Proceedings of the 5th International Conference on Social Psychology and Humanity Studies
DOI: 10.54254/2753-7048/2027.38675

Does Bilingual Code-Switching Enhance Executive Function in Children? A Focused Review of When and under What Conditions Cognitive Benefits Emerge

Kingkai Lam[1,*,†], Zhuoqi Hu[2,†]

[1]*Department of Arts and Science, University of Toronto, Toronto, Canada*
[2]*College of Economics and Management, Nanjing Agricultural University, Nanjing, China*
**Corresponding Author. Email: 584943838@qq.com*
[†]*These authors contributed equally to this work and should be considered as co-first authors*

Abstract. Research on the bilingual executive-function advantage has produced positive, null, and inverse findings. One likely reason is that bilingualism is often treated as a uniform category, even though children differ substantially in how they use their languages. This focused critical review examines whether code-switching, rather than bilingual status alone, is associated with cognitive flexibility and inhibitory control in children and identifies the conditions under which benefits are most plausible. Eleven peer-reviewed sources were selected from the project's literature corpus to provide theoretical foundations, broad child-level syntheses, methodological critiques, and direct evidence. The evidence does not support a universal code-switching advantage. Direct child studies report a conditional positive association, a null association, and an inverse association; another study shows that the relation between language control and cognitive control may also operate in the opposite direction. Across this literature, language ability, interactional context, switching type, task choice, and age emerge as candidate boundary conditions. The most defensible conclusion is therefore not that code-switching generally improves executive function, but that specific forms of regulated switching may be associated with specific executive processes in particular children. Longitudinal, ecologically valid, and better harmonized studies are required before causal or educational claims can be made.

Keywords: bilingual children, code-switching, cognitive flexibility, executive function, inhibitory control

1. Introduction

For over twenty years, researchers have asked whether bilingualism sharpens executive function (EF). The logic seems straightforward: bilinguals constantly manage two active languages, so they may get more practice at selecting one language, suppressing the other, and switching between them. That practice could carry over to non-linguistic control. But the evidence has not cooperated. Gunnerud et al. meta-analyzed studies with children and found an overall advantage of only Hedges' g = 0.06, along with signs of publication bias [1]. Planckaert et al. reviewed children aged 12 and

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-7048/2027.38675

under and found that results varied widely depending on age and task [2]. Given this, comparing bilinguals and monolinguals as two fixed groups is hard to justify.

A more useful question is what bilingual children do with their languages. Code-switching (CS), alternating languages within or across conversational turns, is one candidate because it directly involves language regulation. But CS is not one thing. A child might switch voluntarily with a bilingual parent, adapt to a new speaker, respond to an external cue, or switch simply because a word is missing in the weaker language. Treating all of these as the same behavior can hide real differences in how much control they require.

This review therefore asks: does bilingual code-switching enhance executive function in children, and if so, when and under what conditions? It focuses on cognitive flexibility and inhibitory control, and evaluates five possible moderators: EF task, age, interactional context, switching type, and language ability. The central argument is that current evidence supports a conditional-association account, not a universal training effect.

2. Conceptual and theoretical framework

EF is not a single ability. Miyake et al. showed that it includes at least three related but distinct processes: shifting, inhibition, and updating [3]. Shifting, often called cognitive flexibility, means moving between rules, tasks, or mental sets, and is usually measured with tasks like the Dimensional Change Card Sort (DCCS). Inhibition means suppressing a dominant or irrelevant response, and is typically measured with Stroop, Simon, or Flanker tasks. These tasks do not measure the same thing. Doing well on one does not guarantee doing well on another. This is one reason why bilingual advantage studies often disagree: task choice alone can determine whether an effect appears [2].

The Adaptive Control Hypothesis is the main framework for linking language use to EF. Green and Abutalebi proposed that language control adapts to the demands of different interactional contexts [4]. A single-language context, a dual-language context where speakers switch across interlocutors, and a dense code-switching context do not require the same kind of control. The hypothesis predicts that a child's regular language environment shapes their control processes, rather than bilingualism producing a general benefit on its own. Verreyt et al. found supporting evidence: frequent language switchers outperformed non-switchers on conflict tasks such as Flanker and Simon, suggesting that switching experience itself, not just being bilingual, may drive any advantage [5].

Ecological validity adds another complication. Laboratory switching tasks usually require externally cued changes, but everyday switching is often voluntary and socially meaningful. Voluntary switches may carry lower behavioral and neural costs than cued ones, which suggests that switching is not always effortful [6]. This means switch frequency alone tells us little about how much control practice a child actually gets. What matters is why the switch happens, who starts it, whether it is externally constrained, and whether it reflects communicative skill or a gap in vocabulary.

3. Review approach

This review is a narrative synthesis, not a full systematic review. Eleven peer-reviewed works were chosen from the project's existing literature corpus. Four types of sources were prioritized: direct empirical studies that link child CS or language control to nonverbal EF; child-focused systematic or meta-analytic reviews; foundational frameworks for EF and adaptive language control; and recent syntheses on ecological validity or interactional context. The selection was purposive. The aim was

DOI: 10.54254/2753-7048/2027.38675

not to cover every study in the field, but to bring together the strongest sources on a focused question.

Studies were compared along six dimensions: the direction of the association (positive, null, or inverse), the EF domain (cognitive flexibility or inhibitory control), the age group, how CS was measured (self-report, observation, or experimental task), the interactional context (single-language, dual-language, or dense code-switching), and language ability. Comparing studies across these dimensions shows not just whether findings conflict, but where and why they conflict. It also helps separate genuine differences in the underlying relationship from differences in how key constructs were measured. Because this review does not follow a formal PRISMA search and screening protocol, the conclusions should be read as critical interpretations of the selected evidence, not as an exhaustive or quantitative summary.

Why a critical rather than systematic approach? The decision reflects both practical and theoretical considerations. Practically, the review draws on a curated corpus rather than an exhaustive search, which keeps the analysis focused on the most relevant sources. Theoretically, the literature on code-switching and executive function varies widely in its definitions, measures, and participant characteristics. A rigid meta-analytic approach would require treating constructs as comparable when they may not be. This review instead treats that variation as part of what needs to be explained. The guiding question is why different studies reach different conclusions, rather than what the average effect is across them.

4. Evidence synthesis

4.1. No uniform code-switching advantage

Direct evidence from children is still limited. Hansen et al. tested 43 Spanish-English bilinguals between four and six years old [7]. The researchers coded cross-speaker switches while children played with a parent and measured inhibitory control with a nonverbal Flanker task. The results were not straightforward: more frequent switching predicted better inhibitory control, but only for children with relatively strong language skills. Among children with weaker language ability, the association disappeared. So this study does offer positive evidence, but the effect is both conditional and correlational.

Two studies challenge a general benefit. Kang and Lust [8] tested 43 highly proficient English-Chinese bilingual eight-year-olds in Singapore. Spontaneous CS did not predict either task switching or Stroop performance; bilingual proficiency, rather than CS, was associated with EF. Kuzyk et al. [9] followed 29 French-English bilingual children from 36 to 61 months. In single-language play sessions, less frequent switching was associated with better inhibitory control. The authors also found that children often switched from the nondominant to the dominant language to fill lexical gaps. Thus, the same observable behavior - a switch - may represent adaptive regulation in one child and difficulty accessing the intended language in another.

Gross and Kaushanskaya [10] add an important directionality warning. In 62 Spanish-English bilingual children aged four to six, language ability predicted control of language choice overall, while DCCS performance moderated children's adjustment to a dual-language context. The study primarily tested whether cognitive and linguistic abilities predicted language control, not whether switching trained EF. It therefore cannot be cited as evidence of a CS advantage. Together, these studies show that language control and domain-general control may be related without establishing that CS causes improved EF.

DOI: 10.54254/2753-7048/2027.38675

4.2. Task type and cognitive specificity

If code-switching trains EF, the clearest effect might be expected on cognitive flexibility because both involve shifting. Planckaert et al. [2] provide partial support at the broader bilingualism level: among children younger than six, bilingual advantages were reported more often for switching than inhibition, and DCCS-like tasks produced especially high detection rates. However, their review compared bilingual and monolingual groups and did not isolate CS behavior. It therefore supports task specificity as a hypothesis, not as proof that switching experience causes the difference.

The direct CS evidence is less orderly. Kang and Lust [8] found no prediction for either switching or inhibition. Kuzyk et al. [9] found an inverse association with inhibition, while Hansen et al. [7] found a proficiency-dependent positive association on a Flanker task. Task labels alone therefore do not resolve the inconsistency. Performance can also depend on task reliability, scoring, verbal demands, and whether a single task adequately represents an EF construct. Stronger studies should use multiple tasks or latent variables for each EF domain.

4.3. Age as a candidate, not a confirmed moderator

Planckaert et al. [2] reported bilingual advantages more often in children under six than in those aged six to twelve: 56% versus 37% of inhibition outcomes and 63% versus 33% of switching outcomes. They interpreted this as possible acceleration during a period of rapid EF development, followed by convergence as monolingual peers catch up. This pattern is useful but descriptive, and it concerns bilingual status broadly.

The direct CS studies appear superficially compatible: significant associations occurred in preschool samples [7, 9], whereas the study of eight-year-olds was null [8]. Age cannot explain this contrast by itself, however, because language pairs, proficiency, contexts, CS measures, and EF tasks also differed. Treating six years as a universal boundary would therefore be premature. Longitudinal evidence across a wider age range is needed to test developmental change directly.

4.4. Context, switching type, and language ability

The strongest shared pattern is contextual dependence. Hansen et al. [7] measured cross-speaker switching during interaction with a familiar bilingual parent, whereas Kuzyk et al. [9] examined switches during sessions organized around one target language. A cross-speaker switch can be an appropriate response to an interlocutor; a switch away from the assigned language may instead reflect a lexical gap. Frequency has opposite interpretive meanings across these contexts.

Broader evidence reinforces this caution. A scoping review of 49 studies found mixed results and substantial heterogeneity in definitions of interactional context, language-use measures, participant characteristics, and EF tasks [11]. The authors argue that interactional contexts are dynamic and continuous, not clean categories. This aligns with the Adaptive Control Hypothesis but also limits strong conclusions: researchers often use the same label for experiences that impose different demands.

Language ability may be the most immediate child-level boundary condition. It moderated the positive association in Hansen et al. [7], predicted EF instead of CS in Kang and Lust [8], and predicted language control in Gross and Kaushanskaya [10]. Unless proficiency and lexical gaps are measured directly, high CS frequency can be misclassified as intensive control practice when it may reflect limited access to one language.

DOI: 10.54254/2753-7048/2027.38675

5. Discussion and implications

Current evidence does not justify the statement that bilingual CS generally enhances children's EF. A more precise model is conditional: regulated switching may be associated with particular executive processes when it is responsive to external communicative demands and supported by sufficient language ability. Switching that is voluntary, effortless, or driven by lexical gaps may recruit less control and should not be expected to produce the same association. This interpretation reconciles positive, null, and inverse findings without assuming that one study must be wrong.

The evidence also reveals three methodological priorities. First, CS should be observed in ecologically meaningful interaction and coded by type, direction, speaker relation, and communicative function, rather than reduced to a single self-reported frequency. Second, researchers should measure proficiency, exposure, socioeconomic background, and lexical access as continuous covariates. Third, EF should be assessed with multiple tasks, separating cognitive flexibility from inhibitory control and reporting effect sizes and uncertainty. Longitudinal cross-lagged designs would be especially valuable because they can test whether earlier switching predicts later EF, earlier EF predicts later switching, or both reflect a third factor.

Educational implications must remain cautious. The evidence provides no basis for banning natural CS as a sign of confusion; switching can be a functional bilingual practice. At the same time, it does not support prescribing more CS as a cognitive intervention. Classrooms should permit strategically useful switching for comprehension, participation, and communication, while claims about EF benefits should await stronger causal evidence.

6. Conclusion

Bilingual code-switching is not a uniform cognitive exercise, and its relationship with children's executive function is not uniformly positive. The best available evidence indicates that outcomes depend on language ability, interactional context, switching function, age, and the EF task used. The field should therefore replace the question "Does code-switching create an advantage?" with a more specific one: which switching behaviors relate to which executive processes, for which children, in which environments, and in what direction? On current evidence, code-switching is best understood as a conditional correlate of executive control rather than a proven cause of cognitive enhancement.

References

[1] Gunnerud, H. L., ten Braak, D., Reikerås, E. K. L., Donolato, E., & Melby-Lervåg, M. (2020). Is bilingualism related to a cognitive advantage in children? A systematic review and meta-analysis. *Psychological Bulletin, 146*(12), 1059-1083. https://doi.org/10.1037/bul0000301

[2] Planckaert, N., Duyck, W., & Woumans, E. (2023). Is there a cognitive advantage in inhibition and switching for bilingual children? A systematic review. *Frontiers in Psychology, 14*, Article 1191816. https://doi.org/10.3389/fpsyg.2023.1191816

[3] Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49-100. https://doi.org/10.1006/cogp.1999.0734

[4] Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology, 25*(5), 515-530. https://doi.org/10.1080/20445911.2013.796377

[5] Verreyt, N., Woumans, E., Vandelanotte, D., Szmalec, A., & Duyck, W. (2016). The influence of language-switching experience on the bilingual executive control advantage. *Bilingualism: Language and Cognition, 19*(1), 181–190. https://doi.org/10.1017/S1366728914000352

[6] Blanco-Elorrieta, E., & Pylkkänen, L. (2018). Ecological validity in bilingualism research and the bilingual advantage. *Trends in Cognitive Sciences, 22*(12), 1117-1126. https://doi.org/10.1016/j.tics.2018.10.001

DOI: 10.54254/2753-7048/2027.38675

[7] Hansen, E., Slawny, C., & Kaushanskaya, M. (2025). The influence of cross-speaker code-switching and language ability on inhibitory control in bilingual children. *Bilingualism: Language and Cognition, 28*(4), 980-988. https://doi.org/10.1017/S1366728924000804

[8] Kang, C., & Lust, B. (2019). Code-switching does not predict executive function performance in proficient bilingual children: Bilingualism does. *Bilingualism: Language and Cognition, 22*(2), 366-382. https://doi.org/10.1017/S1366728918000299

[9] Kuzyk, O., Friend, M., Severdija, V., Zesiger, P., & Poulin-Dubois, D. (2020). Are there cognitive benefits of code-switching in bilingual children? A longitudinal study. *Bilingualism: Language and Cognition, 23*(3), 542-553. https://doi.org/10.1017/S1366728918001207

[10] Gross, M. C., & Kaushanskaya, M. (2020). Cognitive and linguistic predictors of language control in bilingual children. *Frontiers in Psychology, 11*, Article 968. https://doi.org/10.3389/fpsyg.2020.00968

[11] Semenova, E., Norkina, M., Logvinenko, T., Ryseva, K., Chinn, L. K., Crabb, K., & Grigorenko, E. L. (2026). The modulating role of interactional contexts in executive functioning of bilinguals: A scoping review. *Bilingualism: Language and Cognition, 29*(2), 527-561. https://doi.org/10.1017/S1366728925100084