

Summary of Findings: Importance of Inhibitory Control and its Impact on Academic Achievement of Children with Low Socioeconomic Status

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I. INTRODUCTION

This document outlines the summary of the findings of fifteen extracted papers from the search and screening process. The research topic focuses on the role of executive functions and the importance of its development early on in life. The original research question was “Why is it important to improve and assess executive functions early? What are the consequences for not doing so?”, which was then narrowed down to specifically focus on inhibitory control (IC) in children with low socioeconomic status and the impact its development has on their academic success. The importance of this review lies in consolidating evidence to highlight the role of IC in academic success especially for disadvantaged children. The goal of this review is to collect data from different studies and synthesize it to provide insight on this topic. In order to achieve this, the team divided the 15 papers evenly, assigning each member three papers to thoroughly read and extract data from. Recurrent themes were identified to develop a framework for synthesizing the findings.

II. SUMMARY OF SEARCH AND SCREENING RESULTS

A systematic search was conducted using Google Scholar Boolean search queries to select 104 most relevant papers on the research topic. Through applying inclusion and exclusion criteria, the papers were screened in the following process:

- *Title and Abstract Screening:* 71 papers were excluded, leaving 33 papers to be screened in the full-text review.
- *Full-Text Screening:* An additional 18 papers were excluded in this stage, where 2 papers were removed for incorrect setting, 11 removed for incorrect population, 4 removed for wrong outcome, and 1 removed for wrong indication.
- *Final Selection for Data Extraction:* 15 papers that best addressed the research question and were chosen for the final data extraction inclusion criteria.

III. DATA EXTRACTION TABLE AND STUDY CHARACTERISTICS

Included studies were published in high income English speaking countries, including the United States of America, Australia, and Great Britain and North Ireland. Studies were published between 2010 and 2023. Sample sizes ranged from 44 to 15,000 participants. Participants that were primarily studied during early life, ranging from ages 0 to 15. Study designs included prospective cohort studies, longitudinal studies, systematic literature reviews, randomized control trials, and dissertations. Tables 1-5 include extracted data.

Table 1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	United Kingdom of Great Britain and Northern Ireland; United States of America	The study was conducted using data from the Avon Longitudinal Study of Parents and Children (ALSPAC)	Deer, LillyBelle K.; Hastings, Paul D.; Hostinar, Camelia E.	2020
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	United States of America	Schools within Florida	Delucca, Teri L.	2010
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	United States of America	Urban schools in Chicago, Illinois	Doxie, Jacquelyn L	2014
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	United States of America	Urban schools in Chicago, Illinois	Allee-Herndon, Karyn A; Roberts, Sherron Killingsworth	2019
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	United States of America	Families were from a Texas Twin Study cohort	Sabhlok, Aditi	2023

Title	Country of Publication	Setting	Author	Year
Inhibitory control within the context of early life poverty and implications for outcomes	United States of America	Participants are primarily from families which are living in poverty	Taylor, Rita L; Barch, Deanna M	2022
Socioeconomic status and executive function in early childhood: a bioecological approach	United States of America	Data was collected in laboratory sessions at Boston University	John, Ashley Moore St	2019
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	United States of America	Conducted at St. John's University in New York, United States. The research focuses on the academic outcomes of low-income students and explores the impact of self-regulation and mindset on their performance.	Lindo, Jamilah Shanice	2023
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	United States of America	Children were recruited shortly after birth in 10 US cities. Data was collected in a school setting.	Herbert, Robyn Shea	2022
Executive function mediates socio-economic and racial differences in early academic achievement	United States of America	Durham Child Health and Development Study	Nesbitt, Kimberly Turner; Baker-Ward, Lynne; Willoughby, Michael T.	2013
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	United States of America	The study was conducted in an emergency homeless shelter and involved 86 children aged 9 to 11.	Lafavor, Theresa	2018
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	United States of America	This study uses data from the National Institute of Child Health and Human Development Study of Child Care and Youth Development.	Blums ,Angela; Belsky ,Jay; Grimm ,Kevin; Chen ,Zhe	2016

Title	Country of Publication	Setting	Author	Year
Does executive function mediate SES and home quality associations with academic readiness?	United States of America	The study was conducted in a mid-western city. The participants were recruited through various community channels, including child-care providers, mailings, community centers, and local events. The study involved both home observations and laboratory visits.	Dilworth-Bart, Janean E.	2012
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	Australia	This study was conducted using data from the Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC). Data was collected through biennial home visits, involving children, parents, and teachers	Berthelsen, Donna ; Hayes, Nicole ; White, Sonia L. J. ; Williams, Kate E.	2017
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	United States of America	7.6% of the children were from North Carolina, and 42.4% were from Pennsylvania .	Perry, Rebecca K.	2017

Table 2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	https://dx.doi.org/10.1111/cdev.13383	"Attention-regulation skills that make it possible to sustain attention, keep goals and information in mind, refrain from responding immediately, resist distraction, tolerate frustration, consider the consequences of different behaviors, reflect on past experiences, and plan for the future"	Ages 0-5 until 16-18
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	http://myaccess.library.utoronto.ca/login?url=https%3A%2F%2Fwww.proquest.com%2Fdissertations-theses%2Frole-executive-functioning-skills-academic%2Fdocview%2F856603410%2Fse-2%3Faccountid%3D14771	The ability to suppress irrelevant or inappropriate responses while performing a task.	Ages 0-5
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	https://via.library.depaul.edu/csh_etd/96	Inhibition is a skill originally identified by Barkley (1990) and is described as the ability to resist behavior as well as the ability to not act impulsively. A child with adequate inhibition skills is able to stop his or her behavior, actions, and/or thoughts at the appropriate time. Examples of inhibition items include "have trouble sitting still and get in other people's faces."	Childhood and adolescence

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	https://doi.org/10.1080/02568543.2019.1613273	A component of executive function that involves the ability to suppress impulsive responses and resist distractions.	Children from pre-kindergarten (PK) through second grade (K-2)
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	https://doi.org/10.26153/tsw/52231	Executive functions (EFs) are highly heritable higher-order cognitive processes that govern goal-directed thoughts and behaviors and enable individuals to self-regulate. These processes include response inhibition (the ability to inhibit a prepotent response).	Childhood and adolescence
Inhibitory control within the context of early life poverty and implications for outcomes	https://doi.org/10.1016/j.neubiorev.2022.104778	IC is a component of EF that allows for the suppression of prepotent, or automatic, responses. It is important for effective goal-directed thoughts and behaviors, future planning, decision-making, and healthy social interactions. IC is considered to be one of the earliest emerging higher order cognitive functions and is an essential component of many other EF processes (Barkley, 2001; Best and Miller, 2010; Munakata et al., 2011).	Early Childhood
Socioeconomic status and executive function in early childhood: a bioecological approach	http://myaccess.library.utoronto.ca/login?url=https%3A%2F%2Fwww.proquest.com%2Fdissertations-theses%2Fsocioeconomic-status-executive-function-early%2Fdocview%2F3037266793%2Fse-2%3Faccountid%3D14771	Executive functioning (EF) refers to higher order cognitive and goal directed processes that are essential for adaptive functioning in childhood and throughout the lifespan. The child must have the ability to control attention and inhibit prepotent responses, such as the desire to talk to a neighboring peer.	Ages 3-6
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	https://www.proquest.com/docview/2863683339?pq-origsite=gscholar&fromopenview=true&sourcetype=Dissertations%20&%20Theses	According to Dweck (1999), mindset regarding intelligence is inherently based upon these two theories in which an individual perceives intelligence as a stable construct unable to be changed (i.e., you either have it, or you donâ€™t) or as flexible and subject to change with effort.	Ages 0-10
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	http://myaccess.library.utoronto.ca/login?url=https%3A%2F%2Fwww.proquest.com%2Fdissertations-theses%2Frelation-between-executive-functioning-academic%2Fdocview%2F2732253795%2Fse-2%3Faccountid%3D14771	Inhibition: the ability of an individual to resist acting on impulse and to overcome their initial responses to a presented stimulus (page 7)	Ages 9-12

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Executive function mediates socio-economic and racial differences in early academic achievement	https://dx.doi.org/10.1016/j.ecresq.2013.07.005	"The facility to impede prepotent responses or ignore information that could interfere with completing a goal" (Diamond, 1990).	Birth to Grade 1
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	https://dx.doi.org/10.1177/0272431616678989	Effortful control difficulties	Ages 9-11
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	https://dx.doi.org/10.1080/15248372.2016.1228652	Selective attention, attentional control, processing speed	1 month - 6 years
Does executive function mediate SES and home quality associations with academic readiness?	https://dx.doi.org/10.1016/j.ecresq.2012.02.002	The ability to stop an ongoing behavior or inhibit a prepotent response. This skill is considered one of the core sub skills of executive function (EF) development in early childhood	54-66 month old children
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2017.00903/full	Attentional regulation and the ability to inhibit prepotent responses	4-5 years.
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	https://etda.libraries.psu.edu/files/final_submissions/14077	SR generally includes both emotional and cognitive processes used to manage emotions, behavior, and attention	Preschool age, around 4 years old

Table 3. Design type and study type for included studies

Title	Design	Type of Study
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	Longitudinal study that looks at children from birth until they nearly reach adulthood. Looks at family income, academic achievement and development of EFs for each child that those measures are available for.	Prospective cohort study
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	The study used growth curve modeling to analyze the development of executive functioning skills in children from low-income families over time.	Longitudinal Study
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	The study examined the relationships between poverty-related stress, executive functioning, and academic achievement in urban adolescents using surveys, interviews, and various psychological measures over two time points.	Prospective cohort study
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	The study systematically reviewed empirical research to explore the relationship between early elementary education, self-regulation or executive function, and poverty, identifying effective interventions and instructional approaches for young children.	Systematic Literature Review

Title	Design	Type of Study
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	Ongoing study of child and adolescent multiples from metropolitan areas of Austin and Houston. This analytic sample consisted of participants who both participated in the laboratory portion of the study, and for whom standardized school testing data was available.	Prospective cohort study
Inhibitory control within the context of early life poverty and implications for outcomes	This study reviews how early life poverty impacts the development of inhibitory control in children, linking it to negative outcomes such as lower academic achievement and behavioral difficulties.	Literature review
Socioeconomic status and executive function in early childhood: a bioecological approach	Children completed a working memory task and a go/no-go task, designed to tease apart at a process level how SES relates to EF in children.	Randomized Control Trial
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	The study examined the relationship between self-regulation, mindset, and academic achievement in low socio-economic standing students by analyzing self-reported data from 44 students in grades 4-6, using regression analyses to predict English Language Arts and math outcomes based on self-regulation skills and mindset scores.	Dissertation
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	The study used a sample from the Study Early Child Care and Youth Development and used the Continuous Performance Task as a measure of inhibition. Additionally parents were interviewed and teachers gave participants a rating	Prospective cohort study
Executive function mediates socio-economic and racial differences in early academic achievement	The study used structural equation modeling to analyze data from a longitudinal sample of 206 children, examining how executive function and expressive vocabulary in kindergarten mediate the relationship between socio-economic status, race, and academic achievement.	Prospective cohort study
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	The study explored how inhibition control, social competence, and emotional control predict academic success in 86 homeless children aged 9 to 11, using standardized assessments and parent interviews conducted in emergency shelters.	Prospective cohort study
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	The study used structural equation modeling to examine how early socioeconomic status (SES), measured by maternal education and family income-to-needs ratio, influences high school STEM achievement through the mediating effects of early environment, executive function, and language abilities.	Retrospective cohort study
Does executive function mediate SES and home quality associations with academic readiness?	Participants were recruited through various community channels, with the majority of mothers being married or partnered and having diverse educational backgrounds; data collection involved home visits and laboratory assessments of children's literacy, math, and verbal abilities, with maternal education and income combined into a composite SES score to evaluate home environment quality and children's academic skills.	Prospective cohort study

Title	Design	Type of Study
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	The study used a longitudinal, cross-sequential design with biennial home visits and a two-stage clustered sampling to collect data from approximately 5,000 children aged 4-5 years in 2004, examining the impact of family socio-economic position, child behavior problems, and maternal parenting behaviors on executive function at age 14-15 through attentional regulation and approaches to learning.	Prospective cohort study
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	The study used a multiple regression design to examine the relationship between preschool classroom quality and self-regulation (SR), with executive functioning (EF) as a potential moderator. It utilized extant data from the Family Life Project and included exploratory factor analysis (EFA) to test the factor structure of classroom SR variables.	Dissertation

Table 4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	~15000	Ages 0-18	Poverty, disadvantaged, low-income
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	185	Ages 4-7	Low and Middle Income. Low income was based on eligibility for free and reduced lunch program
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	262 at Time 1, 1380 at Time 2 (6 months after time 1)	Children and adolescents	Low SES
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	46,277	Kindergarten to Grade 2	All SES levels. A family was defined as poor if their income-to-needs ratio was 2.0 or less and not poor if the income-to-needs ratio was greater than 2.0.
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	639 (twins and triplets included)	Ages 7.9 to 15.3	Residents of poorer neighbourhoods of Austin and Houston, Texas
Inhibitory control within the context of early life poverty and implications for outcomes		Each study has populations of differently aged children	Low SES
Socioeconomic status and executive function in early childhood: a bioecological approach	121	4.5 - 5.5 years	Low SES
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	44	Students in grades 4-6	Participants qualified for free or reduced-price lunch (FRPL), which was used as the proxy-based measure of household income to determine socioeconomic status for inclusion.

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	700	Ages 8-10	Families with SES of 3.60 (SES of 0 represents a family living on the poverty line)
Executive function mediates socio-economic and racial differences in early academic achievement	206	Kindergarten age (5-7)	Low- and middle-income African American and European American families.
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	86	Ages 9-11	Participants were living in emergency homeless shelter
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	1084	1 month to 15 years of age	SES was measured by maternal education (total years of education reported when the child was 1 month old) and family income-to-needs ratio (self-reported at 15 months, calculated by dividing total family income by the federal poverty threshold, with a ratio of 2.0 or less indicating poverty).
Does executive function mediate SES and home quality associations with academic readiness?	49	54-66 months and their mothers	Mean household income was \$55911.08. Majority of the mothers in the sample (79.6%) were married or living with a partner. 8.2% of mothers completed some high school, 26.5% obtained a highschool diploma or equivalent, 12.2% obtained a trade or vocational degree, 38.8% obtained a bachelor's or associate degree, 14.3% obtained a graduate or professional degree.
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	4819 children and families	4-5 years old and then again at 14-15	There were 41% of mothers who had not completed high school and 44.4% of mothers who had completed a tertiary degree, of at least Bachelor level.
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	877	3-5, about 4 years old	33.5% of the sample were identified as in poverty, and 63.3% lived above the poverty threshold

Table 5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	Academic Achievement by EF Tasks	Mathematical model to show how factors related to SES effects EFs
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	Measures include Verbal IQ Assessment, The Tower of London task, and Academic Achievement.	Executive functioning skills, particularly the efficiency of moves when solving problems, mediated the relationship between family income and academic achievement.

Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	Measures include median family income, number of violent crimes, major life events/daily hassles, executive functioning skills (inhibition, shift, emotional control, monitor, working memory, planning/organization, organization of materials, task completion), and grade point average (GPA).	Overall results of age differences suggest that, with the exception of attention abilities and other timeline (6 months difference between the first and second conducted methods) shift abilities, executive skills are poorer for older adolescents. These results are inconsistent with the definition of executive functions as higher order processes associated with the frontal lobe. In accordance with this biological explanation of the development of executive functioning processes, skills are hypothesized to improve as children get older
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	Measures the impact of poverty on K-2 children's academic performance differ for each study examined during this systematic review. Self-regulation, executive function, and learning outcomes were all examined.	Improvements in EF and SR among K-2 students positively associated with academic outcomes.
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	Standardized Test Results	Results of standardized test called the STAAR test for children (mainly twins) and similarity between scores of twins
Inhibitory control within the context of early life poverty and implications for outcomes	Measures include inhibitory control in children using parent/teacher reports (BRIEF, CBQ) and behavioral tasks (Stop Signal Task, Go/No-Go Task, Stroop Task, Flanker Task, Delay-of-Gratification paradigms)	Taken together, the results of these studies suggest that housing instability is a commonly experienced feature within the poverty context and may confer worse developmental outcomes than those that are suggested by financial hardship alone. Results of behavioral research that has examined IC as a mechanism explaining relations of poverty to outcomes have been mixed
Socioeconomic status and executive function in early childhood: a bioecological approach	Results of EF Tasks	Scores of Go/No-Go task results: Reaction time and working memory
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	Self-Regulation Strategy Inventory	"LA state assessment scores showed the strongest correlation with ELA report card grades , while math state assessment scores were strongly correlated with both math report card grades and ELA report card grades and ELA state assessment scores were also strongly correlated with math report card grades."
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	Measures include the Tower of Hanoi, Continuous Performance Task, Disruptive Behaviour Rating Scale, Woodcock-Johnson Psychoeducational Batter, Revised Edition, Family, Education, & Income Survey, and a Student Teacher Research Study	The results of this study were conducted on a population considered above the poverty line which violates one of our inclusion constraints. but the final results indicated that stronger EF skills are associated with higher academic achievements and that supportive family environments and higher socioeconomic status are generally linked to better executive functioning and academic outcomes
Executive function mediates socio-economic and racial differences in early academic achievement	Kindergarten executive function, Grade 1 assessments	Assessments conducted when participants were in grade 1

Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	WIAT-II Test Scores	Children with better emotional regulation and social skills tend to achieve higher academically, regardless of their cognitive abilities.
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	Measures include Socioeconomic Status, Home/Childcare Environment, Executive function (assessed with the continuous performance task, delay of gratification task, and the children's Stroop task), Language Ability (assessed with the Letter-Word Identification and Picture Vocabulary subscales of the Woodcock-Johnson), Problem Solving, STEM achievement (assessed with GPA) and Analytic Strategy.	Family income was significantly correlated with maternal education, which in turn was positively related to environmental enrichment and engagement, both of which were positively correlated with various cognitive and problem-solving measures, ultimately linking these measures to higher math and science GPAs.
Does executive function mediate SES and home quality associations with academic readiness?	Measures include outcomes related to executive function, academic readiness, verbal ability, socioeconomic status, and home environment quality in preschoolers	Significant proportions of EF variance were accounted for by SES, but not home-environment quality, after entry of verbal abilities in block one and (2) EF accounted for significant proportions of variance in the academic readiness scores over and above verbal ability.
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	Measures include child behavior, family risk factors, self-regulation, and executive function in early childhood and adolescence.	The study found that early ecological risks, including child behavior risk and socio-economic position (SEP), directly and indirectly influenced executive function at 14-15 years through attentional regulation and approaches to learning, with significant effects from child characteristics and early receptive vocabulary.
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	Verbal IQ Assessment (PPVT), Tower of London (TOL) task performance (proportion of correctly solved problems, solution time, and move efficiency), and academic achievement (reading and math scores from the Stanford Achievement Test Series 10).	For children in poverty, only classroom organization had a significant positive relationship with classroom self-regulation (SR), while emotional and instructional support did not show significant effects.

IV. SYNTHESIS OF FINDINGS

The studies extracted consistently highlight that inhibitory control plays a crucial role in young children's academic achievement, particularly children from low socioeconomic status (SES). Inhibitory control was commonly defined as the ability to suppress irrelevant or inappropriate responses while performing a task [1].

One of the most prevalent findings that were observed while extracting was that children in poverty or lower-income backgrounds face more difficulty in developing inhibition control due to their limited resources, high-stress levels, and varying environmental factors, which all lead to poor academic achievement [2][3]. Children who come from families with low SES are not provided with adequate learning material to help their executive functions, primarily inhibition control. Children living in low SES homes are often not exposed to age-appropriate physical and psychosocial resources, and stimulating learning opportunities that support their executive function development [4]. It was also reported that children in low-SES environments are subject to higher stress situations. Allee-Herndon and Roberts identify some of these stressors to be “large crowded households, household chaos, family mobility, harsh or inconsistent parenting, changes in family configuration or adult caregivers, caregiver depression, stressful life events, and neighborhood risks” [2].

It was also commonly reported that children in low SES status households were at a larger risk of not developing the cognitive capacities needed to achieve academically. The home environment plays a defining role in how children from low SES homes will perform in school, as parental responsibility and family companionship have been shown to mediate the association between SES and inhibitory control [5]. In addition to household environments, the quality of school environments influences a student's academic achievement, highlighting the importance of a stimulative and supportive educational environment [6]. Heightened child reactivity to positive or negative environments can increase within family environments, essentially creating a feedback loop, and hindering EF development [7].

The studies extracted present differing views and results on how these various factors interrelate. One study by Allee-Herndon and Roberts [2] found that other than attention abilities, executive functions were poorer in older children. This is an important finding because it challenges the assumptions that a child's executive function improves with age, suggesting other factors that may have disrupted this expected trajectory. In contrast, the studies on family support and SES show positive associations with executive functions. It was found that family income and specifically maternal education were positively correlated with environmental enrichment at home [8]. This in turn improved or worsened a child's inhibition control, which was directly related to academic outcomes. These varying findings emphasize the importance of a holistic approach to supporting the development of executive functions across diverse populations.

V. DISCUSSION

This review emphasizes the significant role of inhibitory control, a core executive function, in shaping academic achievement for children from low socioeconomic status backgrounds. Longitudinal and observational studies highlight that assessing and improving is essential in influencing academic outcomes. These insights underscore the importance of integrating EF-focused interventions in educational settings, especially for underprivileged children.

This review has several strengths, including its focus on longitudinal data, which provides a comprehensive understanding of inhibitory control's developmental trajectory and academic impact. However, limitations include the reliance on studies predominantly conducted in North America, which may not fully represent global variations in SES, cultural, and geographical contexts. Furthermore, the differences in methodologies across studies complicate direct comparisons since some examine the performance on standardized tests, such as the STAAR test, while others observe the results of EF tasks such as the Go/No-go task.

Future research should address these limitations by exploring the relationship between SES, inhibitory control, and academic success in diverse cultural and geographic settings, outside of the United States and Canada. For instance, investigating how stressors related to poverty interact with EF development in regions with varying economic and cultural contexts could produce broader, more applicable results than just focusing on one region. Additionally, experimental studies comparing different models and methods of assessment, such as mindfulness training rather than structured academic activities, could clarify the most effective strategies for enhancing inhibitory control.

VI. CONCLUSION

In conclusion, this review highlights the central themes of the impact of socioeconomic status, limited academic and executive function assessment resources, and higher stress levels. These themes are discussed mainly in relation to inhibitory control and how they lead to poorer academic performance in children. In order to expand further, addressing the vital role of inhibitory control in academic success through targeted interventions and broader research across diverse contexts is pivotal for fostering equity in educational settings and opportunities to ultimately support the overall development of children.

References

- [1] T. L. Delluca; "The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis", University of Florida, 2010
- [2] K. A. Allee-Herndon and S. K. Roberts, "Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research," **Journal of Research in Childhood Education**, vol. 33, no. 3, pp. 345–362, 2019.
- [3] A. M. St. John, "Socioeconomic status and executive function in early childhood: A bioecological approach," Ph.D. dissertation, Dept. of Psychology, Univ. of Toronto, Toronto, ON, Canada, 2019. [Online]
- [4] J.E. Dilworth-Bart, "Does executive function mediate SES and home quality associations with academic readiness?", Department of Human Development and Family Studies, 2012
- [5] A. Blums, J. Belsky, K. Grimm, and Z. Chen, "Building links between early socioeconomic status, cognitive ability, and math and science achievement," **Journal of Cognition and Development**, vol. 18, no. 1, pp. 16–40, 2016. [Online]
- [6] S.Aditi, "Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts", Dept. of Psychology, Univ. of Texas at Austin, 2023 [Online]
- [7] D. Berthelsen, N. Hayes, S. L. J. White, and K. E. Williams, "Executive function in adolescence: Associations with child and family risk factors and self-regulation in early childhood," **Frontiers in Psychology**, vol. 8, 2017 [Online]
- [8] R. S. Herbert, "The relation between executive functioning and academic achievement through inattention and hyperactivity/impulsivity: The role of family factors and teacher-student relationships," Ph.D. dissertation, Dept. of Psychology, Florida State Univ., Tallahassee, FL, USA, 2022. [Online]
- [9] Taylor, Rita R. L. Taylor and D. M. Barch, "Inhibitory control within the context of early life poverty and implications for outcomes," **Neuroscience & Biobehavioral Reviews**, vol. 140, 2022

Appendix A - Data Extraction Tables for Anjali Jammulamadaka

Table A.1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	United States of America	Urban schools in Chicago, Illinois	Allee-Herndon, Karyn A; Roberts, Sherron Killingsworth	2019
Executive function mediates socio-economic and racial differences in early academic achievement	United States of America	Durham Child Health and Development Study	Nesbitt, Kimberly Turner; Baker-Ward, Lynne; Willoughby, Michael T.	2013
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	United States of America	The study was conducted in an emergency homeless shelter and involved 86 children aged 9 to 11.	Lafavor, Theresa	2018

Table A.2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	https://doi.org/10.1080/02568543.2019.1613273	A component of executive function that involves the ability to suppress impulsive responses and resist distractions.	Children from pre-kindergarten (PK) through second grade (K-2)
Executive function mediates socio-economic and racial differences in early academic achievement	https://dx.doi.org/10.1016/j.jecresg.2013.07.005	"The facility to impede prepotent responses or ignore information that could interfere with completing a goal" (Diamond, 1990).	Birth to Grade 1
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	https://dx.doi.org/10.1177/0272431616678989	Effortful control difficulties	Ages 9-11

Table A.3. Design type and study type for included studies

Title	Design	Type of Study
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	The study systematically reviewed empirical research to explore the relationship between early elementary education, self-regulation or executive function, and poverty, identifying effective interventions and instructional approaches for young children.	Systematic Literature Review

Title	Design	Type of Study
Executive function mediates socio-economic and racial differences in early academic achievement	The study used structural equation modeling to analyze data from a longitudinal sample of 206 children, examining how executive function and expressive vocabulary in kindergarten mediate the relationship between socio-economic status, race, and academic achievement.	Prospective cohort study
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	The study explored how inhibition control, social competence, and emotional control predict academic success in 86 homeless children aged 9 to 11, using standardized assessments and parent interviews conducted in emergency shelters.	Prospective cohort study

Table A.4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	46,277	Kindergarten to Grade 2	All SES levels. A family was defined as poor if their income-to-needs ratio was 2.0 or less and not poor if the income-to-needs ratio was greater than 2.0.
Executive function mediates socio-economic and racial differences in early academic achievement	206	Kindergarten age (5-7)	Low- and middle-income African American and European American families.
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	86	Ages 9-11	Participants were living in emergency homeless shelter

Table A.5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
Poverty, self-regulation and executive function, and learning in K-2 classrooms: A systematic literature review of current empirical research	Measures the impact of poverty on K-2 children's academic performance differ for each study examined during this systematic review. Self-regulation, executive function, and learning outcomes were all examined.	Improvements in EF and SR among K-2 students positively associated with academic outcomes.
Executive function mediates socio-economic and racial differences in early academic achievement	Kindergarten executive function, Grade 1 assessments	Assessments conducted when participants were in grade 1
Predictors of Academic Success in 9- to 11-Year-Old Homeless Children: The Role of Executive Function, Social Competence, and Emotional Control	WIAT-II Test Scores	Children with better emotional regulation and social skills tend to achieve higher academically, regardless of their cognitive abilities.

Appendix B - Data Extraction Tables for Jaden Hinds

Table B.1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	United States of America	Schools within Florida	Delucca, Teri L.	2010
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	United States of America	Conducted at St. John's University in New York, United States. The research focuses on the academic outcomes of low-income students and explores the impact of self-regulation and mindset on their performance.	Lindo, Jamilah Shanice	2023
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	United States of America	7.6% of the children were from North Carolina, and 42.4% were from Pennsylvania .	Perry, Rebecca K.	2017

Table B.2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	http://myaccess.library.utoronto.ca/login?url=http://ps%3A%2F%2Fwww.proquest.com%2Fdisserations-theses%2Frole-executive-functioning-skills-academic%2Fdocview%2F856603410%2Fse-2%3Faccountid%3D14771	The ability to suppress irrelevant or inappropriate responses while performing a task.	Ages 0-5
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	https://www.proquest.com/docview/2863683339?pq-origsite=gscholar&fromopenview=true&source-type=Dissertations%20&%20Theses	According to Dweck (1999), mindset regarding intelligence is inherently based upon these two theories in which an individual perceives intelligence as a stable construct unable to be changed (i.e., you either have it, or you don't) or as flexible and subject to change with effort.	Ages 0-10
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	https://etda.libraries.psu.edu/files/final_submissions/14077	SR generally includes both emotional and cognitive processes used to manage emotions, behavior, and attention	Preschool age, around 4 years old

Table B.3. Design type and study type for included studies

Title	Design	Type of Study
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	The study used growth curve modeling to analyze the development of executive functioning skills in children from low-income families over time.	Longitudinal Study
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	The study examined the relationship between self-regulation, mindset, and academic achievement in low socio-economic standing students by analyzing self-reported data from 44 students in grades 4-6, using regression analyses to predict English Language Arts and math outcomes based on self-regulation skills and mindset scores.	Dissertation
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	The study used a multiple regression design to examine the relationship between preschool classroom quality and self-regulation (SR), with executive functioning (EF) as a potential moderator. It utilized extant data from the Family Life Project and included exploratory factor analysis (EFA) to test the factor structure of classroom SR variables.	Dissertation

Table B.4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	185	Ages 4-7	Low and Middle Income. Low income was based on eligibility for free and reduced lunch program
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	44	Students in grades 4-6	Participants qualified for free or reduced-price lunch (FRPL), which was used as the proxy-based measure of household income to determine socioeconomic status for inclusion.
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	877	3-5, about 4 years old	33.5% of the sample were identified as in poverty, and 63.3% lived above the poverty threshold

Table B.5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
The role of executive functioning skills in the academic achievement of children from low-income families: A growth curve modeling analysis	Measures include Verbal IQ Assessment, The Tower of London task, and Academic Achievement.	Executive functioning skills, particularly the efficiency of moves when solving problems, mediated the relationship between family income and academic achievement.

Title	Outcome details: Measures	Outcome details: Results
The Role of Self-Regulation and Mindset in the Academic Outcomes of Low-Income Students	Self-Regulation Strategy Inventory	"LA state assessment scores showed the strongest correlation with ELA report card grades , while math state assessment scores were strongly correlated with both math report card grades and ELA report card grades and ELA state assessment scores were also strongly correlated with math report card grades."
Executive Functioning as a Moderator Between Preschool Classroom Quality and Self-Regulation for Children from High and Low Poverty Backgrounds	Verbal IQ Assessment (PPVT), Tower of London (TOL) task performance (proportion of correctly solved problems, solution time, and move efficiency), and academic achievement (reading and math scores from the Stanford Achievement Test Series 10).	For children in poverty, only classroom organization had a significant positive relationship with classroom self-regulation (SR), while emotional and instructional support did not show significant effects.

Appendix C - Data Extraction Tables for Lea Akzam

Table C.1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	United States of America	Urban schools in Chicago, Illinois	Doxie, Jacquelyn L	2014
Inhibitory control within the context of early life poverty and implications for outcomes	United States of America	Participants are primarily from families which are living in poverty	Taylor, Rita L; Barch, Deanna M	2022
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	United States of America	Children were recruited shortly after birth in 10 US cities. Data was collected in a school setting.	Herbert, Robyn Shea	2022

Table C.2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	https://via.library.depaul.edu/csh_etd/96	Inhibition is a skill originally identified by Barkley (1990) and is described as the ability to resist behavior as well as the ability to not act impulsively. A child with adequate inhibition skills is able to stop his or her behavior, actions, and/or thoughts at the appropriate time. Examples of inhibition items include "I have trouble sitting still and get in other people's faces."	Childhood and adolescence
Inhibitory control within the context of early life poverty and implications for outcomes	https://doi.org/10.1016/j.neubior.ev.2022.104778	IC is a component of EF that allows for the suppression of prepotent, or automatic, responses. It is important for effective goal-directed thoughts and behaviors, future planning, decision-making, and healthy social interactions. IC is considered to be one of the earliest emerging higher order cognitive functions and is an essential component of many other EF processes (Barkley, 2001; Best and Miller, 2010; Munakata et al., 2011).	Early Childhood
The Relation between Executive Functioning and Academic Achievement through Inattention and	http://myaccess.library.utoronto.ca/login?url=https%3A%2F%2Fw	Inhibition: the ability of an individual to resist acting on impulse and to overcome their	Ages 9-12

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	www.proquest.com/2Fdisertations-theses/2Frelation-between-executive-functioning-academic/2Fdocview/2F2732253795/2Fse-2/3Faccountid/3D14771	initial responses to a presented stimulus (page 7)	

Table C.3. Design type and study type for included studies

Title	Design	Type of Study
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	The study examined the relationships between poverty-related stress, executive functioning, and academic achievement in urban adolescents using surveys, interviews, and various psychological measures over two time points.	Prospective cohort study
Inhibitory control within the context of early life poverty and implications for outcomes	This study reviews how early life poverty impacts the development of inhibitory control in children, linking it to negative outcomes such as lower academic achievement and behavioral difficulties.	Literature review
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	The study used a sample from the Study Early Child Care and Youth Development and used the Continuous Performance Task as a measure of inhibition. Additionally parents were interviewed and teachers gave participants a rating	Prospective cohort study

Table C.4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	262 at Time 1, 1380 at Time 2 (6 months after time 1)	Children and adolescents	Low SES
Inhibitory control within the context of early life poverty and implications for outcomes		Each study has populations of differently aged children	Low SES
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	700	Ages 8-10	Families with SES of 3.60 (SES of 0 represents a family living on the poverty line)

Table C.5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement	Measures include median family income, number of violent crimes, major life events/daily hassles, executive functioning skills (inhibition, shift, emotional control, monitor, working memory, planning/organization, organization of materials, task completion), and grade point average (GPA).	Overall results of age differences suggest that, with the exception of attention abilities and other timeline (6 months difference between the first and second conducted methods) shift abilities, executive skills are poorer for older adolescents. These results are inconsistent with the definition of executive functions as higher order processes associated with the frontal lobe. In accordance with this biological explanation of the development of executive functioning processes, skills are hypothesized to improve as children get older
Inhibitory control within the context of early life poverty and implications for outcomes	Measures include inhibitory control in children using parent/teacher reports (BRIEF, CBQ) and behavioral tasks (Stop Signal Task, Go/No-Go Task, Stroop Task, Flanker Task, Delay-of-Gratification paradigms)	Taken together, the results of these studies suggest that housing instability is a commonly experienced feature within the poverty context and may confer worse developmental outcomes than those that are suggested by financial hardship alone. Results of behavioral research that has examined IC as a mechanism explaining relations of poverty to outcomes have been mixed
The Relation between Executive Functioning and Academic Achievement through Inattention and Hyperactivity/Impulsivity: The Role of Family Factors and Teacher-Student Relationships	Measures include the Tower of Hanoi, Continuous Performance Task, Disruptive Behaviour Rating Scale, Woodcock-Johnson Psychoeducational Batter, Revised Edition, Family, Education, & Income Survey, and a Student Teacher Research Study	The results of this study were conducted on a population considered above the poverty line which violates one of our inclusion constraints. but the final results indicated that stronger EF skills are associated with higher academic achievements and that supportive family environments and higher socioeconomic status are generally linked to better executive functioning and academic outcomes

Appendix D - Data Extraction Tables for Lydia Messiha

Table D.1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	United States of America	This study uses data from the National Institute of Child Health and Human Development Study of Child Care and Youth Development.	Blums ,Angela; Belsky ,Jay; Grimm ,Kevin; Chen ,Zhe	2016
Does executive function mediate SES and home quality associations with academic readiness?	United States of America	The study was conducted in a mid-western city. The participants were recruited through various community channels, including child-care providers, mailings, community centers, and local events. The study involved both home observations and laboratory visits.	Dilworth-Bart, Janean E.	2012
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	Australia	This study was conducted using data from the Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC). Data was collected through biennial home visits, involving children, parents, and teachers	Berthelsen, Donna ; Hayes, Nicole ; White, Sonia L. J. ; Williams, Kate E.	2017

Table D.2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	https://dx.doi.org/10.1080/15248372.2016.1228652	Selective attention, attentional control, processing speed	1 month - 6 years
Does executive function mediate SES and home quality associations with academic readiness?	https://dx.doi.org/10.1016/j.jecresq.2012.02.002	The ability to stop an ongoing behavior or inhibit a prepotent response. This skill is considered one of the core sub skills of executive function (EF) development in early childhood	54-66 month old children

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2017.00903/full	Attentional regulation and the ability to inhibit prepotent responses	4-5 years.

Table D.3. Design type and study type for included studies

Title	Design	Type of Study
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	The study used structural equation modeling to examine how early socioeconomic status (SES), measured by maternal education and family income-to-needs ratio, influences high school STEM achievement through the mediating effects of early environment, executive function, and language abilities.	Retrospective cohort study
Does executive function mediate SES and home quality associations with academic readiness?	Participants were recruited through various community channels, with the majority of mothers being married or partnered and having diverse educational backgrounds; data collection involved home visits and laboratory assessments of children's literacy, math, and verbal abilities, with maternal education and income combined into a composite SES score to evaluate home environment quality and children's academic skills.	Prospective cohort study
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	The study used a longitudinal, cross-sequential design with biennial home visits and a two-stage clustered sampling to collect data from approximately 5,000 children aged 4-5 years in 2004, examining the impact of family socio-economic position, child behavior problems, and maternal parenting behaviors on executive function at age 14-15 through attentional regulation and approaches to learning.	Prospective cohort study

Table D.4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	1084	1 month to 15 years of age	SES was measured by maternal education (total years of education reported when the child was 1 month old) and family income-to-needs ratio (self-reported at 15 months, calculated by dividing total family income by the federal poverty threshold, with a ratio of 2.0 or less indicating poverty).

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
Does executive function mediate SES and home quality associations with academic readiness?	49	54-66 months and their mothers	Mean household income was \$55911.08. Majority of the mothers in the sample (79.6%) were married or living with a partner. 8.2% of mothers completed some high school, 26.5% obtained a highschool diploma or equivalent, 12.2% obtained a trade or vocational degree, 38.8% obtained a bachelor's or associate degree, 14.3% obtained a graduate or professional degree.
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	4819 children and families	4-5 years old and then again at 14-15	There were 41% of mothers who had not completed high school and 44.4% of mothers had completed a tertiary degree, of at least Bachelor level.

Table D.5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
Building Links Between Early Socioeconomic Status, Cognitive Ability, and Math and Science Achievement	Measures include Socioeconomic Status, Home/Childcare Environment, Executive function (assessed with the continuous performance task, delay of gratification task, and the children's Stroop task), Language Ability (assessed with the Letter-Word Identification and Picture Vocabulary subscales of the Woodcock-Johnson), Problem Solving, STEM achievement (assessed with GPA) and Analytic Strategy.	Family income was significantly correlated with maternal education, which in turn was positively related to environmental enrichment and engagement, both of which were positively correlated with various cognitive and problem-solving measures, ultimately linking these measures to higher math and science GPAs.
Does executive function mediate SES and home quality associations with academic readiness?	Measures include outcomes related to executive function, academic readiness, verbal ability, socioeconomic status, and home environment quality in preschoolers	Significant proportions of EF variance were accounted for by SES, but not home-environment quality, after entry of verbal abilities in block one and (2) EF accounted for significant proportions of variance in the academic readiness scores over and above verbal ability.
Executive Function in Adolescence: Associations with Child and Family Risk Factors and Self-Regulation in Early Childhood	Measures include child behavior, family risk factors, self-regulation, and executive function in early childhood and adolescence.	The study found that early ecological risks, including child behavior risk and socio-economic position (SEP), directly and indirectly influenced executive function at 14-15 years through attentional regulation and approaches to learning, with significant effects from child characteristics and early receptive vocabulary.

Appendix E - Data Extraction Tables for Mazen Ismail

Table E.1. Country of publication, setting, author, and year of included studies

Title	Country of Publication	Setting	Author	Year
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	United Kingdom of Great Britain and Northern Ireland; United States of America	The study was conducted using data from the Avon Longitudinal Study of Parents and Children (ALSPAC)	Deer, LillyBelle K.; Hastings, Paul D.; Hostinar, Camelia E.	2020
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	United States of America	Families were from a Texas Twin Study cohort	Sabhllok, Aditi	2023
Socioeconomic status and executive function in early childhood: a bioecological approach	United States of America	Data was collected in laboratory sessions at Boston University	John, Ashley Moore St	2019

Table E.2. URL/DOI, inhibition control, and early life definitions for included studies

Title	URL	"Inhibition Control" Definition	"Early Life" Definition
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	https://dx.doi.org/10.1111/cdev.13383	"Attention-regulation skills that make it possible to sustain attention, keep goals and information in mind, refrain from responding immediately, resist distraction, tolerate frustration, consider the consequences of different behaviors, reflect on past experiences, and plan for the future"	Ages 0-5 until 16-18
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	https://doi.org/10.26153/tsw/52231	Executive functions (EFs) are highly heritable higher-order cognitive processes that govern goal-directed thoughts and behaviors and enable individuals to self-regulate. These processes include response inhibition (the ability to inhibit a prepotent response).	Childhood and adolescence
Socioeconomic status and executive function in early childhood: a bioecological approach	http://myaccess.library.utoronto.ca/login?url=https%3A%2F%2Fwww.proquest.com%2Fdissertations-theses%2Fsocioeconomic-status-executive-function-early%2Fdocview%2F3037266793%2Fse-2%3Faccountid%3D14771	Executive functioning (EF) refers to higher order cognitive and goal directed processes that are essential for adaptive functioning in childhood and throughout the lifespan. The child must have the ability to control attention and inhibit prepotent responses, such as the desire to talk to a neighboring peer.	Ages 3-6

Table E.3. Design type and study type for included studies

Title	Design	Type of Study
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	Longitudinal study that looks at children from birth until they nearly reach adulthood. Looks at family income, academic achievement and development of EFs for each child that those measures are available for.	Prospective cohort study
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	Ongoing study of child and adolescent multiples from metropolitan areas of Austin and Houston. This analytic sample consisted of participants who both participated in the laboratory portion of the study, and for whom standardized school testing data was available.	Prospective cohort study
Socioeconomic status and executive function in early childhood: a bioecological approach	Children completed a working memory task and a go/no-go task, designed tease apart at a process level how SES relates to EF in children.	Randomized Control Trial

Table E.4. Number of participants, participant age range, and participant SES for included studies

Title	Number of Participants	Population: Participant Age Range	Population: Participants Socioeconomic Background
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	~15000	Ages 0-18	Poverty, disadvantaged, low-income
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	639 (twins and triplets included)	Ages 7.9 to 15.3	Residents of poorer neighbourhoods of Austin and Houston, Texas
Socioeconomic status and executive function in early childhood: a bioecological approach	121	4.5 - 5.5 years	Low SES

Table E.5. Measures and results for included studies

Title	Outcome details: Measures	Outcome details: Results
The Role of Childhood Executive Function in Explaining Income Disparities in Long-Term Academic Achievement	Academic Achievement by EF Tasks	Mathematical model to show how factors related to SES effects EFs
Executive functions and academic achievement in children and adolescents across socioeconomic and historical contexts	Standardized Test Results	Results of standardized test called the STAAR test for children (mainly twins) and similarity between scores of twins
Socioeconomic status and executive function in early childhood: a bioecological approach	Results of EF Tasks	Scores of Go/No-Go task results: Reaction time and working memory