

Article

Improving Learning Outcomes Through the Development of Executive Functioning Skills in Learners

Lara Torrefranca Matbagon

Mitchie Grava Matbagon

Carmina Luna A. Chua

Helen O. Revalde

Margie D. Fulgencio

Veronica Calasang

Corresponding Author: laramatbagon@gmail.com

Abstract: Schools can empower their students with the essential executive functioning skills required to excel academically and thrive in various aspects of their lives. Regular assessment and feedback from both students and educators will be essential to measure the program's success and make necessary improvements. The findings revealed that the teacher respondents had varying levels of experience and had attended relevant training and seminars. Feedback and reflection emerged as the top teaching strategy. The learner respondents were primarily 5-year-olds, and there was a gender disparity with more male learners. The learners demonstrated developmental abilities and cognitive differences, which were measured using indicators and computed mean scores. Moreover, significant relationships were found between age and working memory, gender and inhibitory control, age and cognitive flexibility, and gender and attentional control. The study's results provide insights into the characteristics of teachers and learners, their cognitive abilities, and cognitive control. These findings can inform the design of tailored instructional strategies and interventions to address the learners' developmental needs. Additionally, the study highlights the importance of considering the profiles of learners when promoting their executive functioning skills.

Keywords: Learning outcomes, executive functioning skills, basic education

Introduction

In recent years, there has been growing interest in the role of executive functioning in early childhood education. Bierman et al. (2019) emphasized that executive functioning is not fully developed until early adulthood, and that early childhood is a critical period for their development. Blair (2020) suggested that early childhood



Copyright: © 2023 by the authors.
Submitted for possible open access
publication under the terms and
conditions of the Creative Commons
Attribution (CC BY)
license(<https://creativecommons.org/licenses/by/4.0/>)

educators are increasingly recognizing the importance of supporting the development of executive function skills in young learners. Executive functioning refers to a set of cognitive skills that enable individuals to plan, organize, and execute goal-directed behaviors (Knollman et al. (2022). These skills are crucial for success in academic, social, and emotional domains, and are believed to underlie a range of important outcomes throughout the lifespan (Wanless et al., 2021).

According to Ernst & Burak (2019) executive function is important for various aspects of life, including academic success, social relationships, emotional regulation, and overall well-being. Moreover, Rosen et al. (2020) suggested that executive function is a key factor in school readiness and academic success, as well as in other areas of development. Spiegel et al. (2021) also emphasizes the need for early identification and intervention for children who may be at risk for executive function difficulties, in order to promote positive outcomes in multiple domains. According to Bull & Scerif (2019) executive function skills include working memory, inhibitory control, cognitive flexibility, and attentional control. Working memory involves the ability to hold and manipulate information in one's mind over a short period of time. Inhibitory control involves the ability to suppress automatic or impulsive responses in order to achieve a goal. Cognitive flexibility involves the ability to switch between tasks or perspectives, and attentional control involves the ability to focus attention and resist distractions.

McClelland & Cameron (2019) stated that early childhood educators play a crucial role in supporting the development of executive function skills in young learners. Early childhood educators can create a learning environment that is safe, predictable, and nurturing. This can help young children feel secure and supported, which in turn can promote the development of executive function skills (Bodrova & Leong, 2021). Early childhood educators can use instructional strategies that have been shown to promote the development of executive function skills (Diamon & Ling, 2020). For example, using games and activities that require children to plan, organize, and execute goal-directed behaviors can help to develop these skills. Early childhood educators can encourage young children to develop self-regulation skills by providing opportunities for children to practice self-control and self-regulation (Graziano & Diamantopoulou, 2019). Moreover, early childhood educators can provide targeted interventions for children who are struggling with executive function skills (Brock et al., 2019). For example, providing individualized instruction, offering coaching and feedback, or providing accommodations such as visual aids or reminders can help children to develop these skills. Zelazo (2021) noted that early childhood educators play a critical role in supporting the development of executive function skills in young learners.

Furthermore, research has shown that executive function skills are not fully developed until early adulthood, and that early childhood is a critical period for their development (Diamond, 2020). Children who have strong executive function skills in early childhood are more likely to succeed academically and socially throughout their lives (Murray & Booth, 2020). Jurado & Rosseli (2021) emphasized that it is important to understand the level of executive function in young learners, in order to develop appropriate interventions and support to help them build these skills. Understanding the role of executive functioning in early childhood education is critical for educators, parents, and researchers who seek to support the development of young learners (Diamond, 2020). Thus, by focusing on the development of these skills, we can help to ensure that all children have the tools they need to succeed in school and beyond.

Studying the level of learners' executive function in early childhood education can also provide insights into the effectiveness of different educational approaches and interventions (Diamond, 2012). By identifying the specific executive function skills that are most challenging for young learners, educators can design targeted interventions that support their development (Maye et al., 2019).

As the Philippines continues to develop and compete in the global economy, it is important to ensure that young learners have the cognitive skills necessary for success. Studying executive function skills, educators can help to promote the development of a skilled and capable workforce that can contribute to national development. As the Philippines continues to develop and compete in the global economy, it is important to ensure that young learners have the cognitive skills necessary for success. Focusing on the development of executive function skills, educators can help to promote the development of a skilled and capable workforce that can contribute to national development. Thus, by studying executive function skills in young learners is important in the Philippines for several reasons: The development of executive function skills in young learners is linked to academic success. Understanding how to promote the development of these skills, educators can help students perform better in school, which can have lifelong benefits. Executive function skills are also linked to social-emotional development. Supporting the development of these skills, educators can help students develop healthy relationships and manage their emotions effectively. The development of executive function skills in early childhood has been linked to future outcomes such as academic and career success, as well as overall well-being.

While EF skills are essential for academic success, many early childhood education programs do not explicitly teach or support the development of these skills. This can result in children who struggle to focus, follow instructions, regulate their emotions, and solve problems effectively. Without adequate EF skills, children may

struggle to learn new concepts, communicate effectively, and develop healthy social relationships. Therefore, it is essential to understand the role of EF in early childhood education and to develop strategies to support the development of these critical skills in young children.

Methodology

The descriptive-correlational method of research was used in this study. This method answered the questions who, what, where, when, and how. A descriptive is used when it aims to provide an accurate description of a situation or an association between variables from which one can then make some statements about a certain group or population. With the nature of our study, the level of executive functioning skills of the learners will be determined, hence it will be appropriate to use the mentioned research design. Moreover, data will be described and analyzed through data gathered using the research instrument. The study was conducted at Caw-oy Elementary School, Canjulao Elementary School and Basac Elementary School. It is situated at Barangay San Vicente which approximately found in Olango Island, Lapu -Lapu City. The developmental Stage questionnaire was adopted from (Foulks, 2016), Cognitive differences, adopted from (Zelazo & Carlson, 2012) and Linguistic differences, adopted from (Garcia & Ortiz, (2013). For the level of dimensions of the executive functioning skills as to Working Memory was adopted from (Baddeley, 2012), Inhibitory control, cognitive flexibility and attentional control were adopted from (Diamond, 2013).

Results and Discussion

Table 1. Profile of learner Respondents

Age	Frequency	Percentage
6	7	41.18
5	10	57.82
Gender		
Male	8	52.94
Female	9	47.06

Table 3 presents the profile of learner respondents. The age distribution shows that a significant majority (57.82%) of the respondents are 5 years old, and a substantial minority (41.18%) are 6 years old. This data indicates that the survey primarily includes children in the early pre-primary education. The gender distribution of the learners is almost equal, with slightly more males (52.94%) than females (47.06%). This balance suggests that the data gathered should offer a relatively representative perspective of experiences and responses from both genders at these ages. This indicates that the learner respondents surveyed are predominantly 5 and 6 years old,

and there is a nearly even distribution between male and female respondents. This sample seems to be reflective of early primary or pre-primary educational settings, with a slightly higher representation of males.

Table 2. Learners Developmental Stage

Learners Developmental Stage	WM	VD
The learner is able to follow simple instructions.	3.26	MA
The learner is able to remember and follow multi-step instructions.	3.15	MA
The learner is able to identify and match colors and shapes.	3.25	MA
The learner is able to understand cause and effect relationships.	3.25	MA
The learner is able to engage in cooperative play with peers.	3.08	MA
Total	3.23	MA

Table 2 presents the developmental stage of learners based on their abilities to perform various tasks. Based on the data, learners at this developmental stage are generally able to follow simple instructions, remember and follow multi-step instructions, identify and match colors and shapes, understand cause and effect relationships, and engage in cooperative play with peers. The overall average score for this developmental stage is 3.23 for WM and MA for VD, which indicates that learners at this stage have average abilities in these areas. These abilities are important for a child's development as they contribute to their cognitive and social-emotional growth. Being able to follow instructions and understand cause and effect relationships helps learners to become more independent and self-sufficient, while the ability to engage in cooperative play with peers promotes social skills and emotional regulation.

Table 3. Learners Cognitive Differences

Indicators	WM	VD
The learner is able to focus on a task for an extended period of time.	3.10	MA
The learner is able to switch between tasks easily.	3.08	MA
The learner is able to hold and manipulate information in their mind for a short period of time.	3.20	MA
The learner is able to inhibit impulses and avoid distractions.	3.05	MA
The learner is able to think creatively and come up with new ideas.	3.02	MA
Total	3.09	MA

Table 3 presents the cognitive differences among learners based on their abilities to perform various tasks. Based on the data,

learners at this stage have average abilities in all areas assessed. Learners are able to focus on a task for an extended period of time, switch between tasks easily, hold and manipulate information in their mind for a short period of time, inhibit impulses and avoid distractions, and think creatively and come up with new ideas. The overall average score for this cognitive difference stage is 3.09 for WM and MA for VD. These cognitive abilities are important for learners to succeed in various academic and non-academic tasks. Being able to focus on a task for an extended period of time helps learners to complete tasks more efficiently, while the ability to switch between tasks easily is important for multitasking and flexibility. Holding and manipulating information in one's mind is important for problem-solving and decision-making. Inhibiting impulses and avoiding distractions is essential for self-control and regulation, while thinking creatively and coming up with new ideas is important for innovation and problem-solving. The table highlights the importance of assessing learners' cognitive differences and identifying their strengths and weaknesses in various areas.

Table 4. Learners Linguistic Background

Indicators	WM	VD
The learner has a strong grasp of the language of instruction.	2.89	MA
The learner is able to communicate effectively in their native language.	2.92	MA
The learner is able to understand and use complex vocabulary.	3.05	MA
The learner is able to follow spoken instructions.	3.05	MA
The learner is able to read and comprehend written texts at their grade level.	2.96	MA
Total	2.97	MA

Table 4 presents indicators of learners' linguistic background based on their abilities to perform various tasks. Based on the data, learners at this stage have average abilities in all areas assessed. Learners have a strong grasp of the language of instruction, are able to communicate effectively in their native language, understand and use complex vocabulary, follow spoken instructions, and read and comprehend written texts at their grade level. The overall average score for this linguistic background stage is 2.97 for WM and MA for VD. These linguistic abilities are important for learners to succeed in various academic and non-academic tasks. Having a strong grasp of the language of instruction is important for academic success, while effective communication in one's native language is important for social-emotional development and cultural awareness. Understanding and using complex vocabulary is essential for academic language proficiency, while the ability to follow spoken instructions and read and comprehend written texts at one's grade level is important for

academic achievement. The table highlights the importance of assessing learners' linguistic background and identifying their strengths and weaknesses in various language-related areas. This information can be used to create targeted interventions and activities to support learners' language development and help them succeed in academic and non-academic tasks.

Table 5. Working Memory

Indicators	WM	VD
Learners were able to stay focused and pay attention for extended periods of time.	3.00	MA
Learners were able remember and follow multi-step instructions	2.67	MA
Learners were able to recall details of a story or conversation.	3.00	MA
Learners were able to remember a series of numbers or letters in order.	3.33	MA
Learners have difficulty switching attention from one task to another.	3.33	MA
Total	3.07	MA

Table 5 delineates the indicators related to working memory. The learners' ability to stay focused and pay attention for extended periods scored an average of 3.00. Remembering and following multi-step instructions was slightly more challenging for the learners, as reflected by a lower average score of 2.67. The ability to recall details of a story or conversation matched the score of sustained attention with an average of 3.00. However, learners showed a better performance in remembering a series of numbers or letters in order, and in switching attention from one task to another, with both indicators achieving an average score of 3.33. The overall average score, reflecting the total performance across all the indicators of working memory and attention, stood at 3.07, indicating a moderate acquisition.

Table 6. Inhibitory control

Indicators	WM	VD
Learner has the ability to control impulses and stop oneself from acting on automatic responses.	3.33	MA
Learners were able to wait their turn during games or activities.	3.33	MA
Learners were able to stop themselves from blurting out answers or interrupting others.	3.00	MA
Learners were able resist the temptation to touch or take objects that do not belong to them.	3.00	MA
Learners were able to follow rules or adhere to routines.	3.33	MA
Total	3.20	MA

Table 6 provides an analysis of inhibitory control. The learners' ability to control impulses and stop themselves from acting on automatic responses scored an average of 3.33, as did their ability to wait their turn during games or activities. On the other hand, their ability to stop themselves from blurting out answers or interrupting others, and their ability to resist the temptation to touch or take objects that do not belong to them, both received a slightly lower score of 3.00. Their ability to follow rules or adhere to routines matched the highest score, with an average of 3.33. The average score across all the inhibitory control indicators was 3.20, pointing to a medium level of attention. This indicates that learners are generally able to control their impulses to a reasonable extent, but there may be room for improvement.

Table 7. Cognitive flexibility

Indicators	WM	VD
Learners were able to adapt to changes in routine or schedule.	3.00	MA
Learners were able to shift attention from one activity to another without difficulty.	3.33	MA
Learners were able to think of multiple solutions to a problem.	2.67	MA
Learners were able to adopt to changes in routines or schedules.	3.33	MA
Learners were able to switch attention from one task to another.	3.33	MA
Total	3.12	MA

Table 7 evaluates cognitive flexibility of the learners. The learners' ability to adapt to changes in routine or schedule scored an average of 3.00. Their ability to shift attention from one activity to another without difficulty and to switch attention from one task to another both scored higher, with an average of 3.33. However, their ability to think of multiple solutions to a problem scored slightly lower, with an average of 2.67.

Table 8. Attentional Control

Indicators	WM	VD
Learners were able to sustain attention and resist distractions.	3.00	MA
Learners were able to focus on a task for a reasonable amount of time.	3.00	MA
Learners were able to ignore irrelevant noises or movements around them.	3.00	MA
Learners were able to switch attention back to a task after being interrupted.	3.33	MA
Learners were able to concentrate even in noisy or chaotic environments.	3.00	MA
Total	3.067	MA

It is worth noting that the indicator "Learners were able to adapt to changes in routines or schedules" appears to be repeated with the same average score of 3.33. The total average score for all cognitive flexibility indicators was 3.12, indicating a medium level of attention overall. This reflects the learners' moderate ability to adapt and shift their thinking or focus depending on the demands of their environment.

Table 8 evaluates the attentional control of learners. The learners' ability to sustain attention and resist distractions, to focus on a task for a reasonable amount of time, to ignore irrelevant noises or movements around them, and to concentrate even in noisy or chaotic environments all scored an average of 3.00. This indicates a moderate ability to control and direct their attention. The ability to switch attention back to a task after being interrupted scored slightly higher, with an average of 3.33, suggesting that learners were relatively better at this aspect of attentional control. The total average score for all attentional control indicators was 3.067, indicating a medium level of attention overall. This suggests that while learners have a decent level of attentional control, there is still room for improvement in this key cognitive skill. This indicates that while they are able to maintain focus and ignore distractions to an extent, there's potential for enhancement in these areas.

Table 9. Significant Relationship between profiles and Working Memory

			<i>Learners Developmental Stage</i>	<i>Learners Cognitive Differences</i>	<i>Learners Linguistic Background</i>	<i>Working Memory</i>
Age	1					
	-					
Gender	0.8874	1				
Learners Developmental Stage	-		1			
Learners Cognitive Differences	0.0994	-0.0326	0.170697	1		
Learners Linguistic Background	-		0.227273	0.170697	1	
Working Memory	0.5466	-0.4851	0.045041	0.1776	0.045041	1

The presented outlines the relationships among various factors, including Age, Gender, Learners Developmental Stage, Learners Cognitive Differences, Learners Linguistic Background, and Working Memory. Finding shows a strong positive correlation between Age and Working Memory (0.55), indicating that working

memory improves as learners grow older. Conversely, Gender and Age demonstrate a substantial negative correlation (-0.89), suggesting an inverse relationship. However, this correlation may not have a meaningful interpretation as typically, there is no direct causal link between gender and age. Learners Developmental Stage exhibits weak correlations with other variables, having a slight negative relationship with Age and Gender, and a weak positive relationship with Learners Cognitive Differences and Learners Linguistic Background. Learners Cognitive Differences show a somewhat positive correlation with both Learners Developmental Stage and Learners Linguistic Background, and a slightly stronger positive relationship with Working Memory (0.18). This might imply that cognitive differences play a role in the development of working memory. Lastly, Learners Linguistic Background presents a weak positive relationship with Learners Developmental Stage and Learners Cognitive Differences, and a very weak relationship with Working Memory.

Table 10. Significant Relationship between profiles and Inhibitory Control

	Age	Gender	Learners Developmental Stage	Learners Cognitive Differences	Learners Linguistic Background	Inhibitory Control
Age	1					
Gender	-0.887	1				
Learners Developmental Stage	-0.117	-0.043	1			
Learners Cognitive Differences	0.099	-0.032	0.170697	1		
Learners Linguistic Background	-0.117	-0.043	0.227273	0.170697	1	
Inhibitory Control	0.553	-0.490	-0.01899	0.10699	-0.01899	1

The table shows the correlation coefficients between each pair of variables, as well as the correlation coefficient of Inhibitory Control. The variables included are Age, Gender, Learners Developmental Stage, Learners Cognitive Differences, Learners Linguistic Background, and Inhibitory Control. The table shows that there is a statistically significant positive relationship between Inhibitory Control and Age ($r = 0.553$, $p < 0.05$), indicating that as Age increases, Inhibitory Control also increases. On the other hand, there is a statistically significant negative relationship between Inhibitory Control and Gender ($r = -0.490$, $p < 0.05$), indicating that females have higher Inhibitory Control than males. However, there is no statistically significant relationship between Inhibitory Control and Learners Developmental Stage, Learners Cognitive Differences, or Learners Linguistic Background, as the correlation coefficients are not significant ($p > 0.05$).

Table 11. Significant Relationship between profiles and Cognitive Flexibility

			<i>Learners Developmental Stage</i>	<i>Learners Cognitive Differences</i>	<i>Learners Linguistic Background</i>	<i>Cognitive Flexibility</i>
Age	1					
Gender	-0.8874	1				
Learners Developmental Stage	-0.1177	-0.043	1			
Learners Cognitive Differences	0.0994	-0.032	0.170697	1		
Learners Linguistic Background	-0.1177	-0.043	0.227273	0.170697	1	
Cognitive Flexibility	0.5430	-0.481	-0.09788	0.015752	-0.09788	1

The table shows the correlation coefficients between each pair of variables, as well as the correlation coefficient of Cognitive Flexibility. The variables included are Age, Gender, Learners Developmental Stage, Learners Cognitive Differences, Learners Linguistic Background, and Inhibitory Control. The table shows that there is a statistically significant positive relationship between Inhibitory Control and Age ($r = 0.553$, $p < 0.05$), indicating that as Age increases, Inhibitory Control also increases. On the other hand, there is a statistically significant negative relationship between Inhibitory Control and Gender ($r = -0.490$, $p < 0.05$), indicating that females have higher Inhibitory Control than males.

Table 12. Significant Relationship between profiles and Attentional Control

			<i>Learners Developmental Stage</i>	<i>Learners Cognitive Differences</i>	<i>Learners Linguistic Background</i>	<i>Attentional Control</i>
Age	1					
Gender	0.887	1				
Learners Developmental Stage	-0.117	-0.043	1			
Learners Cognitive Differences	0.099	-0.032	0.170697	1		
Learners Linguistic Background	-0.117	-0.043	0.227273	0.170697	1	
Attentional Control	0.546	-0.485	-0.05067	0.069771	-0.05067	1

However, there is no statistically significant relationship between Inhibitory Control and Learners Developmental Stage, Learners Cognitive Differences, or Learners Linguistic Background, as the correlation coefficients are not significant ($p > 0.05$).

The table 12 shows the correlation coefficients between each pair of variables, as well as the correlation coefficient of Attentional Control. The variables included are Age, Gender, Learners Developmental Stage, Learners Cognitive Differences, Learners Linguistic Background, and Attentional Control. The table shows that there is a statistically significant positive relationship between Attentional Control and Age ($r = 0.546$, $p < 0.05$), indicating that as Age increases, Attentional Control also increases. On the other hand, there is a statistically significant negative relationship between Attentional Control and Gender ($r = -0.485$, $p < 0.05$), indicating that females have higher Attentional Control than males. However, there is no statistically significant relationship between Attentional Control and Learners Developmental Stage, Learners Cognitive Differences, or Learners Linguistic Background, as the correlation coefficients are not significant ($p > 0.05$).

Conclusion

The data presents a profile of learner respondents, focusing on various aspects such as age, gender, developmental stage, cognitive differences, linguistic background, and specific cognitive abilities like working memory, inhibitory control, cognitive flexibility, and attentional control. The majority of respondents were 5-6 years old, with a slightly higher representation of males. Overall, learners demonstrated a moderate to high level of development across developmental stages, cognitive differences, and linguistic background. However, their working memory and cognitive flexibility were rated slightly lower in comparison. In terms of relationships between these profiles and cognitive abilities, the analysis revealed some noteworthy findings. Working memory was positively correlated with age, suggesting that older learners tended to have better working memory skills. In contrast, inhibitory control and attentional control did not show a strong relationship with age. Gender did not significantly influence any of the cognitive abilities assessed. Interestingly, learners at more advanced developmental stages and those with stronger cognitive differences and linguistic backgrounds tended to have better inhibitory control and attentional control. However, cognitive flexibility did not appear to be strongly influenced by these factors. In conclusion, this analysis provides valuable insights into the learner profiles and their relationships with cognitive abilities. It highlights the importance of considering developmental stage, cognitive differences, and linguistic background when assessing and addressing inhibitory control and attentional

control skills in young learners. Additionally, the findings suggest the potential for age-related improvements in working memory. Further research and interventions tailored to these profiles can help support the holistic development of these young learners.

References

- Alan Baddeley: Baddeley, A. D. (1992). Working memory. *Science*, 255(5044), 556-559.
- Ahn, Y., & Miller, L. M. (2019). The association between executive function and academic achievement in children: A meta-analysis. *Journal of Educational Psychology*, 111(2), 211-222. <https://doi.org/10.1037/edu0000294>
- Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., ... & Greenberg, M. T. (2019). Effects of Head Start REDI on children's outcomes 1 year later in different kindergarten contexts. *Child development*, 90(1), 128-150.
- Bialystok, E., & Craik, F. I. (2022). How does bilingualism modify cognitive function? Attention to the mechanism. *Psychonomic Bulletin & Review*, 29(4), 1246-1269.
- Bodrova, E., & Leong, D. J. (2021). Developing Executive Function Skills in Early Childhood. *Young Children*, 76(3), 10-18.
- Blair, C. (2020). Early Childhood Development and School Readiness: Executive Function as a Key Construct. *Annual Review of Psychology*, 71, 271-295.
- Brock, L. L., Rimm-Kaufman, S. E., Nathanson, L., & Grimm, K. J. (2019). Improving self-regulation skills in young children: A review of the literature and implications for education. *Early Childhood Research Quarterly*, 48, 40-53.
- Çeliköz, N., Erişen, Y., & Şahin, M. (2019). Cognitive learning theories with emphasis on latent learning, gestalt and information processing theories. *Journal of Educational and Instructional Studies in the World*, 9(3).
- Clark, S. V., Semmel, E. S., Aleksonis, H. A., Steinberg, S. N., & King, T. Z. (2021). Cerebellar-subcortical-cortical systems as modulators of cognitive functions. *Neuropsychology Review*, 1-25.
- Diamond, A., & Ling, D. S. (2020). Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not. *Developmental Cognitive Neuroscience*, 42, 100771.

- Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science*, 333(6045), 959-964. <https://doi.org/10.1126/science.1204529>
- Diamond, A. (2020). Executive functions. *Annual Review of Psychology*, 71, 335-361.
- Diamond, A. (2012). Activities and programs that improve children's executive functions. *Current Directions in Psychological Science*, 21(5), 335-341. doi: 10.1177/0963721412453722
- Drigas, A., & Karyotaki, M. (2019). Executive Functioning and Problem Solving: A Bidirectional Relation. *Int. J. Eng. Pedagog.*, 9(3), 76-98.
- Doebel, S. (2020). Rethinking executive function and its development. *Perspectives on Psychological Science*, 15(4), 942-956.
- Ernst, J., & Burcak, F. (2019). Young children's contributions to sustainability: The influence of nature play on curiosity, executive function skills, creative thinking, and resilience. *Sustainability*, 11(15), 4212.
- John Anderson: Anderson, J. R. (1993). *Rules of the mind*. Hillsdale, NJ: Erlbaum.
- Graziano, P. A., & Diamantopoulou, S. (2019). Individualized Classroom Interventions to Promote Young Children's Self-Regulation. *Child Development Perspectives*, 13(2), 92-98.
- Harrington, E. M., Trevino, S. D., Lopez, S., & Giuliani, N. R. (2020). Emotion regulation in early childhood: Implications for socioemotional and academic components of school readiness. *Emotion*, 20(1), 48.
- Ibbotson, P. (2023). The Development of Executive Function: Mechanisms of Change and Functional Pressures. *Journal of Cognition and Development*, 1-19.
- Kassai, R., Futo, J., Demetrovics, Z., & Takacs, Z. K. (2019). A meta-analysis of the experimental evidence on the near-and far-transfer effects among children's executive function skills. *Psychological Bulletin*, 145(2), 165.
- Mayer, R. E., Parong, J., & Bainbridge, K. (2019). Young adults learning executive function skills by playing focused video games. *Cognitive Development*, 49, 43-50.
- Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63(2), 81-97. <https://doi.org/10.1037/h0043158>

- Rudd, J. R., O'Callaghan, L., & Williams, J. (2019). Physical education pedagogies built upon theories of movement learning: How can environmental constraints be manipulated to improve children's executive function and self-regulation skills?. *International journal of environmental research and public health*, 16(9), 1630.
- Robbie Case: Case, R. (1992). *The mind's staircase: Exploring the conceptual underpinnings of children's thought and knowledge*. Hillsdale, NJ: Erlbaum.
- Johnson, A., Nelson, J. M., Tomaso, C. C., James, T., Espy, K. A., & Nelson, T. D. (2020). Preschool executive control predicts social information processing in early elementary school. *Journal of Applied Developmental Psychology*, 71, 101195.
- Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., ... & Greenberg, M. T. (2019). Effects of Head Start REDI on children's outcomes 1 year later in different kindergarten contexts. *Child development*, 90(1), 128-150.
- Markant, J., & Amso, D. (2022). Context and attention control determine whether attending to competing information helps or hinders learning in school-aged children. *Wiley Interdisciplinary Reviews: Cognitive Science*, 13(1), e1577.
- Knollman-Porter, K., Kaminski, J. W., & Valle, L. A. (2022). Building Strong Foundations: A Systematic Review of Early Childhood Interventions to Promote Executive Function Development. *Early Childhood Research Quarterly*, 57, 198-215.
- Mao, F., Xu, Z., Li, Y., Huang, Y., Lu, Y., Wang, J., ... & Cao, F. (2023). Maternal impaired cognition and infant neglect: exploring the independent and combined effects of maternal executive function and reflective function. *Journal of interpersonal violence*, 08862605231154940.
- Murray, J., & Booth, J. (2020). Executive function and academic achievement in early childhood: A meta-analysis. *Journal of Educational Psychology*, 112(3), 428-450.
- Mitsea, E., Drigas, A., & Mantas, P. (2021). Soft Skills & Metacognition as Inclusion Amplifiers in the 21 st Century. *International Journal of Online & Biomedical Engineering*, 17(4).
- McClelland, M. M., & Cameron, C. E. (2019). Developing together: The role of executive function and motor skills in children's early academic lives. *Early Childhood Research Quarterly*, 46, 142-151.
- Montgomery, L., Chondrogianni, V., Fletcher-Watson, S., Rabagliati, H., Sorace, A., & Davis, R. (2022). Measuring the impact of bilingualism on executive functioning via inhibitory control

- abilities in autistic children. *Journal of Autism and Developmental Disorders*, 52(8), 3560-3573.
- Ocampo, D. J., & Buenviaje, J. (2021). Basic education in the Philippines. *International Handbook on Education in South East Asia*, 1-27.
- Rosen, M. L., Hagen, M. P., Lurie, L. A., Miles, Z. E., Sheridan, M. A., Meltzoff, A. N., & McLaughlin, K. A. (2020). Cognitive stimulation as a mechanism linking socioeconomic status with executive function: A longitudinal investigation. *Child development*, 91(4), e762-e779.
- Raghunathan, R. (2020). Patterns of Inhibitory Control and Socioemotional Development: A Multimodal Examination in Early and Middle Childhood (Doctoral dissertation, Johns Hopkins University).
- Sarma, U. A., & Mariam Thomas, T. (2020). Breaking the limits of executive functions: Towards a sociocultural perspective. *Culture & Psychology*, 26(3), 358-368.
- Uddin, L. Q. (2021). Brain mechanisms supporting flexible cognition and behavior in adolescents with autism spectrum disorder. *Biological Psychiatry*, 89(2), 172-183.
- Van Stockum Jr, C. A., & DeCaro, M. S. (2020). When working memory mechanisms compete: Predicting cognitive flexibility versus mental set. *Cognition*, 201, 104313.
- Van der Oord, S., & Tripp, G. (2020). How to improve behavioral parent and teacher training for children with ADHD: Integrating empirical research on learning and motivation into treatment. *Clinical child and family psychology review*, 23(4), 577-604.
- Vuong, Q. H., Le, T. T., & Nguyen, M. H. (2022). Mindsponge mechanism: an information processing conceptual framework. *The Mindsponge and BMF Analytics for Innovative Thinking in Social Sciences and Humanities*, De Gruyter, 21-46.
- Wanless, S. B., McClelland, M. M., Acock, A. C., Ponitz, C. C., Son, S. H., Lan, X., & Chen, J. (2021). Longitudinal associations between early math skills and executive function in low-income preschoolers. *Journal of Educational Psychology*, 113(5), 825-837.
- Waters, N. E., Ahmed, S. F., Tang, S., Morrison, F. J., & Davis-Kean, P. E. (2021). Pathways from socioeconomic status to early academic achievement: The role of specific executive functions. *Early Childhood Research Quarterly*, 54, 321-331.

- Yan, Z., Hong, S., Liu, F., & Su, Y. (2020). A meta-analysis of the relationship between empathy and executive function. *PsyCh Journal*, 9(1), 34-43.
- Yeh, Y. C., Chang, J. Y., & Ting, Y. S. (2023). Engaging elementary school children in mindful learning through story-based creativity games facilitates their growth mindset. *International Journal of Human-Computer Interaction*, 39(3), 519-528.
- Zelazo, P. D. (2021). Executive function in early childhood: The role of the teacher. *The Elementary School Journal*, 121(4), 592-609.