

Review Protocol: Importance of Executive Functions in Early Life

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AI used: ChatGPT

Abstract—Executive functions are important for cognitive, social, and psychological development. Supporting children from a young age to improve their executive functioning, improving their life prospects, is critical. There is a growing amount of research on the strategies to improve executive functioning in children. This review aims to synthesize this current data, providing clarity on these practices. This protocol is proposed with the following objectives: (1) review previous studies about assessing executive function in childhood, (2) evaluate the quality of the studies, (3) summarize key points, strengths, and limitations, (4) identification of the major role of assessing executive function, (5) identification of the drawbacks of not assessing executive function, (6) identification of the outcomes of the studies, and (7) a summarisation of the findings and future recommendations. **Methods and analysis:** Google Scholar will be the main database and many key search terms will be used to facilitate the research process. Only research papers and case studies centered around the development and assessment of EFs and the consequences of failing to do so will be “accepted”. Papers from 2010 and onwards will mainly be included. Data will be extracted from the most relevant papers and analyzed.

I. INTRODUCTION

Executive Functions are critical for cognitive, social, and psychological developments. Our executive functions refer to a family of skills such as our working memory, inhibitory control, and cognitive flexibility [1]. Research indicates that executive functions are highly malleable in early childhood years. Improving these skills in an individual's younger years can lead to greater happiness and success later in life [1].

Working memory, a key executive function, refers to our ability to hold and manipulate information in our minds [1]. This ability develops very early in young children [1]. The other core executive function skill is inhibitory control, which entails suppressing attention to other things so you can stay focused on what you want [1].

This systematic review synthesizes current research and addresses gaps in the early assessment of executive functions [2]. This review aims to provide a cohesive understanding of how one's long-term developmental outcomes can be shaped by early intervention on executive functioning. This review will outline the main objectives and search strategy needed to carry out a proper review. This review is also an outline for the methods on how, when, and where relevant literature will be obtained to enhance reliability [2]. There will also be a section that aids in screening which papers will be included in the review. The review will outline data extraction process' and analysis methods to offer a clear criterion for data to be reviewed.

The goal of this review is to re-evaluate relevant studies concerned with the importance of early assessment of executive functions. This review will minimize bias by adhering to a predefined protocol which will reduce varying interpretations [2]. By following a predefined protocol, this review justifies why early assessments and interventions on executive functions can support lifelong cognitive success.

II. METHODS AND ANALYSIS

A. Research questions & objectives

The goal is to review the work and research on the topic of executive function assessment. The research questions which follow from this are: Why is it important to improve and assess executive functions early (RQ1)? What are the consequences for not doing so (RQ2)? In answering these questions, the following will be assessed: (1) a review and identification on previous studies about assessing executive function in childhood, (2) an assessment of the quality of the studies, (3) the production of a summary of the key points, strengths, and limitations, (4) identification of the major role of assessing executive function, (5) identification the drawbacks of not assessing executive function, (6) identification of the outcomes of the studies, and (7) a summarisation of the findings and future recommendations.

B. Search strategy and information sources

Using Google Scholar as the main database, peer-reviewed English language publications will be included. Preliminary searches for publications will be conducted by November 17, 2024, to test the high-level keywords.

A list of keywords is below:

- Executive Function
- Cognitive Control
- Self-regulation
- Neurodevelopment
- School readiness
- Academic success
- Working memory
- Assessment
- Intervention
- Early Intervention effects
- Childhood executive function
- Parenting and executive functions
- Risk factors
- Behavioral regulation
- Early childhood

C. Screening process and inclusion criteria

When selecting papers to include in our review, many criteria should be considered to identify which ones to “accept.”

- 1) *Study Design*: Research papers and case studies will be included in our review. Opinion based or unpublished papers will be excluded.
- 2) *Study domain*: Research papers and studies centered around understanding the importance of assessing and developing executive functions early on in life and the consequences of failing to do so will be included in our review.
- 3) *Time Frame*: Papers published from 2010 onward will be prioritized since research conducted from this period will provide the most recent understanding of EFs. Earlier studies could also be considered if they provide foundational insights that could help us gain a deeper understanding of the development and assessment of EFs.
- 4) *Participants being studied*: The participants' age range should be from 3 to 85 years because core components of EFs begin developing in early childhood & continue to evolve through adolescence until early adulthood. In later stages in life, poorly developed EFs can lead to long term consequences [1]. The papers should also include participants from diverse populations and backgrounds since EFs can be affected by one's environment [1].
- 5) *Outcomes*: The targeted outcomes should be centered around academic achievements, behavioral and social outcomes as well as long term life outcomes since these are closely correlated with early EF assessment and development. [1]

D. Data extraction process

Each team member will fully read and extract data from the top three most relevant papers assigned to them [2]. They will extract data independently into a shared Excel spreadsheet. Each team member logs their data into a separate sheet. These will then be consolidated for analysis and synthesis.

The following data will be extracted: author, setting, country of publication, year of publication, DOI/URL, objective, type of study, number of participants, participant age range, participant socioeconomic background, setting/context, measures related to the research questions, results, assessments of results, “executive functions” definition, “early life” definition, measures to mediate and moderate the effects of environmental risk on Executive Functions, limitations, and notes [3]. Missing data will be left blank.

E. Data analysis and synthesis

Extracted data will be analyzed and synthesized qualitatively, following current best practices [4]. The following key themes will be summarized in narrative form: the importance of improving and assessing executive functions early, and the consequences of not doing so. Where applicable, supplementary quantitative data such as mean, sample sizes, and study designs in tabular form to provide context and enhance the clarity of the findings.

III. DISCUSSION/CONCLUSION

Executive functions are essential for cognitive, social, and psychological development, particularly in early childhood when these skills are highly malleable. Early improvement and assessment of executive functions, including working memory, inhibitory control, and cognitive flexibility, have been shown to significantly influence long-term success in academic, social, and behavioral domains [1]. However, the consequences of neglecting the development of these skills can lead to challenges later in life.

This review aims to address the critical question: Why is it important to improve and assess executive functions early? What are the consequences for not doing so? By reviewing existing research on the topic, this systematic review will identify, assess, and summarize the relevant studies. The goal is to provide clarity on the importance of executive functions in early childhood and how it impacts future academic, behavioral, and social life outcomes.

The review will use a systematic search strategy to identify high-quality, relevant studies from 2010 onwards, focusing on studies examining childhood executive function development. The data analysis will employ a qualitative narrative synthesis, supplemented by quantitative data where applicable.

REFERENCES

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Appendix A

AI used: ChatGPT

My question: At a minimum, these criteria must pertain to study design/type, study condition or domain, setting, time frame, participants/population being studied, and outcomes. these are examples of criteria used can you give me some random examples for each

Response: Certainly! Here are examples of minimum inclusion criteria for each of the categories you mentioned.

1. Study Design/Type

- Randomized Controlled Trials (RCTs): Only RCTs are included to ensure high levels of evidence.
- Longitudinal Studies: Only studies that follow participants over a minimum of one year.
- Qualitative Interviews: Only in-depth interviews with at least 10 participants, focusing on personal experiences.

2. Study Condition or Domain

- Mental Health Disorders: Only studies focused on anxiety and depression.
- Executive Function Development: Only studies assessing executive function in children aged 5-12.
- Chronic Disease Management: Studies exploring diabetes management practices in adults.

3. Setting

- Primary Care Clinics: Only studies conducted within primary healthcare settings.
- Educational Settings: Studies conducted in school environments, such as K-12 or university settings.
- Community-Based: Research conducted in community centers or public health settings.

4. Time Frame

- Published within the Last 10 Years: Only studies published from 2014 onwards.
- Pre-pandemic vs. Post-pandemic Studies: Only studies published before March 2020.
- Study Duration: Only studies with data collection lasting at least six months.

5. Participants/Population Being Studied

- Age Range: Only studies on participants aged 18-65.
- Demographic Focus: Studies focusing on low-income families or rural populations.
- Special Conditions: Only studies involving participants diagnosed with ADHD.

6. Outcomes

- Cognitive Improvements: Studies that measure cognitive test scores or executive function improvements.
- Patient Satisfaction: Outcomes focused on patient-reported satisfaction with healthcare services.

- Long-term Health Outcomes: Studies that report on survival rates, quality of life, or chronic disease progression over time.

These examples can be tailored further based on the specifics of your research question and goals.

Appendix B

From the prompt given by ChatGPT to my question, I got a better idea about the different criteria that come into factor when researching papers. Even though the answer was not directly correlated to my study, I was able to apply what I have learned from the research about EFs and fill out the required criteria.