

## The impact of bilingual experience on self-regulation development in early childhood: A systematic review

İki dillilik deneyimin erken çocukluk döneminde öz düzenleme gelişimine etkisi: Sistematik bir inceleme

Meral Şeker<sup>1</sup>, Sophie Kern<sup>2</sup><sup>1</sup> Alanya Alaaddin Keykubat Üniversitesi, 01zxaph45, Eğitim Fakültesi, İngiliz Dili Eğitimi, Antalya, Türkiye<sup>2</sup> Laboratoire Dynamique Du Langage, CNRS, Lyon, Fransa

## ABSTRACT

As a multifaceted construct that plays a significant role in cognitive, psychological and social development in early childhood, Self-Regulation (SR) refers to the ability to actively plan and modulate behaviours operating across multiple levels of function in pursuit of a goal. SR has significant correlations with multiple positive outcomes such as academic success, development of language skills, psychological and physical health, and social competence. Among the significant variables affecting SR strategy development, research indicate that early childhood bilingualism has a significant role in children's development of specific strategies. In this respect, the aim of the study is to compile the indicators of SR strategies impacted by linguistic state (i.e., being bilingual or dual-language learner) of children in preschool age. Adopting systematic review research design, the study reports the results obtained from the review of the articles (N=42). Highlighting the significance of bilingual experience in early childhood, the findings indicate varying degrees of casual relationship between children's linguistic state and SR development in this period. Considering that the development of the strategies during this period is essential for later development, the findings are meant to lead to further discussions and research on the role of linguistic experiences in SR development in early childhood.

**Keywords:** early childhood, early childhood bilingualism, self-regulation, strategy development

## ÖZ

Erken çocukluk döneminde bilişsel, psikolojik ve sosyal gelişimde önemli bir rol oynayan çok yönlü bir yapı olarak Öz Düzenleme (ÖD), bir hedefe ulaşmak için birden fazla işlev düzeyinde çalışan davranışları aktif olarak planlama ve düzenleme yeteneğini ifade eder. ÖD'nin akademik başarı, dil becerilerinin gelişimi, psikolojik ve fiziksel sağlık ve sosyal yeterlilik gibi birden fazla gelişim boyutu ile önemli korelasyonları vardır. ÖD strateji gelişimini etkileyen önemli değişkenler arasında, araştırmalar erken çocukluk dönemindeki iki dilliliğin çocukların belirli stratejileri geliştirmelerinde önemli bir role sahip olduğunu göstermektedir. Bu bağlamda, çalışmanın amacı okul öncesi çağındaki çocukların dilsel durumlarından (yani iki dilli veya çift dilli öğrenci olmak) etkilenen ÖD stratejilerinin göstergelerini derlemektir. Sistematik inceleme araştırma tasarımını benimseyen çalışma, makalelerin incelenmesinden elde edilen sonuçları bildirmektedir (N = 42). Erken çocukluk döneminde iki dillilik deneyimin önemini vurgulayan bulgular, bu dönemde çocukların dilsel durumları ile ÖD gelişimi arasında değişen derecelerde nedensel ilişki olduğunu göstermektedir. Bu dönemde stratejilerin geliştirilmesinin sonraki gelişim açısından önemli olduğu düşünüldüğünde, bulguların erken çocukluk döneminde ÖD gelişiminde dilsel deneyimlerin rolü konusunda daha derin tartışma ve araştırmaya yol açması amaçlanmaktadır.

**Anahtar kelimeler:** erken çocukluk, erken çocuklukta ikidillilik, öz düzenleme, strateji gelişimi

## Introduction

Self-regulation (SR) broadly refers to "... demonstrating control over learning actions" (Fredricks et al., 2011). It is a dynamic process through which individuals set aims, regulate and control their cognition and affective states by taking into consideration the contextual features (Pintrich, 2004). Although the literature shows different conceptualizations of the construct, there are four main dimensions provided for the strategies: cognitive, affective, social-interactional, and metacognitive domains (Oxford, 2011; Schunk & Zimmerman, 1994). Under the cognitive dimensions, the cognitive strategies that manage cognitive processes via elaboration, adaptation, rehearsal, and organization are grouped. While affective domain includes the strategies that manage emotional, motivational and attentional requirements, social-interactional domain covers the strategies dealing with the socio-cultural context through interactions. Metacognitive domain, on the other hand, consists of the strategies that regulate all of the cognitive, affective, and social strategies including planning, managing time, monitoring and evaluating the processes. (Oxford, 2011; Paris et al., 2001; Zimmerman, 1998).

Research has revealed that SR has significant correlations with multiple positive outcomes such as long-term academic success; higher levels of school readiness; enhanced language skills; improved psychological and physical health; higher levels of social competence (e.g., Bohlman et al., 2015; Cole et al., 2009; Fuhs et al., 2014; Hosch et al., 2022; Ramani et al., 2010; Weiland et al., 2014; Whedon et al., 2021; Williford et al., 2013). As a result of these proliferating research findings that reveal the predictive power of SR for multiple competences, the significant variables affecting strategy development have been frequently studied. The findings of these studies indicate three main factor domains that are influential in the development of strategies in children: biological (e.g., gender, age), situational (e.g. maternal/caregiver support), and cognitive (e.g., being bilingual) states. Considering biological factors, the studies provide findings regarding the significance of gender variable in children's SR abilities (Day et al., 2018; Hosch et al., 2022; Kochanska et al., 2001; O'Toole et al., 2019; Smith-Donald et al., 2007). The results indicate that girls exhibit earlier and higher levels of strategy use during early childhood (Kochanska et al., 2001; O'Toole et al., 2019). Furthermore, research indicates that age is a crucial moderator between language ability and self-regulatory skills (Chen et al., 2022). Regarding the impacts of cognitive states, children's linguistic states have been found to correlate with SR development.

Among these, bilingualism and bilingual experience has been found to have an intertwined and casual relationship with SR development among preschool children (Alfonso & Lonigan, 2021; Bialystok & Martin, 2014; Bohlmann et al., 2015; Chen et al., 2022; Mehrani & Zabihi, 2017; Melzi et al., 2017; Williams et al., 2019). A bilingual, in this respect, is an individual who speaks two languages and can flip between each language according to the given needs based on the contextual variables such as the topic, listener(s) and psycholinguistic and socio-pragmatic motivations (Grosjean, 1998; Walters, 2005).

Exploring the effects of bilingualism in the development of SR strategies in children, researchers maintain that bilingualism may positively affect the way regulatory components are managed to address complex goals (e.g., Alfonso & Lonigan, 2021; Bialystok, 2011; Melzi et al., 2017; Williams et al., 2019). For example, Mehrani and Zabihi (2017), who investigated the effects of bilingual experience on SR skills of Persian- Turkish bilingual children, reported a relative advantage of bilingualism on measures of cognitive shifting and of resisting contradictory urges. Similarly, Melzi et al. (2017) indicated that the relation between bilingualism and SR strategies of emerging bilingual preschoolers should be envisioned along a continuum since children's bilingual skills privilege different aspects of their bilingual experience. Examining the relations between language proficiencies and SR skills, Williams et al. (2019) reported a positive effect of language proficiency of dual language learners, measured by receptive and expressive vocabulary skills, on attention regulation and cognitive control. Another study conducted by Bohlmann et al (2015) with monolingual and dual language learners aimed to explore bidirectional associations between SR and expressive vocabulary skills. The results indicated bidirectional association between SR and vocabulary skills. Thus, it is concluded that early SR abilities play an important role in vocabulary skill development and that vocabulary skills are a leading indicator of SR strategies in preschool. Similarly, the results of the study by Bialystok and Martin (2014) exploring bilingual advantage for preschool children in three studies indicate that early childhood bilingualism impacts children's development of control of attention in a positive way helping children to become more attentive to misleading information in the context. SR strategies have also been found to play an important role in the acquisition of reading-related skills regardless of the children's dominant language, and they correlate with the literacy skills of bilingual preschool children (Alfonso & Lonigan, 2021). Overall results show that bilingualism enhances a general network of cognitive control for elevated SR strategy execution.

However, despite the acknowledged multiple positive outcomes, there is a lack of a unifying conceptualisation of the SR construct, which mainly results from the differences in the theoretical approaches adopted for the development of SR (e.g., cognitive developmental perspectives and social-cognitive developmental perspectives). These differences in the conceptualizations have led to inconsistencies in terms of the terminology used referring to the strategies (e.g., effortful control, executive function or functioning, cognitive control, self-control, etc.), and maybe more importantly, to excessive diversity in terms of measurement methods and tools adopted, which entail measurement of different levels of traits assessed in diverse contexts resulting in divergent conceptualisations. In this respect, the aim of the present systematic review study is twofold. First, it is aimed to compile the indicators of regulatory strategies used by children to contribute to the development of a unifying conceptual representation. And secondly, it aims to identify the regulatory strategies that have been studied in the context of bilingual preschool children in order to find out possible differences reported in the previous research between bilingual and monolingual children regarding the use of regulatory strategies. The study also attempts to identify the main reasons reported for the (possible) differences between bilinguals and monolinguals in terms of the development of regulatory strategies.

Specifically, the following research questions were formulated to guide the review of the articles:

1. What are the self-regulation strategies observed in children until 5 years of age?
2. What are the regulatory strategies that have been studied frequently in the context of bilingual preschool children?
3. Are there bilingual advantages reported in the previous research regarding the use of regulatory strategies? If yes, what are the main reasons provided for the advantages reported for bilingual children?

## Method

A systematic search on "Web of Science" Database (using: ALL=(self regulation OR self-regulation OR effortful control AND bilingual children AND preschool OR early childhood NOT (autism OR Dysphasia OR disorders OR pathology OR disability))) was conducted. The search resulted in 195.463 studies in total. As the next step, predefined filters were set: a) Publication Type (only Articles and Review Articles included); b) Publication Years (between 2000 and 2023); c) Web of Science categories (selecting Education & Educational Research, Psychology, Psychology Developmental, Psychology Educational, Psychology Experimental, Language & Linguistics, Neurosciences, Behavioural Sciences); d) Languages (Articles in English, French, and Turkish included); e) Citation Topics 'Meso' (selecting Education & Educational Research, Language & Linguistics, Neuroscience, Brain Imaging, Autonomic Regulation, Psychiatry & Psychology). As a result, the number of the studies decreased to 1.072 articles and these were transferred to a computer via EndNote including the information regarding i) Author(s) Name(s); ii) Journal Name; iii) Article Title; iv) Abstract; and v) Publication Year. In the next step, all the articles were scanned twice by the two authors independently before deciding on the inclusion of the articles in the sample for the study. As a result of this first review, 501 articles were selected (Cohen's Kappa Inter-rater Reliability: 88.8 %). The exclusion criteria were:

- a. The article has a duplicate in the sample.
- b. The research is not published as a research article or as a review article.
- c. The focus is on teachers, parents, caretakers or on teaching methodology, policy, program, or curriculum.
- d. Self-regulation is used to refer to 'behaviour regulation (well-behaved)' or medical regulation.
- e. The participants are not normally developing children.
- f. The participants are not within the targeted age interval.

Having evaluated and selected the articles to be included separately, the reviewers then worked together to evaluate whether the disagreed articles were eligible for the next stage of review. In case of disagreements, the reviewers re-evaluated the articles

together and discussed until a consensus was reached. Reviewing the articles separately, the final sample of the articles consisted of 42 articles (Cohen's kappa = 97 %). (see Appendix for the list of the articles and the studied language pairs).

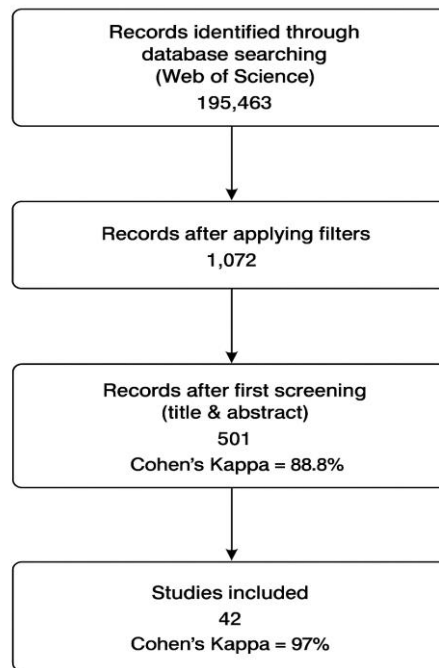


Figure 1. Flow diagram of data inclusion, exclusion, and sampling phases in the systematic review

Following the sampling phases presented in Figure 1, the sample was then reviewed in order to find out which regulatory strategies studied in the context of bilingual preschool children, to identify the differences reported between bilingual and monolingual children regarding the use of regulatory strategies, and the main reasons for the possible differences.

## Findings

The data extracted as a result of the systematic review include information on a) domains of SR; b) indicators of the SR strategies; c) the strategies investigated in the context of bilingual children; d) the differences between bilingual and monolingual children; and e) the main reasons reported for the differences between bilinguals and monolinguals. Then, the data was synthesised and classified based on the extracted information.

Reviewing the articles resulted in 18 strategy indicators used by preschool (monolingual & bilingual) children under four strategy domains: cognitive, metacognitive, affective, and socio-interactional. Table 1 presents the results for the cognitive domain.

Table 1. The Results for the SR Strategies under the Cognitive Domain

| Domain                      | Indicators                                             | Bilingual Advantage                                                       | No Difference                           |
|-----------------------------|--------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------|
| <b>Cognitive Strategies</b> | 1. Being cognitively adaptive to changing task demands | [2]; [30]<br>50%                                                          | [26]; [35]<br>50%                       |
|                             | 2. Being able to resist contradictory urges stimuli    | [14];[23];[24];[28];[32];[37];[41]<br>100%                                | -                                       |
|                             | 3. Establishing relationships and making connections   | [15];[18];[23];[24];[30];[32];[37]<br>100%                                | -                                       |
|                             | 4. Using linguistic means to achieve task goals        | [17];[32]<br>100%                                                         | -                                       |
|                             | 5. Activating previous knowledge or experience         | [6];[7];[8];[11];[12];[14];[15]; [21];[22]; [26];[31]<br>64.7%            | [3];[4];[20];[33];[38];[40]<br>35.2%    |
|                             | 6. Using context clues                                 | [1];[5];[6];[7];[8];[12];[13];[14];[22];<br>[26];[31];[36]; [40]<br>68.4% | [11];[16];[19];[21];[33];[38];<br>31.5% |

According to the results, 6 strategies were found to be used by children until the age of 5. Children as early as 2 years old start using regulatory strategies to cognitively adapt to changing task demand, to resist contradictory stimuli, and to establish relationships to understand (e.g., Blair, 2016; Blakey et al., 2016; Camerota et al., 2020; Daneri et al., 2018; Kalin & Roebbers,

2021; Nieto et al., 2016). By the age of 3, children start to activate their working memory and to use linguistic means and context clues to achieve their goals (e.g., Chiu & Alexander, 2000; Manfra & Winsler, 2006; Wang et al., 2023; Whedon et al., 2021). All the strategies under the cognitive domain have been investigated in the context of bilingual children. While being cognitively adaptive has been found to be executed at similar levels by bilingual and monolingual children (Articles No: 2, 30, 26, 35), all the studies focusing on resisting contradictory stimuli, establishing relationships to understand and for using linguistic means to achieve task goals report full advantage of bilingual children (Articles No: 14, 15, 23, 17, 28, 30). As for the strategies for activating previous knowledge and using context clues, the number of the studies that report bilingual advantage are considerably higher than the ones reporting no difference between bilinguals and monolinguals (64.7 % and 68.4% versus 35.2% and 31.5%, respectively). No study has been found among the reviewed articles to report monolingual advantage for the strategies under the cognitive domain. Table 2 displays the findings for the metacognitive domain.

Table 2. The Results for the SR Strategies under the Metacognitive Domain

| Domain                          | Indicators                                                                 | Bilingual Advantage | No Difference |
|---------------------------------|----------------------------------------------------------------------------|---------------------|---------------|
| <b>Metacognitive Strategies</b> | 1. Identifying or setting goals (verbally and/or behaviourally)            | Not Studied         |               |
|                                 | 2. Persisting or Persevering to reach goals                                | [17]<br>100%        | -             |
|                                 | 3. Planning and organising (verbally and/or behaviourally)                 | [32]<br>100%        | -             |
|                                 | 4. Selecting, deploying or alternating appropriate strategies              | [24]<br>100%        | -             |
|                                 | 5. Self-Evaluation of performance/progress (verbally and/or behaviourally) | [9]<br>100%         | -             |

The review resulted in 5 strategies used by preschool children under metacognitive domain. The first indicator, identifying and/or setting goals, is observable as early as 2 years (Wang et al., 2023). Similarly, persisting or persevering to reach goals also emerges around 2 years of age (Tan et al., 2023). By the age of 3, children start to use the strategies of planning and organising, selecting and deploying appropriate strategies, and self-evaluation of performance (e.g., McClelland & Cameron, 2012; Montroy et al., 2016; Sawyer et al., 2015; Winsler et al., 2003). While identifying or setting goals has not been investigated in bilingual context, the other four strategies have been explored by one study for each. All four studies have reported bilingual advantage (Articles No: 9, 17, 24, 32) and there was no study indicating monolingual advantage for metacognitive strategies.

Table 3. The Results for the SR Strategies under the Affective Domain

| Domain                      | Indicators              | Bilingual Advantage                                 | No Difference |
|-----------------------------|-------------------------|-----------------------------------------------------|---------------|
| <b>Affective Strategies</b> | 1. Regulating Emotions  | Not Studied                                         |               |
|                             | 2. Regulating Attention | [1];[2];[5];[7];[14];[21];<br>[25];[36];[41]<br>90% | [29]<br>10%   |

The review resulted in two strategies used by children under the affective domain. Regulating attention is observed as early as 8 to 10 months of age and regulating emotions is executed by children around 2 years old (e.g., He et al., 2016; Kloo & Sodian, 2017; Vitiello & Greenfield, 2017). While regulating emotions has not been studied with a focus on bilingual experience, attention regulation has been considerably studied with significant advantage for bilinguals (Articles No: 1, 2, 7, 25, 41). Again, no monolingual advantage has been reported for the use of affective strategies.

Table 4. The Results for the SR Strategies under the Social-Interactional Domain

| Domain                                | Indicators                                                      | Bilingual Advantage | No Difference |
|---------------------------------------|-----------------------------------------------------------------|---------------------|---------------|
| <b>Socio-Interactional Strategies</b> | 1. Complying or Cooperating with the socio-cultural surrounding | Not Studied         |               |
|                                       | 2. Sharing (knowledge, toys, materials, etc)                    | [32]<br>100%        | -             |
|                                       | 3. Seeking support (verbally and/or behaviourally)              | [24]; [32]<br>100%  | -             |
|                                       | 4. Showing care or concern for others                           | Not Studied         |               |
|                                       | 5. Interacting with others related to task goals                | [32]<br>100%        | -             |

The last group of strategies are categorized under social-interactional domain, which consists of 5 strategies. The earliest observable social-interactional strategy is complying with the surrounding, which is manifested as complying with rules or taking turns, following instructions, initiating or ceasing activities according to situational demands, remaining seated, or complying with caregivers' demands and can be observed as early as 12 months (Kochanska et al., 2001; Hosch et al., 2022; Tan et al., 2023). By the age of 2, children start to seek support and share their toys or materials (Wang et al., 2023). Following 3 years, children use the strategies of interacting with others and of showing care or concern for others. The strategies under social-interactional domain have frequently been reported in relation to emotional and social competence, which is defined as "...the ability of children to successfully interact with other children and adults in a way that demonstrates an awareness of, and ability to manage, emotions in an age and context-appropriate manner" (LeBuffe et al., 2009, p. 5). Children with higher levels of social competence have been observed to demonstrate more effective emotion regulation and fewer externalising behaviour and engage more in appropriate interactions with others (Ramani et al., 2010; Harrington et al., 2020). While the two of the strategies under social-interactional

domain have not been studied in bilingual context (i.e., complying or cooperating with the socio-cultural surrounding and showing care or concern for others), the other three strategies (i.e., sharing, seeking support, and interacting with others related to task goals), also show 100 % bilingual advantage, though reported only in two studies.

Overall findings reveal that, among the 42 articles focusing on self-regulation development in early childhood, 74 strategy indicators have been studied (i.e., it should be noted that sometimes multiple strategies were studied in the same study and there were also multiple studies focusing on the same strategy).

Table 5. The Results for the Impacts of Bilingual Experience on the SR Strategies

|          | Total Strategies Studied | Bilingual Advantage | No Difference |
|----------|--------------------------|---------------------|---------------|
| <b>F</b> | 74                       | 59                  | 15            |
| <b>%</b> | 100 %                    | 79.7 %              | 20.2 %        |

As the results presented in Table 5 indicate, based on the indicators studied, the rate of the studies reporting positive impacts of bilingual experience on the use and the development of self-regulation has been significantly higher (79.7 %). Therefore, it could be claimed that, based on the reviewed studies, bilingual experience enhances regulatory strategy use in children.

## Discussions and Conclusion

The present review study aimed to find out the impacts of bilingual experience on self-regulation development in early childhood. Most of the reviewed research suggests that bilingual experience impacts the use and the development of self-regulatory mechanism positively. Studies have specifically reported bilingual advantage for most cognitive strategies (e.g., resisting contradictory stimuli, establishing relationships to understand and for using linguistic means to achieve task goals); for metacognitive strategies (e.g., persisting to reach goals, planning and organising, and self-evaluation of performance); and for the social-interactive strategies (e.g., sharing, seeking support, and interacting with others related to task goals). As for the affective strategies, while emotion regulation has not been studied among the reviewed articles in the context of bilingual children, attention regulation has also been found to be used better by bilingual children.

The findings obtained from the review also point out that there is bidirectional causal relation between cognitive regulation and bilingual experience (e.g., Chen et al., 2022; Dahlgren et al., 2017; Diaz & Farrar, 2018; Melzi et al., 2017; Williams et al., 2019). Bilingual children have been found to have a better general cognitive control, particularly in terms of abstract and symbolic representation skills and performance on spatial problems. They show better performance in false-belief reasoning tasks, better understanding of 'object constancy' and divergent and creative thinking abilities (Barac et al., 2016; Bialystok et al., 2010; Carlson & Meltzoff, 2008; Costa et al., 2008). In fact, research provides strong behavioural and brain evidence suggesting that language switching is not just an isolated linguistic process but could indicate a more generalized executive and behaviour-selection processes (Carlson & Meltzoff, 2008; Chee, 2006).

Although the related literature shows some advantages of being monolingual in early childhood in terms of linguistic skills such as having better verbal skills and better grammatical judgement as well as showing signs of earlier linguistic processing (e.g., Barac & Bialystok, 2011; Bialystok et al., 2010; Davidson et al., 2010; Mehrani & Zabihi, 2017), studies unfold numerous positive impacts of bilingual experience. For instance, bilingual children have been reported to have an increased metalinguistic and metacommunicative awareness with a heightened sensitivity to communicative contexts and a better understanding of referential intent (e.g., Olmedo, 2003 ; Stegall-Rodriguez et al., 2019; Vorstman et al., 2009; Yow & Markman, 2011). Bilingual children tend more frequently to search for and use contextual cues and to reformulate their knowledge according to the situational factors because of their increased metacommunicative awareness (Vorstman et al., 2009).

Bilinguals have been claimed to have more advanced concept generation and word-object associations abilities, which leads to better understand, paraphrase and translate messages (e.g., Adesope et al., 2010; Chen et al., 2023; Dahlgren et al., 2017). Olmedo (2003) remarks the superior social-interactive skills of bilingual children by summarizing their typical behaviours in a classroom context. Monitoring and making judgements about the linguistic proficiency of their peers, they intervene assistance is needed and execute a variety of strategies help to facilitate communication in the classroom. For Olmedo (2003), such strategies reflect "bilingual echo that covers translating and paraphrasing of a message, code-switching or alternation between languages, the use of para-linguistic cues and gestures to accompany speech and thereby, scaffold communication" (p.160).

The reviewed studies suggest multiple reasons for the positive influence of bilingual experience on the development and the use of regulatory strategies in early childhood. These reasons are mostly related to their additional cognitive load and cognitive training experience as well as demonstrating different neural efficiency. Bilinguals have the opportunity for enhanced cognitive training from early on as they have to manage two linguistic systems. Prior and Gollan (2011) explain that since bilinguals have to understand the connection between the words from two different languages at an abstract level through persisting shifting between languages, their cognitive shifting skills are continuously enhanced. In fact, having two linguistic systems and their ability to attend to different language representations enable bilinguals to see things from different perspectives. This powerful form of 'brain training' (Barac et al., 2016), provide various opportunities to improve their regulatory abilities (Mehrani & Zabihi, 2017).

The second line of reasons are related to bilinguals' spending greater extra-cognitive effort because of their greater cognitive load. That is, bilinguals need to display a heightened sensitivity to the social, pragmatic, and communicative contexts. Due to the increased risk of failure, they need to be better at taking the perspectives of the interlocutors into account and picking up on feedback and prompts from them (Siegal et al., 2009; Yow & Markman, 2011). As greater vigilance is required to maintain effective communication with their social surroundings, they are constantly required to spend greater effort in order to mobilize interactional and cognitive strategies (Comeau & Genesee, 2001).

Finally, there are reasons related to the differences in neural efficiency of bilinguals. It has been reported that specific brain regions including the left dorsolateral prefrontal cortex and the anterior cingulate cortex are activated when bilinguals switch

languages. Since these two regions are also involved in a more general control and attentional processes, including prioritization of information and conflict monitoring, bilinguals differ from monolinguals in neural efficiency or mental effort, which might not always be captured in performance (Abutalebi & Green, 2008; Enke et al., 2022; Luk et al., 2012; Sulpizio et al., 2020). Furthermore, it has been found that, for specific tasks, the dorsolateral prefrontal cortex is the center of activation for monolinguals and the Broca's area for bilinguals. This may be the evidence to suggest that while frontal cortex is involved in shaping language, language experiences are also important in the development of frontal lobe functions (Craig & Bialystok, 2005; Deak, 2003).

In conclusion, overall findings of the present review indicate that bilingual experience provides children with numerous advantages, most of which persist across the life span (Bialystok et al., 2004). The experience of constructing two linguistic systems, of functioning in two linguistic environments is a powerful causal factor in children's developing cognitive and linguistic systems. As bilingual children develop the ability to manipulate the linguistic input in their surrounding, providing opportunities for interaction in more than one language can enhance the cognitive and social skills aimed in educational systems (Bialystok et al., 2010; Olmedo, 2003). And, as they continuously need to coordinate the dual language use, their self-regulation of general cognitive processes is enhanced (Barac & Bialystok, 2011; Bialystok, 2011; Iluz-Cohen & Armon-Lotem, 2013; Poulin-Dubois et al., 2011; Rodriguez-Fornells et al., 2006). Highlighting the significance of bilingual experience in early childhood, the findings indicate varying degrees of casual relationship between children's linguistic states and SR development in this period (Alfonso & Lonigan, 2021; Bohlmann et al., 2015; Chen et al., 2022; Mehrani & Zabihi, 2017; Melzi et al., 2017; Williams et al., 2019). As most real-life tasks are integrative and based on networks of control, the effect of bilingualism on cognitive performance during childhood may be more powerful than previously believed. In bilingual situations, general cognitive abilities are recruited to control dual language use and the use of more than one language may improve control and self-regulation of general cognitive processes (Bialystok, 2011; Iluz-Cohen & Armon-Lotem, 2013; Rodriguez-Fornells et al., 2006). The behavioural and brain evidence thus far supports the notion that language switching might be a subset of more generalized executive and behaviour-selection processes rather than an isolated linguistic process (Chee, 2006; Carlson & Meltzoff, 2008). The findings of this review carry several implications for educational practice and early childhood policy. First, the consistent bilingual advantage observed across cognitive, metacognitive, affective, and social-interactional domains suggests that early bilingual exposure can be leveraged as a pedagogical tool to strengthen children's regulatory and executive function skills. Early childhood curricula should therefore integrate dual-language or multilingual activities that promote flexible thinking, attention shifting, and self-monitoring. Educators can design play-based and interaction-rich learning environments that stimulate both linguistic and regulatory development simultaneously. For parents and caregivers, the results provide reassurance that maintaining and nurturing children's heritage languages does not hinder but rather enhances self-regulation and learning readiness. Home environments that encourage balanced bilingual use may thus contribute positively to children's socio-emotional and cognitive growth. From a research and policy standpoint, these results highlight the need for longitudinal and cross-linguistic studies to explore how specific bilingual experiences (e.g., balanced vs. dominant bilingualism, language switching frequency) influence self-regulation trajectories. Policymakers and educators should recognize bilingualism as a developmental asset and support programs that promote early multilingual exposure within preschool education systems.

Considering the centrality of regulatory processes in later cognitive life, exposing their children to a second language early in life has significant implications for parents and educators who might be concerned with the effect of exposing their children to a second language (Barac & Bialystok, 2011; Poulin-Dubois et al., 2011), instead it should be encouraged by parents and educators as it helps to promote the communicative and cognitive skills desired to develop through educational systems. Although the study presents valuable insights to the present related literature, it should be noted that the findings are limited to one database. Further studies could integrate a wider range of databases to validate and contribute to the results presented here.

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The authors declare that they have no competing interests.

### Referee Evaluation

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### Author Contributions

M.Ş.: Conceiving the Study, Data Collection, Data Analysis, Writing up, Submission and Revision

S.K.: Conceiving the Study, Data Collection, Data Analysis, Writing up, Submission and Revision

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- Williams, A. I., Uchikoshi, Y., Bunge, S. A., & Zhou, Q. (2019). Relations of English and heritage language proficiency to response inhibition and attention shifting in dual language learners in head start. *Early Education and Development*, 30(3), 357-374.
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#### APPENDIX. List of the Articles Included in the Review

| No | Article                                                                                                                                                                                                                                                      | Language Pairs                                                                                                                             |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Abutalebi, J., & Green, D. W. (2016). Neuroimaging of language control in bilinguals: neural adaptation and reserve. <i>Bilingualism: Language and cognition</i> , 19(4), 689-698.                                                                           | Perspective                                                                                                                                |
| 2  | Adesope, O. O., T. Lavin, T. Thompson & C. Ungerleider (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. <i>Review of Educational Research</i> 80, 207–245.                                                         | Meta-Analysis                                                                                                                              |
| 3  | Adi-Japha, E., Berberich-Artzi, J., & Libnawi, A. (2010). Cognitive flexibility in drawings of bilingual children. <i>Child development</i> , 81(5), 1356-1366.                                                                                              | English–Hebrew and Arabic–Hebrew                                                                                                           |
| 4  | Armon-Lotem, S., & Chiat, S. (2012). How do sequential bilingual children perform on non-word repetition tasks. In <i>Proceedings of the 36th Annual Boston University Conference on Language Development</i> (pp. 53-62). Somerville, MA: Cascadilla Press. | Russian-Hebrew                                                                                                                             |
| 5  | Barac, R., Moreno, S., & Bialystok, E. (2016). Behavioral and electrophysiological differences in executive control between monolingual and bilingual children. <i>Child development</i> , 87(4), 1277-1290.                                                 | English - + L2 (Spanish; French; Mandarin; Greek; Ukrainian; Korean; Cantonese; Russian; German; Vietnamese; Tagalog; and Polish)          |
| 6  | Bialystok, E. & M. M. Martin (2004). Attention and inhibition in bilingual children: evidence from the dimensional change card sort task. <i>Developmental Science</i> 7, 325–339.                                                                           | English – Chinese; English - French                                                                                                        |
| 7  | Bialystok, E. & L. Senman (2004). Executive processes in appearance-reality tasks: the role of inhibition of attention and symbolic representation. <i>Child Development</i> 75, 562–579.                                                                    | English + L2 (Armenian, Polish, Russian, Filipino, Hebrew, Tagalog, Spanish, Arabic, African, Chinese, Somali, Hungarian, Persian, French) |
| 8  | Bialystok, E., Barac, R., Blaye, A., & Poulin-Dubois, D. (2010). Word mapping and executive functioning in young monolingual and bilingual children. <i>Journal of</i>                                                                                       | English + L2 (Italian, Spanish, Arabic, Tamil, Mandarin,                                                                                   |

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|    | <i>cognition and development</i> , 11(4), 485-508.                                                                                                                                                                                                                                            | Romanian, Cantonese, French, Hebrew, Persian, Serbian Urdu, Amharic, Hungarian, Russian, Portuguese, Punjabi, Hindi)                                       |
| 9  | Bialystok, E. (2010). Global-local and trail-making tasks by monolingual and bilingual children: beyond inhibition. <i>Developmental Psychology</i> 46, 93–105.                                                                                                                               | English + L2(Cantonese, French, Russian, Mandarin, Urdu, Hindi, and Spanish)                                                                               |
| 10 | Bohlmann, N. L., Maier, M. F., & Palacios, N. (2015). Bidirectionality in self-regulation and expressive vocabulary: Comparisons between monolingual and dual language learners in preschool. <i>Child development</i> , 86(4), 1094-1111.                                                    | English -Spanish                                                                                                                                           |
| 11 | Carlson, S. M. & A. N. Meltzoff (2008). Bilingual experience and executive functioning in young children. <i>Developmental Science</i> 11, 282–298.                                                                                                                                           | English - Spanish                                                                                                                                          |
| 12 | Chen, J., Kwok, S. C., & Song, Y. (2023). An intricate relationship between executive function and second-language ability in a cohort of Uyghur-Chinese bilingual children. <i>Developmental Science</i> , 26(2), e13312.                                                                    | Uyghur-Chinese                                                                                                                                             |
| 13 | Chen, J., Zhao, Y., Xu, X., Liu, J., & Deng, C. (2023). Effects of language switching frequency on inhibitory control in bilingual preschool children: Different roles of expressive and receptive language abilities. <i>Early Childhood Research Quarterly</i> , 63, 327-336.               | Uyghur -Mandarin                                                                                                                                           |
| 14 | Dahlgren, S., Almén, H., & Dahlgren Sandberg, A. (2017). Theory of mind and executive functions in young bilingual children. <i>The Journal of genetic psychology</i> , 178(5), 303-307.                                                                                                      | Swedish - Slavonic languages                                                                                                                               |
| 15 | Diaz, V., & Farrar, M. J. (2018). The missing explanation of the false-belief advantage in bilingual children: A longitudinal study. <i>Developmental science</i> , 21(4), e12594.                                                                                                            | Spanish-English                                                                                                                                            |
| 16 | Donnelly, S., Brooks, P. J., & Homer, B. D. (2019). Is there a bilingual advantage on interference-control tasks? A multiverse meta-analysis of global reaction time and interference cost. <i>Psychonomic bulletin &amp; review</i> , 26, 1122-1147.                                         | Meta-Analysis                                                                                                                                              |
| 17 | Enke, S., Gunzenhauser, C., Hepach, R., Karbach, J., & Saalbach, H. (2022). Differences in cognitive processing ? The role of verbal processes and mental effort in bilingual and monolingual children's planning performance. <i>Journal of Experimental Child Psychology</i> , 213, 105255. | German–Russian                                                                                                                                             |
| 18 | Goetz, P. J. (2003). The effects of bilingualism on theory of mind development. <i>Bilingualism : Language and Cognition</i> 6, 1–15.                                                                                                                                                         | Mandarin–English                                                                                                                                           |
| 19 | Goldman, M. C., Negen, J., & Sarnecka, B. W. (2014). Are bilingual children better at ignoring perceptually misleading information ? A novel test. <i>Developmental Science</i> , 17(6), 956-964.                                                                                             | English + L2 (Chinese, Tagalog, Mandarin, Spanish, Hindi, Farsi, Tamil, Cantonese, Japanese, Korean, Czech, French, Gujarati, Hebrew, Italian, Vietnamese) |
| 20 | Gordon, K. R. (2016). High proficiency across two languages is related to better mental state reasoning for bilingual children. <i>Journal of Child Language</i> , 43(2), 407-424.                                                                                                            | Spanish–English                                                                                                                                            |
| 21 | Hilchey, M. D., & Klein, R. M. (2011). Are there bilingual advantages on nonlinguistic interference tasks? Implications for the plasticity of executive control processes. <i>Psychonomic bulletin &amp; review</i> , 18, 625-658.                                                            | Review                                                                                                                                                     |
| 22 | Iluz-Cohen, P., & Armon-Lotem, S. (2013). Language proficiency and executive control in bilingual children. <i>Bilingualism : Language and cognition</i> , 16(4), 884-899.                                                                                                                    | English–Hebrew                                                                                                                                             |
| 23 | Kovács, A. M. (2009). Early bilingualism enhances mechanisms of false-belief reasoning. <i>Developmental Science</i> 12, 48–54.                                                                                                                                                               | Romanian-Hungarian                                                                                                                                         |
| 24 | Le Pichon Vorstman, E., De Swart, H., Ceginskas, V., & Van Den Bergh, H. (2009). Language learning experience in school context and metacognitive awareness of multilingual children. <i>International Journal of Multilingualism</i> , 6(3), 258-280.                                        | French or English + L2(Spanish, Italian, Dutch, German and Farsi and other additional languages)                                                           |
| 25 | Martin-Rhee, M. M. & E. Bialystok (2008). The development of two types of inhibitory control in monolingual and bilingual children. <i>Bilingualism : Language and Cognition</i> 11, 81–93.                                                                                                   | English – French                                                                                                                                           |
| 26 | Mehrani, M. B., & Zabihi, R. (2017). A comparative study of shifting ability, inhibitory control and working memory in monolingual and bilingual children. <i>Psychological Studies</i> , 62, 421-427.                                                                                        | Turkish – Persian                                                                                                                                          |
| 27 | Melzi, G., Schick, A. R., & Escobar, K. (2017). Early bilingualism through the looking glass : Latino preschool children's language and self-regulation skills. <i>Annual Review of Applied Linguistics</i> , 37, 93-109.                                                                     | Spanish-English                                                                                                                                            |
| 28 | Morales, P. Z., & Rumenapp, J. C. (2017). Talking about Language in Pre-School : The Use of Video-Stimulated Recall with Emergent Bilingual Children. <i>Journal of Multilingual Education Research</i> , 7(4), 19-42.                                                                        | Spanish-English                                                                                                                                            |
| 29 | Morton, J. B., & Harper, S. N. (2007). What did Simon say ? Revisiting the bilingual advantage. <i>Developmental science</i> , 10(6), 719-726.                                                                                                                                                | English – French                                                                                                                                           |
| 30 | Nguyen, T. K., & Astington, J. W. (2014). Reassessing the bilingual advantage in theory of mind and its cognitive underpinnings. <i>Bilingualism: Language and Cognition</i> , 17(2), 396-409.                                                                                                | English–French                                                                                                                                             |

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| 31 | Okanda, M., Moriguchi, Y., & Itakura, S. (2010). Language and cognitive shifting: Evidence from young monolingual and bilingual children. <i>Psychological Reports</i> , 107(1), 68-78E.                                                                                | Japanese-French                                                                                             |
| 32 | Olmedo, I. M. (2003). Language mediation among emergent bilingual children. <i>Linguistics and education</i> , 14(2), 143-162.                                                                                                                                          | Spanish-English                                                                                             |
| 33 | Paap, K. R., Johnson, H. A., & Sawi, O. (2014). Are bilingual advantages dependent upon specific tasks or specific bilingual experiences?. <i>Journal of Cognitive Psychology</i> , 26(6), 615-639.                                                                     | English + L2 (Various languages, not specified)                                                             |
| 34 | Paap, K. R., Johnson, H. A., & Sawi, O. (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. <i>Cortex</i> , 69, 265-278.                                                       | Review                                                                                                      |
| 35 | Pascale M. J. Engel de Abreu (2011) Working memory in multilingual children: Is there a bilingual effect?, <i>Memory</i> , 19:5, 529-537, DOI:10.1080/09658211.2011.590504                                                                                              | Luxembourgish + L2 (French, Spanish, German, Dutch, Portuguese, Czech, Italian)                             |
| 36 | Poulin-Dubois, D., Blaye, A., Coutya, J., & Bialystok, E. (2011). The effects of bilingualism on toddlers' executive functioning. <i>Journal of experimental child psychology</i> , 108(3), 567-579.                                                                    | English - French                                                                                            |
| 37 | Stegall-Rodriguez, S. E., Weimer, A. A., & Rice Warnell, K. (2021). Alternative perspectives: Relations between belief reasoning and ambiguous figure perception in bilingual children. <i>Infant and Child Development</i> , 30(5), e2258.                             | Spanish-English                                                                                             |
| 38 | Tonér, S., & Gerholm, T. N. (2021). Links between language and executive functions in Swedish preschool children: A pilot study. <i>Applied Psycholinguistics</i> , 42(1), 207-241.                                                                                     | Multilingual Swedish                                                                                        |
| 39 | Westerveld, M. F. (2014). Emergent literacy performance across two languages: assessing four-year-old bilingual children. <i>International Journal of Bilingual Education and Bilingualism</i> , 17(5), 526-543.                                                        | Samoan – English                                                                                            |
| 40 | Williams, A. I., Uchikoshi, Y., Bunge, S. A., & Zhou, Q. (2019). Relations of English and heritage language proficiency to response inhibition and attention shifting in dual language learners in head start. <i>Early Education and Development</i> , 30(3), 357-374. | Spanish - English ;<br>English – Chinese                                                                    |
| 41 | Yoshida, H., Tran, D. N., Benitez, V., & Kuwabara, M. (2011). Inhibition and adjective learning in bilingual and monolingual children. <i>Frontiers in psychology</i> , 2, 210.                                                                                         | English + L2 (Chinese, French, Spanish, Russian, Urdu, Vietnamese)                                          |
| 42 | Yow, W. Q., & Markman, E. M. (2011). Young bilingual children's heightened sensitivity to referential cues. <i>Journal of cognition and development</i> , 12(1), 12-31.                                                                                                 | English + L2 (Spanish, Mandarin, French, Portuguese, Russian, Dutch, Hungarian, Korean, Greek, and Tagalog) |