (Lekwa et al., 2018, p. 115). Student engagement also increased when teachers utilized higher quality teaching strategies. In fact, "teacher practices promoted student engagement which in turn predicted later reading achievement" (Lekwa et al., 2018, p. 115). When both high-quality behavior management strategies and teacher practices were put together by one teacher "higher rates of student academic engagement" was measured by observers (Lekwa et al., 2018, p. 115).

To conclude this study, Lekwa and company stated that there was a "significant indirect effect in which the quality of behavior management predicted quality of instructional strategies, and quality of instructional strategies predicted academic engagement; this indirect effect almost completely explained the statistical relationship observed between behavior management strategies and academic engagement" (Lekwa et al., 2018, p. 115).

# CHAPTER III: DISCUSSION AND SUMMARY

## Summary of Literature

Childhood poverty can have a significantly negative effect on a developing brain. The most effected regions are the amygdala, hippocampus, as well as the frontal and parietal lobes. Many studies have highlighted those regions along with the consequences of living with the underdevelopment of those portions of the brain (Bock et al., 2016; Evans & Kim, 2007; Hanson et al.; 2019; Pavlakis et al., 2015; Tomalski et al., 2013).

When the amygdala is not properly formed the individual's stress response will not allow a healthy response to environmental stress (Evans & Kim, 2007; Pavlakis et al., 2015). Living with an underdeveloped hippocampus will affect one's ability to utilize working memory (Evans et al., 2013; Hanson et al., 2019; Pavlakis et al, 2015; Pluck et al., 2018). Working memory effects most areas of one's life in that the individual will have a difficult time learning from old and new experiences as well as maintaining focus on one task long enough to gain tangible knowledge from that event.

Development of the frontal and parietal lobes effect decision-making. Children who grew up in poverty have been found to have less growth in those two areas when compared to middle- and upper class peers (Bock et al., 2016; Hanson et al., 2013; Hanson et al., 2019; Pavlakis et al., 2015; Pluck et al., 2018). Living with immature frontal and parietal lobes can cause the individual to lead an impulsive lifestyle having to

deal with consequences for actions the person may have a difficult time learning from because of the lack of development in the hippocampus.

Growing up in poverty has also led to smaller volumes of overall gray matter in the brain. The lack of gray matter causes a child to be more susceptible to attention deficits and cognitive delays making school difficult (Pavlakis et al., 2015; Tomalski et al., 2013). The deficits and delays can follow the individual all the way through adulthood creating a roadblock to the middle- and upper-class for many of these individuals (Evans et al., 2019; Evans et al., 2013; Giuliano et al., 2018).

One way to intervene on behalf of the children growing up in poverty is to get them into high-quality childcare at an early age. Enrolling a child living in a low socio-economic household into a structured, loving, nutritional environment has shown that the effects of living in that home can be minimized (Duncan et al., 2011; Hanson et al, 2013; Huston et al., 2005; Landry et al., 2014). Strong child-adult relationships in concordance with a structured environment supports the development of the brain that is not being fostered in the home.

More studies have been done, however, on the effects of early intervention through high-quality preschool programs. When families living in poverty have the opportunity to enroll the preschool-aged child in one of these programs, positive outcomes through adulthood have been proven through research. The participants are less likely to depend on public assistance, be incarcerated, unemployed and are more likely to receive a higher education followed by higher paying careers (Barnett, 1993;

Blair & Raver, 2014; Campbell et al., 2012; Nix et al., 2016; Norwalk et al., 2012; Papay et al., 2013; Slaby et al., 2005; Yusuf et al., 2004).

Once a child is in school there are specific interventions that have shown to be more effective in supporting the brain development that children growing up in poverty need most. One such intervention is the teaching of self-regulatory behaviors or social-emotional learning. Curriculum focusing on decision making and mindfulness not only benefits children coming from low-income homes, it builds up the entire group. However, the children coming from a background of poverty have the greatest need for this curriculum as they may not have exposure to these skills outside of school (Bierman et al., 2010; Blair & Raver, 2014; Cavadel & Frye, 2017; Evans et al., 2014; Nix et al., 2016).

Two other interventions that benefit children growing up in poverty bring in the family along with other adult mentors surround those students who are most in need. Schools that encourage and even require families to be involved in the day-to-day activities and decisions that allow the building to be robust produce students who are ready to face the challenges of life (Collins et al., 2015). Mentors paired with students at any level, but especially in high school when big life decisions are being made about life after graduation, can have a profound effect on the trajectory of life for a child living in poverty. Having the opportunity to be mentored by a person who has come from a similar situation and is now doing well as an adult can have profound effects on impressionable children (Collins et al., 2015).

Literacy interventions can also provide positive outcomes. More often than not, children living in poverty have difficulty learning how to read, struggle with comprehension, and can experience little growth in this subject area. Many researchers have proven that intervention in literacy can affect other subject areas as reading is important in them all. Flexible grouping, challenging yet interesting texts, working with highly qualified teachers, participating in discussions, and encouraging reading simply for pleasure are all part of the literacy intervention process (Cavadel & Frye, 2017; Diuk et al, 2019; Kennedy, 2018; Nix et al., 2016; Norwalk et al., 2012; Slaby et al., 2005; VanTassel-Baska & Stambaugh, 2006).

One final intervention worth mentioning is exposing low-income children to the arts. Participating in music, dance, and art classes showed how they brought stress levels down for the most vulnerable population. Researchers tracked the cortisol levels in students who participated in these classes taught by highly qualified teachers and found that the levels stayed down for several hours after class (Brown et al., 2017). Ways in which teachers can level the playing field for these children are by maintaining high standards while using best practices to teach each lesson, form meaningful relationships, and being consistent, especially in the area of classroom management (Cavadel & Frye, 2017; Dishman & Martin, 2007; Lekwa et al., 2019; Sorhagan, 2013). Combining these three aspects of teaching will set each child up for success while providing the structure that children living in poverty need in order to succeed.

## Limitations of the Research

To acquire the literature for this thesis, searches of Academic Search Premier, EBSCO MegaFile, Education Journals, ERIC, and PsycARTICLES were for publications from 1990-2019. This list was reduced by focusing on published empirical studies from peer-reviewed journals that highlight brain development and teacher best practices for children living in poverty. The key words used in these searches contained "brain development," "effects of brain development in poverty," "parts of the brain most effected by poverty," "working memory and poverty," "attention deficits and poverty," "teacher best practices for children in poverty," and "interventions for children in poverty."

Boundaries implemented to acquire accurate research information excluded studies that did not provide scientific evidence of brain development in children growing up in poverty. Studies that were heavily relied on for comparative information were those that provided some form of MRI imaging documentation for children living in poverty and middle- or upper-class homes. Articles that did not include before and after data on specific intervention strategies were also excluded from this research.

What did not exist was an abundance of research conducted on what teachers can do to level the playing field for these children. Therefore, the last section of chapter two has only a few suggestions for teachers.

## Implications for Future Research

Future research should focus on the second guiding question for this literature review. How teachers can level the playing field has shown to be a work in progress on

the research front. Abundant research has been done on the effects growing up in poverty has on brain development. However, little empirical studies have been published on what to do about these effects as a teacher.

Teachers play a significant role in the development of children. Those who work with low-income families ought to be guided by research that has been done proving which practices to implement and which to avoid.

Future research could focus on classroom management styles, teacher-student relationships, administrative leadership, school culture, educational funding, and classroom curriculum. Research in these areas could reveal where teachers are gaining the most results in regard to academic achievement as well as disruptive behavior.

The gaps in the research that I would like to see filled are the most important next steps. We know how growing up in poverty can negatively effect brain development, so what do we do with this knowledge? Teachers spend an enormous amount of time with students. How can they use that time to create the most positive affect for those who are most vulnerable?

Filling these gaps would provide higher education institutions with the information they need to train teachers going in to high-poverty schools with the skills they need to be successful. It would also help guide professional development for current teaching staff.

## Implications for Professional Application

This research applies to educators working with students living in low-income households. These students come with unique challenges and require the teacher to bring his/her A game each and every day.

I work in a Title I building. This means that over half of our student body qualifies for free/reduced lunch through the state of Minnesota. My coworkers and I are faced with the negative effects of living in poverty every day. Children living in these households face enormous obstacles to living a successful life for a multitude of reasons. Therefore, school becomes so much more than school.

My classroom is a safe haven of structure, organization, love, discipline, and support for everyone, but especially for my students living in poverty. They have needs that are not being met outside of school, pressing me to be more than just a curriculum deliverer every single day. I provide emotional support while finding ways to fill in the gaps for students who come to school not having the material possessions they need in order to be successful.

Behaviors are also a constant concern for teachers who work in high-poverty schools. We need to have tools at our fingertips that can be utilized in diffusing high-stress situations with students so that our energies can be focused on building relationships and teaching of content rather than constant behavior management. Knowing where our students are lacking due to improper brain development is the first step to choosing most effective strategies to implement in the classroom.

This research has demonstrated that relationships, parent involvement, high standards, and consistency are the first steps in leveling the playing field for our

students who are growing up in poverty. This research has also pointed out the areas of the brain most effected by poverty. This aids in knowing what to look for in our students. The next step is knowing how to be proactive as a result of data that has been shared through this literature.

Looking back on my career and college education, I can see that experience has been the best teacher. I had field experiences in both affluent and low-income schools. One thing I lacked, however, was specific instruction on how to prepare for teaching in a low-income school. More and more children are facing poverty and are coming to school with deficits that did not exist on this level in the past. My hope is that research such as this encourages individuals who desire to make a positive impact in the lives of others who are facing poverty to be proactive in preparing themselves with the tools necessary to be influential. The better prepared our teachers are to face the challenges of teaching in a low-income area, the more likely the teacher will stay in the profession and make a lasting impact on the lives of our most vulnerable citizens.

## Conclusion

Poverty can have negative effects on brain development that can last for a lifetime if not intervened early and often. High-quality childcare, education, and leadership can turn the tide for students living in low-income homes. The interventions implemented should be carefully chosen and executed by qualified teachers who are applying best practices.

**References**

Barnett, W. S. (1993). Benefit-cost analysis of preschool education: Findings from a 25-year follow-up. *American Journal of Orthopsychiatry, 63*(4), 500-508. doi:10.1037/h0079481

Bierman, K. L., Coie, J. D., Dodge, K. A., Greenberg, M. T., Lochman, J. E., McMahon, R. J., & Pinderhughes, E. (2010). The effects of a multiyear universal social–emotional learning program: The role of student and school characteristics. *Journal of Consulting and Clinical Psychology, 78*(2), 156-168. doi:10.1037/a0018607

Blair, C., & Raver C. C. (2012). Child development in the context of adversity: experiential canalization of brain and behavior. *American Psychologist, 67*(4), 309-318. Doi: 10.1037/a0027493

Blair, C., & Raver C. C. (2014). Closing the achievement gap through modification of neurocognitive and neuroendocrine function: results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten. *Plos One,* 9(11), 1-13. doi: 10.1371/journal.pone.0112393

Bock, J., Poeschel, J., Schindler, J., Börner, F., Shachar-Dadon, A., Ferdman, N., Gaisler Salomon, I., Leshem, M., Braun, K., Poeggel, G. (2016). Transgenerational sex specific impact of preconception stress on the development of dendritic spines and dendritic length in the medial prefrontal cortex. *Brain Structure & Function, 221*(2),

855-863. doi:10.1007/s00429-014-0940-4

Brown, E. D., Garnett, M. L., Anderson, K. E., & Laurenceau, J. (2017). Can the arts get under the skin? arts and cortisol for economically disadvantaged children. *Child Development, 88*(4), 1368-1381. doi:10.1111/cdev.12652

Campbell, F. A., Pungello, E. P., Burchinal, M., Kainz, K., Pan, Y., Wasik, B. H., Sparling, J. J., Barbarin, O. A., & Ramey, C. T. (2012). Adult outcomes as a function of an early childhood educational program: An abecedarian project follow-up. *Developmental Psychology, 48*(4), 1033-1043. doi:10.1037/a0026644

Cavadel, E. W., & Frye, D. A. (2017). Not just numeracy and literacy: Theory of mind development and school readiness among low-income children. *Developmental Psychology, 53*(12), 2290-2303. doi:10.1037/dev0000409

Collins, G., & Collins, M., Butt, G. (2015). Social mobility or social reproduction? A case study of the attainment patterns of students according to their social background and ethnicity. *Educational Review, 67*(2), 196-217. doi: 10.1080/00131911.2013.859127

Diuk, B., Barreyro, J. P., Ferroni, M., Mena, M., & Serrano, F. (2019). Reading difficulties in low-SES children: A study of cognitive profiles. *Journal of Cognition and Development, 20*(1), 75-95. Retrieved from https://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1203911&site=ehost-live&scope=site http://dx.doi.org/10.1080/15248372.2018.1545656

Duncan, G. J., Morris, P. A., & Rodrigues, C. (2011). Does money really matter? estimating impacts of family income on young children's achievement with data from random-assignment experiments. *Developmental Psychology, 47*(5), 1263-1279. doi:10.1037/a0023875

Evans, G. W., & Fuller-Rowell, T. E. (2014). Childhood poverty, chronic stress, and young adult working memory: the protective role of self-regulatory capacity. *Developmental Science, 16*(5), 688-696. doi: 10.1111/desc.12082

Evans, G. W., & Kim, P. (2007). Childhood poverty and health: Cumulative risk exposure and stress dysregulation. *Psychological Science (0956-7976), 18*(11), 953-957. doi:10.1111/j.1467-9280.2007.02008.x

Evans, G. W., & Schamberg, M. A. (2009). Childhood poverty, chronic stress, and adult working memory. *Proceedings of the National Academy of Sciences of the United States of America,* 106 (16), 6545-6549. doi: 10.1073/pnas.0811910106

Giuliano, R. J., Karns, C. M., Roos, L. E., Bell, T. A., Petersen, S., Skowron, E. A.,Nelville, H. J., &Pakulak, E. (2018). Effects of early adversity on neural mechanisms of distractor suppression are mediated by sympathetic nervous system activity in preschool-aged children. *Developmental Psychology, 54*(9), 1674-1686. doi:10.1037/dev0000499; 10.1037/dev0000499.supp (Supplemental.

Hanson, J. L., Gillmore, A. D., Yu, T., Holmes, C. J., Hallowell, E. S., Barton, A. W.,Beach, S. R. H., Galvan, A., MacKillop, J. Windle, M., Chen, E., Miller, G., Sweet, L. H., & Brody, G. H. (2019). A family focused intervention influences hippocampal-prefrontal

connectivity through gains in self-regulation. *Child Development, 90*(4), 1389-1401. doi:10.1111/cdev.13154

Hanson J. L., Gilmore, J. H., Hair, N., Shen, D. G., Shi, F., & Wolfe, B. L. (2013). Family poverty affects the rate of human infant brain growth. *PLoS One, 8*(12), e80954. Doi: 10.1371/journal.pone.0080954

Horst, M., & Martin, B. N. (2007). A case study: leadership and its effect on achievement of children from poverty in a rural setting. *The Rural Educator, 28*(3), 33-40. Retrieved fromhttps://search-proquest-com.ezproxy.bethel.edu/docview/61928340?accountid=8593

Huston, A. C., Duncan, G. J., McLoyd, V. C., Crosby, D. A., Ripke, M. N., Weisner, T. S., & Eldred, C. A. (2005). Impacts on children of a policy to promote employment and reduce poverty for low-income parents: New hope after 5 years. *Developmental Psychology, 41*(6), 902-918. doi:10.1037/0012-1649.41.6.902

Kennedy, E. (2018). Engaging children as readers and writers in high-poverty contexts. *Journal of Research in Reading, 41*(4), 716-731. Retrieved from https://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1199305&site=ehost-live&scope=site http://dx.doi.org/10.1111/1467-9817.12261

Landry, S. H., Zucker, T. A., Taylor, H. B., Swank, P. R., Williams, J. M., Assel, M., Crawford, A., Huang, W., Clancy-Menchetti, J., Lonigan C. J., Phillips, B. M., Eisenberg, N., Spinrad, T. L., Villiers, J., Villiers, P., Barnes, M., Starkey, P. & Klein, A.

(2014). Enhancing early childcare quality and learning for toddlers at risk: The responsive early childhood program. *Developmental Psychology, 50*(2), 526-541. doi:10.1037/a0033494; 10.1037/a0033494.supp (Supplemental)

Lekwa, A. J., Reddy, L. A., & Shernoff, E. S. (2019). Measuring teacher practices and student academic engagement: A convergent validity study. *School Psychology, 34*(1), 109-118. doi:10.1037/spq0000268; 10.1037/spq0000268.supp (Supplemental)

McEwen, C. A. (2017). *Social structure, adversity, toxic stress, and intergenerational poverty: An early childhood model*. Palo Alto, Calif. : Annual Reviews Inc.

Nix, R. L., Bierman, K. L., Heinrichs, B. S., Gest, S. D., Welsh, J. A., & Domitrovich, C. E. (2016). The randomized controlled trial of head start REDI: Sustained effects on developmental trajectories of social–emotional functioning. *Journal of Consulting and Clinical Psychology, 84*(4), 310-322. doi:10.1037/a0039937; 10.1037/a0039937.supp (Supplemental)

Norwalk, K. E., DiPerna, J. C., Lei, P., & Wu, Q. (2012). Examining early literacy skill differences among children in head start via latent profile analysis. *School Psychology Quarterly, 27*(3), 170-183. doi:10.1037/spq0000003

Papay, J., Murnane, R., & Willett, J. (2013). *Inequality and Educational Attainment: Evidence from Massachusetts,* 1-15.

Pavlakis, A. E., Noble, K., Pavlakis, S. G., Ali, N., & Frank, Y. (2015). Brain imaging and electrophysiology biomarkers: is there a role in poverty and education

outcome research?. *Pediatric Neurology,* 52. doi:10.1016/j.pediatrneurol.2014.11.005

Pluck, G., Banda-Cruz, D., Andrade-Guimaraes, M., & Trueba, A. F. (2018). Socioeconomic deprivation and the development of neuropsychological functions: A study with “street children” in Ecuador. *Child Neuropsychology, 24*(4), 510-523. doi:10.1080/09297049.2017.1294150

Slaby, R., Loucks, S., & Stelwagon, P. (2005). Why is preschool essential in closing the achievement gap? *Educational Leadership and Administration, 17*, 47-57,132-133. Retrieved from https://search-proquest-com.ezproxy.bethel.edu/docview/232843618?accountid=8593

Sorhagen, N. S. (2013). Early teacher expectations disproportionately affect poor children's high school performance. *Journal of Educational Psychology, 105*(2), 465-477. doi:10.1037/a0031754

Tomalski, P., Moore, D. G., Ribeiro, H., Axelsson, E. L., Murphy, E., Karmiloff-Smith, A., Johnson, M. H., & Kushnerenko, E. (2013). Socioeconomic status and functional brain development--associations in early infancy. *Developmental Science, 16*(5), 676-687. Retrieved from https://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1026003&site=ehost-live&scope=site http://dx.doi.org/10.1111/desc.12079

VanTassel-Baska, J., & Stambaugh, T. (2006). Project Athena: A pathway to advanced literacy development for children of poverty. *Gifted Child Today, 29*(2), 58-63. Retrievedfrom https://ezproxy.bethel.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ746301&site=ehost-live&scope=site http://www.prufrock.com/client/client_pages/prufrock_jm_giftchild.cfm