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Review

A head taller: A meta-analysis on the relation between pretend play and executive functions in early childhood

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ABSTRACT

Executive functions emerge gradually in early childhood and are predictive of a range of developmental outcomes. Pretend play, a type of play that is imaginative and creative, has been posited to benefit children's early development of executive functions. Yet, previous studies on the relation between pretend play and executive functions have not consistently evidenced a clear connection. This study aimed to quantitatively assess the relation between pretend play and executive functions in early childhood via a systematic review and *meta*-analysis for the first time. A pre-registered, systematic literature search was conducted across five databases (i.e., ERIC, ProQuest Dissertation and Theses Index, PsycInfo, Scopus, Web of Science). The screening process identified 26 studies, which reported on 2,915 children, aged 12–72 months. A three-level, random effects *meta*-analysis across 131 correlational effect sizes identified a significant, small effect between executive functions and pretend play, $r = 0.17$, 95 % CI [.13, 0.20], $SE = 0.02$, $t(130) = 9.93$, $p < 0.001$, albeit with significant heterogeneity within the cumulative effect. No evidence of publication bias was identified. Effect sizes were significantly larger for studies measuring executive functions via a questionnaire compared to performance-based tasks. Other considered variables (i.e. social aspects of pretend play measures, age, socioeconomic status, study design) did not, on their own, affect the observed relation between pretend play and executive functioning in early childhood. While these results do not evidence causality, they invite further research building on the identified, extant literature. The implications of the results are discussed in terms of the direction and the potential mechanisms for the identified relation between pretend play and executive functions.

Introduction

Executive functions, a set of higher-order cognitive processes, are critical to our everyday functioning, particularly in unfamiliar or novel situations, as they enable flexible thinking, problem-solving, and adaptive behaviours. Accordingly, executive functions play an essential role in children's early development, which requires children constantly to adapt to new challenges (e.g., learning to solve puzzles, understanding social rules), routines (e.g., entering kindergarten or preschool), or environments (e.g., going to the doctor, playgroups). Consequently, executive functions are predictive of a range of social, health, and behavioural outcomes, such as social competence or mental health (Stucke & Doebel, 2024).

Given the importance of executive functions in children's everyday functioning and developmental success, they have been

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identified as a valuable target of early interventions (Diamond, 2016). Within this context, play, as a nearly ubiquitous activity of all children, has been identified as a particularly fertile context for children's executive development (Berk & Meyers, 2013; Eberhart et al., 2023). For instance, Vygotsky (1978) describes children "a head taller" in play (p. 102) – in reference to children's heightened cognitive and regulative skills exhibited in their play. Specifically, recent research has focused on children's pretend play (Gleason & White, 2023), which is marked by imagination, creativity, and playfulness (Thompson & Goldstein, 2019). Notably, the ability to engage in pretend play depends on several executive functions, such as turn-taking, inhibition, flexibility, or generativity (Gleason & White, 2023). In turn, pretend play provides rich opportunities to practice and refine these emergent executive skills (Foley, 2017).

However, despite the often-repeated theoretical claims on pretend play and executive functions (e.g., Berk & Meyers, 2013; Gleason & White, 2023; Vygotsky, 1967), the overall empirical evidence base on their relation has been questioned (e.g., Doebel & Lillard, 2023; Smith, 2010). Indeed, an extensive review of studies on pretend play from Lillard et al. (2013) concluded that the "evidence that pretend play assists EF [executive functions] is sparse at best" (p. 23). Nonetheless, recent years have seen an increasing interest in the relation between children's pretend play and the development of executive functions, resulting in the publication of numerous studies (e.g., Bauer et al., 2021; Carlson et al., 2014; Thibodeau et al., 2016; White et al., 2021). Therefore, this systematic review and *meta*-analysis aims to provide an updated review of this field of study and quantitatively assess the relation between pretend play and executive functions in early childhood via a *meta*-analysis of previously published correlational effect sizes.

Executive functions

Executive functions describe a set of higher-order cognitive processes that allow conscious self-control of thoughts, actions and emotions (Diamond, 2013). They develop gradually throughout childhood and adolescence, becoming observable in late infancy and toddlerhood. While there remains ambiguity on how to best identify and conceptualise distinct executive functions, the most commonly tested components of executive functioning in early childhood are inhibitory control, working memory, and cognitive flexibility (Morgan et al., 2024). Inhibitory control refers to the ability to stop a prepotent thought, behaviour or action in favour of an alternative or no response (e.g., waiting for a reward). Working memory refers to the ability to keep and manipulate information in mind (e.g., remember rules in a game). Cognitive flexibility refers to the ability to shift between possible responses, rules, or perspectives (e.g., adapting to new routines). These foundational components, in turn, are thought to enable more complex executive skills such as planning, reasoning, and problem-solving (Diamond, 2013).

Although originally developed in the study of adult executive functioning (Miyake et al., 2000), this so-called "unity and diversity model" is also predominant within developmental literature (Escobar-Ruiz et al., 2023; Silva et al., 2022). Nonetheless, specific developmental models of executive functions have also been proposed (e.g., Hughes et al., 2009; Miller et al., 2012; Wiebe et al., 2011). These models describe the different executive skills to be relatively undifferentiated in early development and to emerge out of a unitary executive construct with related skills, such as attention or information processing (Cuevas & Bell, 2014; Devine et al., 2019). Correspondingly, recommendations for assessing executive functions in early childhood suggest that aggregating scores across multiple tasks can improve precision and reliability compared to using single-task measures. (Miller et al., 2023; Wiebe et al., 2011; Willoughby et al., 2012). Regardless, it has been emphasised that real-life circumstances most often require coordination and interaction of multiple executive skills (Morgan et al., 2024). For example, children playing with a shape sorter need to keep in mind the various shapes, inhibit the impulse to push the blocks simply through any hole, and remain flexible when realizing that their first solution was not correct.

Ibbotson (2023) recently proposed a theoretical framework for the development of executive functions, which incorporates both unity and diversity perspectives, based on the principle of functional analogy. It argues that children's early executive functioning is relatively context-specific and concrete, and may not necessarily translate to other experiences (e.g., being able to wait at a stoplight, but not being able to wait for a treat; also see Doebel, 2020). Yet, over time and with increasing experiences, executive functioning becomes more domain general as analogous instances are categorised based on their shared executive demand (Ibbotson, 2023). For example, children learn that waiting at a stoplight or waiting for a treat both require resisting a prepotent or prompted response. This framework aligns with similar conceptualisations which highlight *meta*-cognitive skills for reflection (Zelazo & Carlson, 2023), but also incorporates proposals that emphasise children's broader beliefs, values, norms, knowledge and preferences in the development of executive functions (Doebel, 2020; Miller-Cotto et al., 2022). Central within Ibbotson's account of the development of executive functions is the "***blessing of abstraction*** argument" (Sim & Xu, 2017, p. 642, italics in original), i.e., that generalisations from concrete experiences form abstract cognitive functioning that may be employed across contexts and situational demands. Ibbotson (2023) also specifically includes play in his hierarchical model of executive functioning, arguing that play is one way to gain and explore new experiences, which, over time, helps generalisation of experiences (see also Gopnik, 2020).

The role of executive functions in development

Throughout life, executive functions play a central role in our everyday functioning, enabling us to adapt to novel situations, plan and monitor our behaviour, and focus on principal aspects of our environment. Executive functions also play a role in children's development, as measures of early executive skills are identified as significant predictors of children's overall developmental outcomes (Stucke & Doebel, 2024). One study, for instance, found executive functions assessed in toddlers aged 20 months to be directly related to their academic achievement in primary school six years later (Jaekel et al., 2016). Accordingly, a recent comprehensive *meta*-analysis identified executive functions, assessed in early childhood, to be related longitudinally to social (i.e., social competence, peer acceptance) and behavioural outcomes (i.e., externalising and internalising problems, adaptive behaviour, inattention and

hyperactivity symptoms) in middle childhood (i.e., 6 to 12 years; Stucke & Doebel, 2024).

Consequently, executive functions have been identified as an important target of early interventions that may play a role in closing socio-economic disparities in academic achievement and mental and physical health (Zelazo & Carlson, 2020). In this regard, the preschool period has been identified as a "*window of opportunity*" (Muir et al., 2023, p. 27, italics in original), given the plasticity and protracted neurodevelopment of the prefrontal cortex during this period. Within this context, play has been posited to provide a fertile context for the development of executive skills in providing copious opportunities for the practice and acquisition of various executive abilities (Foley, 2017). For instance, many traditional children's games, such as Simon Says or Musical Chairs, challenge children's inhibitory control, working memory and cognitive flexibility. Accordingly, play is a key part of many early interventions of executive functions (Muir et al., 2023). Tools of the Mind (Bodrova & Leong, 2018), for example, is a popular play-based preschool curriculum which is targeted at improving children's executive functions and places explicit emphasis on pretend play.

Pretend play

Pretend play is a unique type of play in which children reimagine their surroundings (e.g., to play school, doctor), repurpose their toys or other props (e.g., a stick as a sword), create stories, or take on imagined roles. In pretend play, children step outside their immediate reality and engage in an ephemeral as-if world. As such, pretend play cannot be described purely by outward behaviours but instead is based on mental processes as well (Gleason & White, 2023). Pretend play has been described as "the most commonly studied form of human play" (Lillard, 2015, p. 432), yet (or perhaps for this reason) conceptualisations and measures of pretend play vary widely within the literature (Thompson & Goldstein, 2019). Fundamentally, pretend play encompasses the two concepts of play and pretense (Lillard, 1993). While a reliable definition of play has been evasive, it is generally seen as an activity that is intrinsically motivated, engaging, and fun (see Lillard (2015) for a thorough discussion). Pretense, on the other hand, has been more concretely defined. Specifically in relation to pretend play, Leslie (1987) proposed three main components marking pretense: Object substitution, attribution of pretend properties, and imaginary objects (see Table 1). Complex forms of pretend play, such as role-play (e.g., pretending to be Batman) then emerge from these main components (Leslie, 1987). In the current study, an intentionally broad definition of pretend play was chosen to encompass the diverse conceptualisations within the field. Pretend play was defined as "the nonliteral use of objects, actions, or persons" (Quinn et al., 2018, p. 124) in play.

Development of pretend play

In typical development, pretend play emerges around 18 months of age, with toddlers beginning to create other uses for their toys (i.e., object substitution) or imitating common behaviours, like pretending to sleep or eat (Gleason & White, 2023). Piaget, for example, described observing his daughter starting to pretend shortly before her second birthday. At 18 months, she was pretending to wash her hands; at 20 months, she was pretending to eat, while exclaiming "very nice" (Piaget, 1951, p. 96). Between 36 and 72 months of age, pretence becomes the predominant type of play for preschool children, increasing in complexity with children starting to engage in more complex role-play behaviours or create and act out fictional stories (Thompson & Goldstein, 2019). Although instances of pretend play become less prevalent after 72 months of age, skills of pretend play (e.g., abstraction, perspective taking) remain important throughout development and are further implicated in the development of creativity, playfulness, counterfactual thinking, or scientific reasoning (Ghanamah, 2025; Kapitany et al., 2022; Russ, 2016).

Instances of pretend play throughout early childhood are documented across cultures (e.g., Bitew and Sewagegn, 2024; Cohen & Bamberger, 2021; Shamsudin et al., 2024). Yet, culture can impact the development, expression, and encouragement of pretend play (Gaskins, 2013). Carlson et al. (1998), for example, showed that within the Mennonite community in the US, primary school teachers perceive children's pretend play less favourably, compared to non-Mennonite teachers. Similarly, Farver and Howes (1993) showed that Mexican mothers view pretend play as less important compared to US-American mothers, and, relatedly, are less engaged in their toddler's pretend play. Importantly, pretend play, although sometimes described as "fantastical", is almost always based on children's everyday experiences (e.g., playing toy kitchen, taking care of dolls, pretending to cry), which are also impacted by culture (Göncü & Gaskins, 2011). For example, Cohen and Bamberger (2021) describe a parent's perception of their five-year-old's play during the COVID-19 pandemic, where the child pretended to be a karate warrior and fought an imagined coronavirus.

Table 1
Components of pretense.

Component	Definition	Examples
Object substitution	Using an object as if it were something else.	Using a block as a car.
Attribution of pretend properties	Ascribing features to objects or situations that they don't have.	Giving voice to a teddy. Pretending a clean doll is dirty.
Imaginary objects	Inventing an imaginary object.	Holding and eating an imagined ice cream.

Note. Components are adapted from Leslie (1987).

The role of pretend play in children's development

Theoretically, pretend play and its role in development were highlighted in Vygotsky's sociocultural theory, which described pretence as a "leading activity that determines the child's development" (Vygotsky, 1978, p. 103). In pretence, Vygotsky argues, children learn to understand symbolic thinking and adapt to social norms. Moreover, Vygotsky (1978) posits that pretend play creates a naturally occurring zone of proximal development in which children display self-regulation, planning, and monitoring skills that are more advanced than behaviours shown outside the play context. Given that children are intrinsically motivated to play, i.e., playing for playing's sake, they are more likely to be motivated to pursue tasks or activities when they are encountered in play. Recent empirical studies, in fact, evidence this so-called "Batman effect" (White et al., 2017), where children demonstrate heightened inhibitory control, perseverance, or attention when engaged in pretend play (Karniol et al., 2011; White & Carlson, 2016). For example, children engaged in a challenging science activity can persevere for longer in their attempts when pretending to be a scientist (Shachnai et al., 2022). Importantly, once learned in pretend play, Vygotsky (1978) argues, these skills gradually transfer outside the play context, affecting children's real-life behaviour and, over time, improving their self-regulatory behaviours.

Pretend play and executive functions

Aside from staying on task, pretend play seemingly offers several cognitive challenges that task a diverse set of executive function skills. As such, pretend play provides copious opportunities to practice executive function skills, while at the same time, executive functions are needed to engage in pretend play. Children playing with a toy kitchen, for example, need to sequentially plan out their cooking, and keep in mind the sequence of steps. They are adding ingredients, thereby emphasising their pretend (e.g., salt, tomatoes) and inhibiting their actual qualities (e.g., a white or red wooden block). They are adapting, when their play partner introduces new ideas (e.g., "this needs salt"; "add more tomatoes"). Consequently, pretend play has been incorporated into many guidelines for parents, educators, and healthcare professionals to promote executive functions development (Nesbitt et al., 2023; Wright et al., 2023; Yogman et al., 2018). Yet, contrary to theoretical perspectives and professional guidance, the overall empirical evidence base regarding the relationship between pretend play and executive functions has not always shown a consistent link (Doebel & Lillard, 2023; Lillard et al., 2013).

For instance, early work from Kelly et al. (2011) showed that the ability to engage in pretend play in a sample of 20 children aged 40–89 months was significantly correlated with children's inhibitory control. Yet, in the same study, a measure of generativity showed no association with children's pretend play ability (Kelly et al., 2011). Other studies that have been conducted since mirror this ambiguity. Some studies do find significant associations between children's pretend play and executive functioning (e.g., Held et al., 2024; Kelly et al., 2025; Metaferia, Futo, et al., 2020), while others do not (e.g., Bijvoet-van den Berg and Hoicka, 2019; Buchsbaum et al., 2012) and still others find contradictory results depending on the executive functioning component assessed or the measure of pretend play taken (e.g., Carlson et al., 2014; Slot et al., 2017). Slot et al. (2017), for instance, found a significant association of children's pretend play to an observational measure of their cognitive self-regulation, however, not to task-based measures of hot (i.e., snack and gift delay) and cool (i.e., visual search task, six-boxes task, location task) executive functions.

This ambiguity in the evidence base of correlational studies is mirrored in studies utilising pretend play interventions to improve children's executive functioning. Identifying effective interventions targeting executive functions in early childhood has been a major focus of much research in recent years based on the premise that fostering executive functions early may support school readiness, close socioeconomic disparities, and ensure healthy development (Diamond, 2016; Zelazo & Carlson, 2020). Pretend play, as a nearly ubiquitous, fun, and intrinsically motivated activity, has been at the centre of much of this research, given that pretend play, as an intervention, is easy to implement, cost-effective and engaging (Bierman & Torres, 2016). One early study (Thibodeau et al., 2016), for example, which reported on a five-week preschool-based intervention, showed significant improvements in working memory from before to after the intervention for children in the pretend play group compared to the non-pretend play and control groups. Moreover, it identified a significant difference in cognitive flexibility scores between the pretend play, and the non-pretend play group after the intervention. However, measures of inhibitory control did not show the same effect. Furthermore, a replication study (Thibodeau-Nielsen et al., 2020), including a larger sample of preschool children, observed gains in executive functioning only for children from middle-class backgrounds, but not for children from low-income backgrounds. Similarly, evaluations of the popular Tools of the Mind program have resulted in mixed findings over the years (Baron et al., 2017), despite promising effects in its initial evaluation (Diamond et al., 2007).

Smith (2010) cautions about idealising or overestimating the role of play in development and suggests that this line of research is oftentimes distorted by a "play ethos", which views evidence on the role of play as a priori favourable. Similarly, Lillard and Taggart (2019) critique the "cultural zeitgeist" of viewing play as the "superlative developmental activity" (p. 88) and argue for a more nuanced understanding of the developmental contributions of play. Evidence of a prevailing, uncritical play ethos is evident throughout many reviews or guidance for parents, educators, or healthcare professionals specifically regarding children's executive functions in selectively citing those studies with positive results and neglecting inconclusive or insignificant findings (e.g., Belknap & Hazler, 2014; Leibowitz, 2020; Myck-Wayne, 2010).

Few studies, in contrast, have critically examined the evidence-base on the relation of pretend play and executive functions. An early *meta*-analysis by Fisher (1992) suggested a positive association between pretend play and cognitive skills, though this analysis was found to have serious methodological flaws (Lillard et al., 2013). A more rigorous review, in turn, was conducted by Lillard et al. (2013), who examined the role of pretend play in children's development in a large omnibus review. Following Smith (2010), they proposed that if pretend play is a leading factor of development (i.e., causal hypothesis), it should also have consistent, strong, positive

correlations to children's developmental outcomes. Otherwise, pretend play should only be considered as one possible way to improve development (i.e., equifinality hypothesis) or as a byproduct of some other behaviour that is beneficial for development (i.e., epiphenomenon hypothesis). While others have critiqued this theoretical premise as overly simplistic (e.g., Berk & Meyers, 2013), it serves as an effective device within the review to critically judge a large field of study in the absence of statistical methods.

Specifically, regarding executive functions, Lillard et al. (2013) identified thirteen correlational, experimental, and intervention studies from 1948 to 2012. Overall, they conclude that based on the inconsistency in reviewed results, neither a causal, equifinality, nor epiphenomenon hypothesis regarding pretend play and executive functions can be supported. Nonetheless, Lillard et al. (2013) caveat their conclusion with a note inviting further research. Accordingly, there have been several studies on the relation between children's pretend play and executive functions since. Yet, no additional review has been conducted. More importantly, no quantitative assessment of the current evidence base has been attempted. This kind of assessment, a quantitative *meta*-analysis, would arguably allow the most conclusive assessment of the relation between pretend play and executive functions, by providing the opportunity to explore inconsistent findings within the literature via analysis of potentially moderating variables.

Potential moderators of the relationship between pretend play and executive functions

In past research and theoretical conceptualisations, several factors have been proposed to contribute to the variability within the current evidence base on executive functions and pretend play. These factors, including age, social dimension of pretend play, environmental differences (i.e., socioeconomic status), and aspects related to measurement, will be included within the current *meta*-analysis as moderators, which will allow a quantitative assessment of their impact on the relation of executive functions and pretend play.

Age

Executive functioning and pretend play are both age-dependent. Throughout early childhood children's executive functioning advances rapidly as evidenced by improved performance on various behavioural tasks and neural maturation beginning in late infancy and toddlerhood (Fiske & Holmboe, 2019; Morgan et al., 2024). Infants, between 7 and 12 months of age, for example, show marked improvement with age in the A-not-B-task, which asks infants to find a hidden object in one of two alternating locations and as such tasks both working memory and inhibitory control (Diamond, 1990; Pelphrey et al., 2004). More advanced executive functions, such as cognitive flexibility, or planning skills, in turn, are not observed until later ages (Diamond, 2016). Similarly, children's pretend play changes with age (Andresen, 2005; Thompson & Goldstein, 2022). Consequently, age may play a moderating role in how children engage in pretend play, and in turn, how they benefit from pretend play regarding their cognitive development. It may be hypothesised that younger children, who are only starting to engage in simple pretend play (e.g., talking to their teddy, playing cars), may benefit less than older children involved in more complex pretend play scenarios. Alternatively, it could be plausible that younger children with emergent executive functions benefit more from (even simple) pretend play than older children with more solidified executive function skills. In the current analysis, age was treated as a continuous moderator, to examine its effect on the relation of pretend play and executive functions over time.

The social dimension of pretend play

The development of executive functions in early childhood is associated with the maturation of the related cortical areas but is also dependent on environmental influences and children's personal experiences. Several studies, for instance, indicate that the quality of interactions between parent and child (e.g., warmth, responsiveness, autonomy support, etc.) is related to children's development of executive functions (Fay-Stammbach et al., 2014; Valcan et al., 2018). Moreover, social experiences with peers have been shown to be related to children's developing executive functioning skills (Fang et al., 2024). Similarly, social aspects are relevant to the study of pretend play (Smits-van der Nat et al., 2024; Whitebread & O'Sullivan, 2012). Lillard (2011), for instance, identified toddlers as being more engaged in pretend play with their mothers than when playing by themselves. Concurrently, a recent *meta*-analysis identified a small yet significant effect size linking pretend play and social development for children between three and eight years (Smits-van der Nat et al., 2024).

Relatedly, it has been posited that pretend play may be beneficial to children's development simply by facilitating positive social interactions (Lillard et al., 2013). Children who are frequently engaged in pretend play also have frequent positive social interactions with their parents or peers, which, in turn, may benefit development. This may also be the case regarding the development of executive functions, which have been shown to benefit from positive social experiences (Fang et al., 2024; Fay-Stammbach et al., 2014). Moreover, in social pretend play, children constantly negotiate shared rules and plan out sequences (e.g., I cooked something for you, it's delicious, eat!), which requires cooperation and control of one's own impulses, thereby employing and exercising executive skills (Vygotsky, 1967; White et al., 2021). Solitary pretend play, in which a child does not need to coordinate pretend scenarios with a play partner, arguably poses fewer cognitive challenges and thus does not employ executive function skills to the same extent as social pretend play. Supporting this hypothesis, one recent longitudinal study found that the time spent in social but not solitary pretend play predicted children's inhibitory skills during one preschool year (White et al., 2021). Consequently, it may be posited that social, but not solitary pretend play is linked to children's development of executive functions. Few studies, however, include measures and comparisons of both social and solitary pretend play. As such, the current evidence base does not provide a conclusive interpretation of the role of social aspects of pretend play in relation to children's executive function development.

Sociodemographic factors

Socioeconomic status, identified via resources (e.g., income, housing), access (e.g., health care, education), or environmental factors (e.g., pollution, noise levels), has been identified as an important predictor of a range of developmental outcomes, including executive functioning (Duncan et al., 2015). Children from lower, compared to higher, socioeconomic backgrounds have shown lower performance in measures of executive functions (Lawson et al., 2018; Olson et al., 2021). In this context, a number of studies have identified a significant relation between pretend play and executive functions in children from lower socioeconomic backgrounds (e.g., Metaferia et al., 2020; Thibodeau-Nielsen & Gilpin, 2020; White et al., 2021). Consequently, pretend play has been highlighted as a cost-effective intervention that may be particularly important for children with deficits in executive functioning from low-income backgrounds (Berk & Meyers, 2013). Accordingly, Thibodeau-Nielsen et al. (2020) identified pretend play as a moderating factor between socioeconomic risks (i.e., parental education, income, presence of a father figure) and executive functions in a longitudinal study of children transitioning from preschool to first grade. For children who frequently engaged in pretend play during preschool, socioeconomic risk factors showed no association with their executive functioning in first grade. In turn, socioeconomic risk factors of children who engaged in pretend play less frequently showed a significant, negative association with their executive functioning in first grade (Thibodeau-Nielsen et al., 2020).

Given these results, it may be hypothesised that children at greater risk of executive function difficulties due to socioeconomic factors may gain more from pretend play than those whose development is not similarly affected (Berk & Meyers, 2013). Yet, an intervention study for preschool children, which facilitated a five-week pretend play intervention, showed results counter to that hypothesis (Thibodeau-Nielsen et al., 2020). Following the five-week intervention, only children from middle-class backgrounds exhibited significant improvements in their executive functioning scores. In contrast, no effect was observed for children from low-income backgrounds (Thibodeau-Nielsen et al., 2020). As such, current evidence regarding the role of socioeconomic status within the relation between pretend play and executive functions warrants further investigation.

Measurement of executive functions and pretend play

Lastly, the relation between executive functions and pretend play may be moderated by aspects related to the measurement of executive functions. Although the unity and diversity model of executive functions has been identified as predominant in developmental literature (Escobar-Ruiz et al., 2023; Silva et al., 2022), variability remains in how executive functions are conceptualised and assessed across studies. Measures of executive functions, that have been used in previous studies, may lack convergent validity, challenging uniform interpretation (Soto et al., 2020). Moreover, separate executive function components may be related differently to pretend play. For example, Thibodeau-Nielsen et al. (2020) found that composite scores of executive functioning and scores of inhibitory control, but not working memory or cognitive flexibility, were significantly related to concurrent ratings of pretend play in preschoolers of 4–5 years of age. Similarly, van Reet (2020) found inhibitory control, but not working memory, to be related to a task of children's pretend play in 86 toddlers aged 17 to 33 months. Comparison of how separate executive skills are related differently to pretend play, however, is challenged by studies employing different assessments of executive functions or analysing composite instead of individual scores. As such, further exploration is warranted.

The present study

A strong theoretical foundation suggests an association between children's pretend play and the development of executive functions. However, previous studies have not always shown a clear link between the two and potentially moderating variables have received little attention in prior research. Therefore, this review aims to comprehensively map existing studies on this topic and investigate the extent of the relation between pretend play and executive functions in children aged 12 to 72 months via a systematic review and *meta*-analysis. The second aim is to provide an overview of current conceptualisations and assessment tools of pretend play and executive functions within studies examining both constructs to inform further research. The following research questions were specified:

Research Question 1: To what extent is pretend play related to children's executive functions in early childhood?

Research Question 2: How are pretend play and executive functions conceptualised and assessed within developmental studies on pretend play and executive functions?

Method

Design

These research questions were examined via a systematic review and quantitative *meta*-analysis. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA; Page et al., 2021) as well as the American Psychological Association (APA) journal reporting standards for *meta*-analyses were employed (Appelbaum et al., 2018). A protocol for this review was piloted and registered on the Open Science Framework on September 27th, 2024, prior to the database search (osf.io/v28fp). All materials from this study, including the analysis script and dataset, are uploaded on the accompanying OSF project page (osf.io/tup39). This study did not seek ethical approval, as only publicly available literature was reviewed.

Information Sources and search strategy

The search strategy for this review was developed in coordination with a subject librarian. Articles for inclusion were sought within five scientific databases: PsycINFO, ERIC, Web of Science, Scopus, and the ProQuest Dissertation and Thesis Index. All searches were conducted on October 14th, 2024. Following the PEO search strategy (Munn et al., 2018), search terms were identified relevant to the population (i.e., children between twelve and 72 months), exposure (i.e., pretend play), and outcome (i.e., executive functions). All search terms are presented in Table 2. In addition to the database search, individual authors were invited to submit unpublished or other literature for this review via an open call for data sent out through e-mail lists organised by the International Congress for Infant Studies, and Divisions seven and ten of the APA on October 16th, 2024.

Inclusion and exclusion criteria

Studies were deemed eligible for inclusion if they met the following criteria: (1) The study's participants were typically developing children in late infancy, toddlerhood, or the preschool period between twelve to 72 months of age. This age range was chosen given the advances in both pretend play, and executive functioning throughout this period, the consensus that instances of pretend play become less prevalent after 72 months (Thompson & Goldstein, 2022), and in consensus with previous *meta*-analytic reviews on pretend play (Quinn et al., 2018; Smits-van der Nat et al., 2024). Studies which included children outside of this age range, children with clinical diagnoses of neurodevelopmental disorders, vision, motor, hearing impairment, or brain injuries were excluded. (2) The study included an independent, quantitative measure of children's pretend play. Given the expected heterogeneity in measures and conceptualisations of pretend play, an initially broad working definition of pretend play was chosen for the purpose of this review. Pretend play was defined as "the nonliteral use of objects, actions, or persons" (Quinn et al., 2018, p. 124) in play. Lastly, (3) only studies with an independent measure of children's executive functions were included. For this review, executive functions were conceptualised using the unity and diversity model, which identifies three separate, but correlated components of executive functioning: Inhibitory control, working memory, and cognitive flexibility. This conceptualization was chosen, as it is currently the most widely used model of executive functions within developmental literature (Escobar-Ruiz et al., 2023; Silva et al., 2022).

Moreover, only quantitative cross-sectional or longitudinal studies assessing the relation between pretend play and executive functions were included. Experimental or training studies were included only if they provided correlational data of pretend play and executive functions at the baseline, which were used in the *meta*-analysis. For example, White & Carlson (2021) conducted an experimental study on the effect of pretend play on executive functions in three-year olds. Only data that was collected prior to their experiment (i.e., the correlation between the baseline measures of executive functions and pretend play) were used as data from this study. The decision to exclude findings from intervention and experimental studies was made in line with a previous *meta*-analysis (i.e., Quinn et al., 2018) and based on theoretical considerations. As intervention and observational studies address conceptually different research questions, it is not possible to combine effect sizes from these study designs (Borenstein & Hedges, 2019). Lastly, no restrictions regarding the year or language of publication were set.

Screening process

The database search identified 845 total search results. Additionally, three datasets (Kelly et al., 2025; Metaferia, Futo, et al., 2020; Metaferia, Takacs, et al., 2020) and two studies (Albertson & Shore, 2009; Cemore & Herwig, 2005) were identified via the open call for data. After duplicates were removed, 829 search results were screened using the online platform Covidence (https://www.covidence.org) at a (1) level of title and abstract, and (2) full-text level. The screening was conducted by the first two authors, [TC] and [SM], who reached substantial agreement in the first level, $\kappa = 0.64$, and the second level of screening, $\kappa = 0.67$ (Landis & Koch, 1977). Initially, 30 reports (i.e., publications, or dissertations) were identified following the screening process. However, two included dissertations (Held, 2022; Thibodeau, 2017) were removed from consideration after consultation with the authors confirmed

Table 2
Search terms.

Population	Exposure	Outcome
toddler*	pretend play	executive function*
infant*	pretense	inhibition
early childhood	pretence	inhibitory control
pre-school*	imagina*	working memory
preschool*	role play	cognitive flexibility
kindergarten	as-if play	set shifting
	socio-dramatic play	self-regulation
	fantastical play	impulse control
	fantasy play	cognitive fluency
	playfulness	task switching
		goal setting

Note. Search terms within a column were connected with the Boolean operator OR, and each column in turn was connected with AND. See supplementary material for the entire search string.

that results from both dissertations were also reported in included, peer-reviewed publications (Held et al., 2024; Thibodeau-Nielsen et al., 2020. Additionally, three identified reports, including two dissertations, did not provide the necessary data to calculate an effect size for the *meta*-analysis, and the authors did not respond in time to supply the missing data. Subsequently, these three reports had to be excluded. To ensure the independence of the study's samples, authors with multiple included reports were contacted for further information regarding the underlying datasets of their studies. Two reports (Thibodeau-Nielsen et al., 2020; Thibodeau-Nielsen & Gilpin, 2020) were based on the same dataset and consequently entered into analysis as one study. In turn, one report comprised results from two studies (Van Reet, 2015). Ultimately, 26 studies were selected for inclusion in the review and *meta*-analysis (see Fig. 1).

Data extraction

Data was extracted following a pre-registered extraction template, which identified information on bibliometrics (i.e., authors, year of publication, title, country), study design (i.e., cross-sectional, longitudinal, experimental), study sample (i.e., sample size, age, gender, socioeconomic background), pretend play (i.e., conceptualisation, measurement tool), executive functions (i.e., conceptualisation, measurement tool), as well as effect sizes relevant for the *meta*-analysis. Assessments of pretend play were coded as social or solitary, depending on whether the assessment included a social component (e.g., observation of play in groups; White et al., 2021). As such, free play observations were generally coded as "social", whereas task-based measures were generally coded as "solitary". Importantly, the presence of a researcher, who might have modelled or prompted children's pretend play, did not constitute an

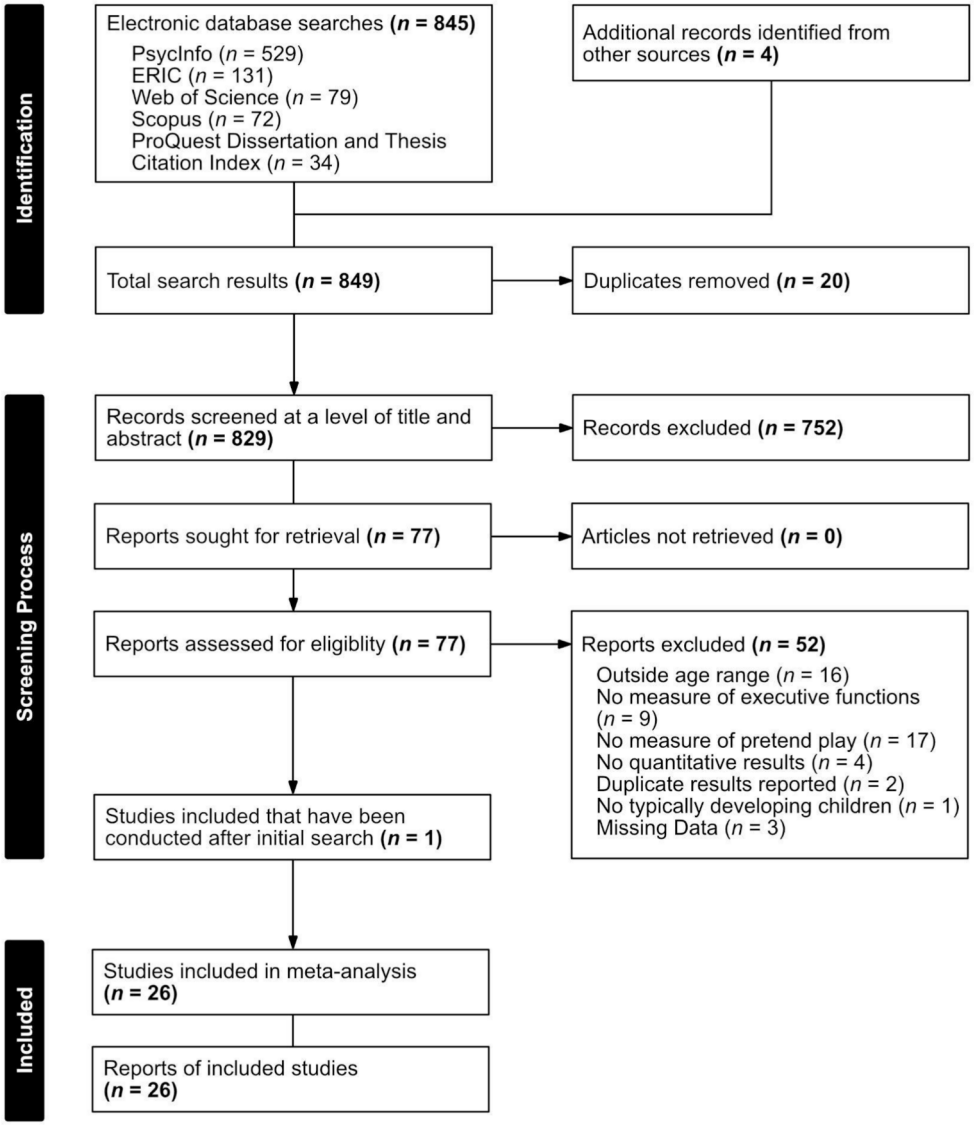

Fig. 1. *PRISMA Flowchart* Note. The initial database search was conducted on October 14, 2024.

engaged play partner so was not coded as social (e.g., Pretend Actions Task; Bauer & Gilpin, 2023). Questionnaires, which did not specify the social quality of children's pretend play, were not coded for this moderator. Socioeconomic status was identified in line with Gunnerud et al. (2020) and Stucke and Doebel (2024) as low, middle, or upper-middle, based on reported socioeconomic background, salary, or the education of children's parents or guardians in the primary studies. Extraction for all studies was conducted by the first author, TC, with the second author, additionally, extracting four included reports, resulting in moderate interrater reliability, $\kappa = 0.59$.

Notably, all but three studies (Buchsbaum et al., 2012; Held et al., 2024; Thibodeau-Nielsen and Gilpin, 2020) reported multiple effect sizes that were included in the analysis, ranging from one to 18 effect sizes per study ($Md = 3$). For example, Adam et al. (2022) reported effect sizes (included in their online supplementary material) derived from a correlation of an observational measure of children's pretend play and an observational task of executive functions (i.e., Head to Toe Task), as well as a questionnaire of children's everyday executive functioning (i.e., BRIEF-P). In sum, $k = 131$ effect sizes were reported across studies and included in the analysis.

Quality assessment

All included studies, except for the unpublished dataset which has not yet been written up for publication (Kelly et al., 2025), were reviewed using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). The MMAT asks two basic questions of every study to identify a study as empirical (i.e., Are there research questions? Does the collected data address these questions?), before applying specific criteria for each study type. As per the recommendation from Hong et al. (2018), no summative score was computed. Instead, a summary of flaws was created to identify specific problematic areas across studies. The assessment was conducted independently by the first author, TC.

Data analysis

The effect sizes were correlations (i.e., Pearson's *r*, Spearman's rho) describing the relation between children's pretend play and executive functions in early childhood. Correlations were coded so that positive values reflected a positive relationship between pretend play and executive functions. As such, correlations from studies that used the BRIEF-P questionnaire, in which lower scores indicate better executive functions (i.e., Adam et al., 2022; Thorne et al., 2024), were multiplied by −1 prior to analysis. For the purpose of the *meta*-analysis, all effect sizes were converted to z-scores using Fisher's z-transformation (Pustejovsky, 2014), and sampling variances were calculated based on sample size to weigh each effect size in the *meta*-analysis model.

All analyses were conducted within RStudio (Vers. 2024.12.0 + 467) using the *metafor* package (Viechtbauer, 2010) and the analysis template developed by Moreau and Gamble (2022). As a majority of studies reported multiple effect sizes, a three-level random-effects *meta*-analysis approach was employed to account for the dependence in the extracted effect sizes. The restricted maximum likelihood method was applied, and the *t*-statistic was used to determine the significance of the results. Outlying effect sizes were identified using Cook's distance, which quantifies the impact of individual effect sizes on the overall result (Viechtbauer & Cheung, 2010). Outliers were defined as three times the mean of the Cook's distance. Outlying studies were further confirmed via a Baujat plot, which graphically depicts an effect size's impact on the overall heterogeneity, alongside its impact on the overall *meta*-analytic result.

First, the main effect of the relation between pretend play and executive function, with further inspection of its heterogeneity was computed using a three-level random effects *meta*-analysis. Outlying studies were identified using the procedure outlined above (i.e., Cook's Distance, Baujat plot) and a revised estimate of the main effect excluding outlying effect sizes was computed. Heterogeneity was assessed using the prediction interval (i.e., the likely range of the true effect size of a future study; Borenstein et al., 2017) alongside the I^2 statistic (i.e., the extent of overlap between confidence intervals across effect sizes; Migliavaca et al., 2022) and attributed to between- and within-study variance. To assess if the between- and within-study variances deviated significantly from zero, likelihood ratio tests were applied to compare the model fit of the main three-level model to the adjusted two-level models without (1) between- and (2) within-study variance. Additionally, multilevel *meta*-regression analyses were conducted to account for the observed heterogeneity and assess the impact of several potential moderating variables (i.e., age, conceptualisation of pretend play, executive functions component, assessment method, SES, study design) on the main effect. Studies with missing data on the assessed moderators were excluded from the *meta*-regressions of that moderator.

Multiple tests of publication bias were conducted, including *p*-curve (Simonsohn et al., 2014), trim and fill method, Egger's regression test, as well as a separate *meta*-regression using the publication status of each study. For the trim and fill method, and Egger's regression test, recently developed adaptions specifically for three-level *meta*-analyses were used (Fernández-Castilla et al., 2021). For the trim and fill method, cut-off values for $R_0^+ > 5$ and $L_0^+ > 3$ were adopted based on Fernández-Castilla et al. (2021). Lastly, to visualise results, a forest plot adapted for three-level *meta*-analyses (Fernández-Castilla et al., 2020), a Cook's and Baujat plot of included effect sizes, as well as a *p*-curve and contour-enhanced funnel plot were created.

Results

Bibliometric *overview*

Twenty-six studies were selected for the *meta*-analysis (see Fig. 1). The included studies were conducted predominantly in the US (*n*

= 17) as well as the UK ($n = 2$), France (n = 1), Hungary ($n = 1$), Ireland ($n = 1$), Netherlands ($n = 1$), Australia ($n = 1$), Canada ($n = 1$), and Ethiopia ($n = 1$). Studies were published between 2003 and 2025, with more than 50 % published between 2020 and 2025 ($n = 15$; see Fig. 2). Aside from published journal articles ($n = 22$), the reports included one unpublished dissertation (Bauer, 2022), two open datasets (Metaferia, Futo, et al., 2020; Metaferia, Takacs, et al., 2020), and one unpublished dataset (Kelly et al., 2025). The studies were classified as observational, including cross-sectional ($n = 17$) and experimental or intervention studies ($n = 6$) as well as longitudinal studies ($n = 3$). Importantly, only three of the six longitudinal studies contributed longitudinal effect sizes to the current *meta*-analysis, given restrictions related to data availability (Yeung et al., 2019) and age inclusion criteria (i.e., 12–72 months; Thibodeau-Nielsen et al., 2020; Thibodeau-Nielsen & Gilpin, 2020). The three included longitudinal effect sizes had an average time difference between measurements of 8 months (Range: 7–9 months). An overview of all included reports and their characteristics is presented in Table 3.

Participants

Overall, the studies included 2,915 participants. The number of participants in each study ranged from 22 to 375 children, and 50 % of the total number of participants were identified as female. Studies described participants as preschoolers or preschool-age children, typically developing children, or toddlers. Overall, participants across studies ranged in age from 12 to 72 months of age ($M = 46.67$ months, $SD = 11.87$). Most studies ($n = 21$) focused on children over the age of 36 months. In turn, there were only five studies specifically recruiting infants or toddlers (i.e., below 36 months; Kelly et al., 2025; Rutherford & Rogers, 2003; Slot et al., 2017; van Reet, 2020; Yeung et al., 2019). A range plot depicting the ages of children in each study is shown in Fig. 3. Lastly, 18 studies (68 %) reported the SES of participants (e.g., household income, parental education), which was identified as low ($n = 4$), middle ($n = 10$), or upper-middle ($n = 4$).

The conceptualisation of pretend play

Studies referred to the construct of pretend play as pretend play, pretence, fantasy orientation, imaginative play, or make-believe play. Nonetheless, conceptualisations largely overlapped. Studies described pretend play as a deviation from reality within children's play (i.e., acting as-if) via object invention (i.e., holding an imaginary microphone), attribution (i.e., pretending an empty cup is full), substitution (i.e., using a banana as a telephone), personification (i.e., giving personality to a teddy-bear), or role-play (i.e., acting like a robot). In summary, pretend play can be defined as an intentional activity in play where children create imaginative scenarios that deviate from reality and in which the meaning, attributes, and identity of objects, environments, or people (including the self) are malleable.

Although the included studies generally agreed on the conceptualisation of pretend play, they showed diversity in its assessment. Across studies, there were 23 different measurement tools of children's pretend play, including seven observational measures, ten behavioural measures, and six questionnaires. A full breakdown of all utilised measures of pretend play is presented in the supplementary materials. Notably, some studies utilised multiple measures of pretend play to compute a summative score of pretend play or used latent factor analyses. For example, Bauer and Gilpin (2023) utilised two observational tasks of pretend play (i.e., Pretend Actions Task, Child Imagination Scale), which they compiled into a composite score using factor analysis.

Behavioural measures were focused on children's ability to perform pretend actions (e.g., Pretend Actions Task; Carlson et al., 2014) or understand pretend actions (e.g., Comprehension of Pretence Task; van Reet, 2020). Questionnaires were focused on the frequency of children's pretend play (e.g., Child's Home Activities Scale; Metaferia et al., 2020), children's general propensity towards imagination and experiences with imaginative play as judged by themselves, their teachers, or parents (e.g., Childhood Imagination Questionnaire; Held et al., 2024), or children's ability to engage in pretend play (Early Pretending Survey; Kelly et al., 2025). Lastly, observational measures of children's pretend play focused on the displayed quality or frequency of specific play behaviours, such as the

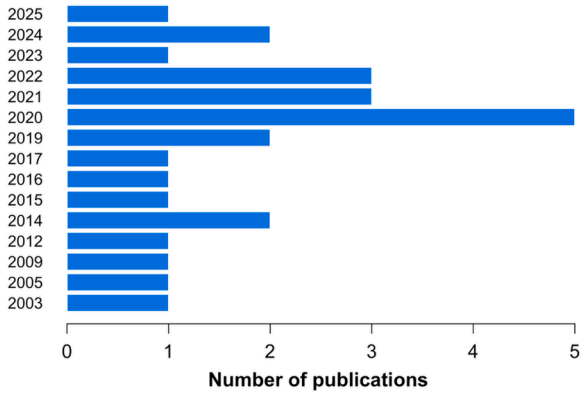

Fig. 2. Year of publication of included reports. Note. N = 26.

Table 3
Overview of included reports.

Reference	Country	Design	*N*	Mean Age (Range)	SES	Number of effect sizes
Adam et al. (2022)	France	Experimental	60	61.50 (48–72)	n. a.	8
Albertson & Shore (2009)	United States	Cross-Sectional	31	50.20 (38–59)	Middle	3
Bauer (2022)	United States	Cross-Sectional	90	48.89 (35–61)	Middle	12
Bauer & Gilpin (2023)	United States	Cross-Sectional	90	54.00 (34–72)	Upper-middle	18
Bauer et al. (2021)	United States	Cross-Sectional	284	49.81 (34–72)	Middle	4
Bijvoet-van den Berg and Hoicka (2019)	UK	Cross-Sectional	32	44.70 (38–51)	Middle	2
Buchsbaum et al. (2012)	United States	Experimental	44	47.00 (33–59)	n. a.	1
Carlson et al. (2014)	United States	Experimental	104	48.00 (39–60)	Middle	16
Cemore & Herwig (2005)	United States	Cross-Sectional	39	56.40 (46–67)	Middle	2
Francis & Gibson (2023)	UK	Cross-Sectional	171	57.60 (48–67)	n. a.	6
Held et al. (2024)	United States	Cross-Sectional	375	49.30 (34–72)	n. a.	1
Kelly et al. (2025)	Ireland	Cross-Sectional	233	24.99 (12–36)	Upper-middle	3
Metaferia, Futo, et al. (2020)	Hungary	Cross-Sectional	70	60.14 (47–72)	Middle	3
Metaferia, Takacs, et al. (2020)	Ethiopia	Cross-Sectional	87	60.82 (50–72)	Low	3
Rutherford & Rogers (2003)	United States	Cross-Sectional	26	19.46 (12–35)	n. a.	4
Slot et al. (2017)	Netherlands	Longitudinal	113	37.00 (28–45)	n. a.	3
Thibodeau et al. (2016)	United States	Experimental	110	52.22 (36–60)	Middle	3
Thibodeau-Nielsen & Gilpin (2020)	United States	Longitudinal*	145	56.89 (48–60)	Low	1
Thibodeau-Nielsen, Gilpin, Palermo et al. (2020)	United States	Longitudinal*	191	57.00 (48–60)	Low	4
Thorne et al. (2024)	Australia	Cross-Sectional	22	52.8 (n. a.)	n. a.	14
Van Reet (2014)	United States	Cross-Sectional	41	37.9 (35–40)	Upper-middle	6
Van Reet (2015)	United States	Experimental	Study 1: 56 Study 2: 46	Study 1: 44 (36–53) Study 2: 46 (36–53)	n. a.	Study 1: 1 Study 2: 2
Van Reet (2020)	United States	Cross-Sectional	86	23.00 (17–33)	Middle	3
White & Carlson (2021)	United States	Experimental	60	42.60 (39–46)	Upper-middle	2
White et al. (2021)	United States	Longitudinal	132	53.00 (44–60)	Low	4
Yeung et al. (2019)	Canada	Longitudinal*	82	25.00 (20–31)	Middle	2

Note. The reports from Thibodeau-Nielsen and Gilpin (2020) and Thibodeau-Nielsen et al. (2020) are based on the same dataset and were thus identified as one study. * While the design of these studies is longitudinal, only cross-sectional effect sizes (i.e., at Time 1) could be included in the current analysis due to data availability or age inclusion criteria (i.e., 12–72 months).

complexity of children's pretend play, or the number of object substitutions in play (e.g., Child-Initiated Pretend Play Assessment; Thorne et al., 2024).

Measurement of executive functions

Studies predominantly conceptualised executive functions with reference to the unity and diversity model of executive functions ($n = 19$). Less commonly used was the conceptualisation of hot (emotionally salient) vs. cold (emotionally neutral) executive functions ($n = 3$). Seven studies were also focused on specific executive skills, such as delay of gratification (Cemore & Herwig, 2005). Seven studies used latent variable modelling to further investigate the underlying structure of executive functions within their sample. Carlson et al. (2014), for instance, applied eight task-based measures of executive functions (i.e., Standard Dimensional Change Card Sort, Backward Digit Span, Grass/Snow, Bear/Dragon, Less is More, Tower Building, Delay of Gratification, Gift Delay), which they then mapped onto the previously conceptualised latent variables of conflict and delay executive functions using confirmatory factor analysis.

Similar to the measurement of pretend play, most studies utilised multiple measures of executive functions. In total, there were 44 different measures of children's executive functioning, including 22 measures of inhibitory control, 13 measures of working memory,

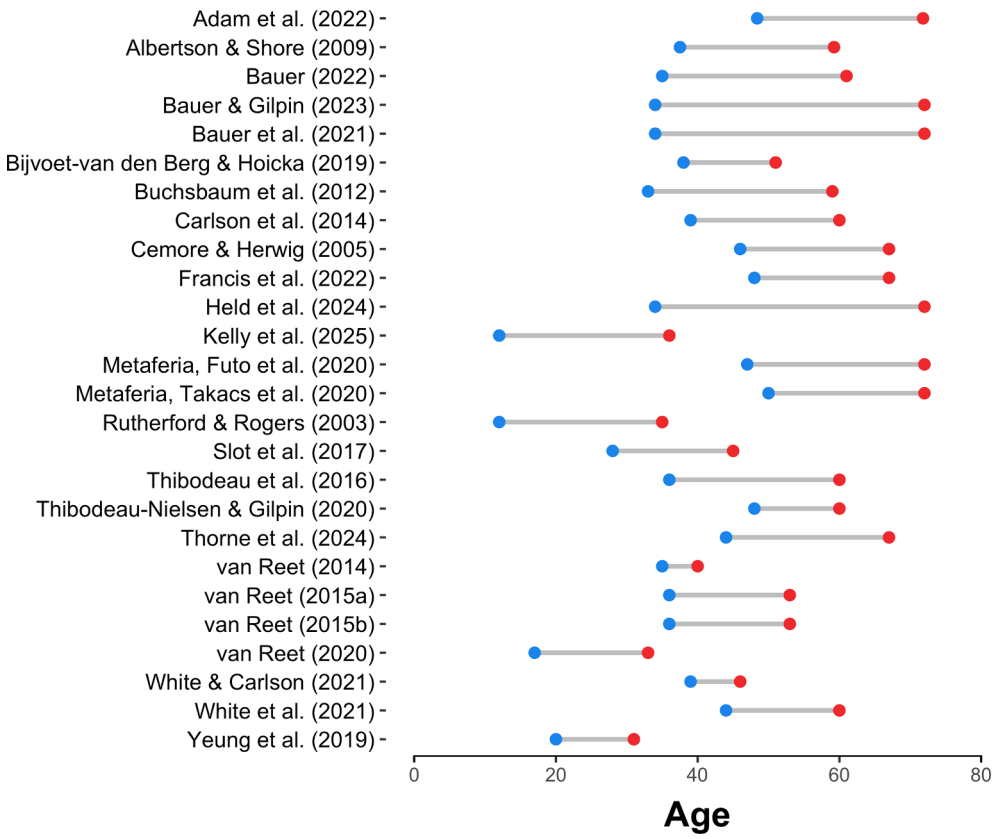

Fig. 3. Age ranges of children in included studies *Note*. Age displayed in months.

six measures of cognitive flexibility, one measure of generativity (i.e, generativity task; Rutherford & Rogers, 2003), and one measure of planning and persistence (i.e., Self-Regulation in Play Scale; Slot et al., 2017). Most studies adopted task-based approaches to the measurement of executive functions, yet two studies utilised questionnaires (i.e., BRIEF-P, Early Executive Functioning Questionnaire). A full breakdown of all utilised measures of executive functions is presented in the supplementary materials.

The relation between pretend play and executive functions

The main model estimated the overall effect size across all included studies ($N = 26$), irrespective of their conceptualization of pretend play and the measured executive function component. The multivariate *meta*-analysis identified a small, significant effect linking children's pretend play and their executive functioning in early childhood, $r = 0.17$, 95 % CI [.13, 0.20], $SE = 0.02$, $t(130) = 9.93$, $p < 0.001$, where greater engagement or skill in pretend play was associated with (modestly) better executive functioning in early childhood, and vice versa.

All included effect sizes in this main analysis ($k = 131$) are depicted in a forest plot specifically adapted for three-level *meta*-analyses (Fernández-Castilla et al., 2020) in Fig. 4. The green lines represent the study-level confidence intervals that indicate the study's precision and are inversely proportional to the size of the centre square, which represents the study's weights within the *meta*-analysis. The red lines, in turn, represent the traditional confidence interval based on a study's sample size (i.e., the smaller the sample size, the wider the red confidence interval). As shown in Fig. 4, the most precise study was from Held et al. (2024), as indicated by the largest centre square and the smallest study-level confidence interval. Conversely, the study with the least precision, as indicated by the widest study-level confidence interval and smallest centre square, was the second study from van Reet (2015).

The 95 % prediction interval ranged from $r = -0.06$ to $r = 0.37$, indicating a moderate amount of heterogeneity between effect sizes, which was further evidenced by the I^2 statistic, $I^2 = 53$ %. The within-study variance (i.e., Level 2) contributed 46 % to the total variance and was statistically significant from zero (LRT = 31.74, $p < 0.001$). The between-study variance (Level 3), on the other hand, contributed 6 % to the total variance and was not statistically significant (LRT = 0.61, $p = 0.44$). In sum, this means that effect sizes varied substantially within but not between studies and that future studies might expect effect sizes ranging from −0.06 to 0.38 linking measures of pretend play and executive functions in early childhood.

Outlying studies were identified via Cook's distance and a Baujat plot, both of which quantify how much the overall results would change if a particular effect size were excluded. Overall, nine effect sizes were identified as outliers (i.e., three times the mean cook distance across all studies, see Fig. 5), however no obvious commonality (e.g., measurement approach, publication year, sample size,

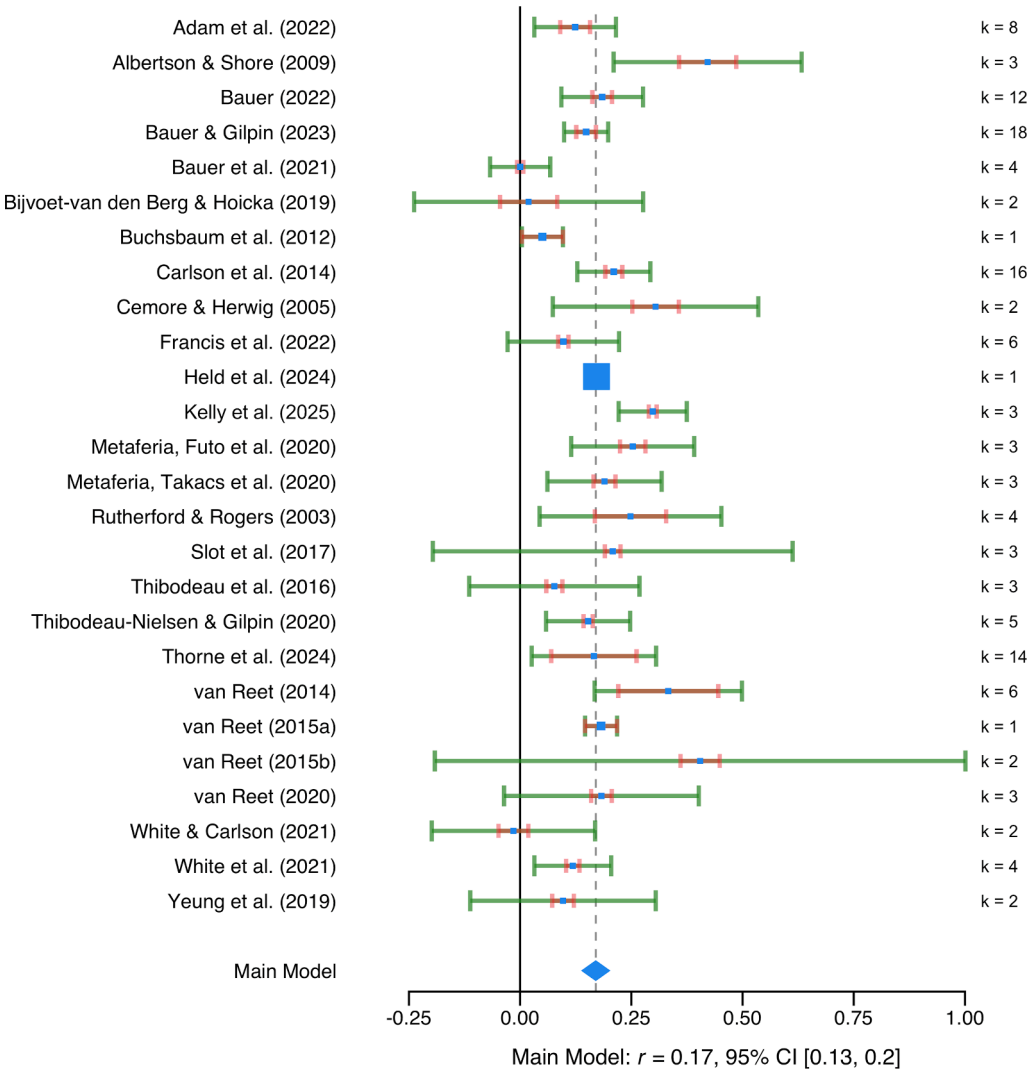

Fig. 4. Forest plot of included study effects sizes *Note*. 131 effect sizes included. The dotted reference line refers to the main effect ($r = 0.17$). The red lines indicate the traditional confidence intervals that are based on the sample size of the study. The green lines are indicative of the study-level confidence intervals that represent the study precision and are inversely proportional to the size of the centre square. The size of the centre square refers to the weight of the study within the *meta*-analysis. *k* refers to the number of effect sizes per study. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

etc.) could be identified between these effect sizes. Visual inspection of the Baujat plot confirmed those results (see supplementary material). One effect size from Slot et al. (2017) was identified as particularly extreme in both the Cook's distance and the Baujat plot. Notably, this effect size, denoting a correlation of $r = 0.54$, was the only effect size that utilised an observational measure both for pretend play and executive functions. An adjusted *meta*-analysis was conducted as a sensitivity check with the identified outlying effect sizes excluded. In this adjusted analysis, the amount of heterogeneity within (16 %) and between studies (19 %) was reduced in the adjusted *meta*-analysis to a small amount, $I^2 = 35$ %. The overall result, however, remained significant, $r = 0.16$, 95 % CI [.13, 0.2], $SE = 0.02$, $t(121) = 9.23$, $p < 0.001$. This indicates that the main model appears robust against influential cases. Therefore, all effect sizes were included in further moderation analyses. Additional sensitivity analyses (i.e., with outlying studies removed, comparing studies with small and large samples, studies with older and younger samples, studies utilising a latent measurement approach) are included in the supplementary materials.

Moderator analyses

Visual inspection of the forest plot (see Fig. 4) shows variability in effect sizes within and between studies, which was further confirmed by a significant *Q*-statistic, $Q(130) = 276.19$, $p < 0.001$, and a wide prediction interval, 95 % PI [-0.06, 0.37]. To account for this heterogeneity, the impact of several potentially moderating variables was tested via *meta*-regression analyses.

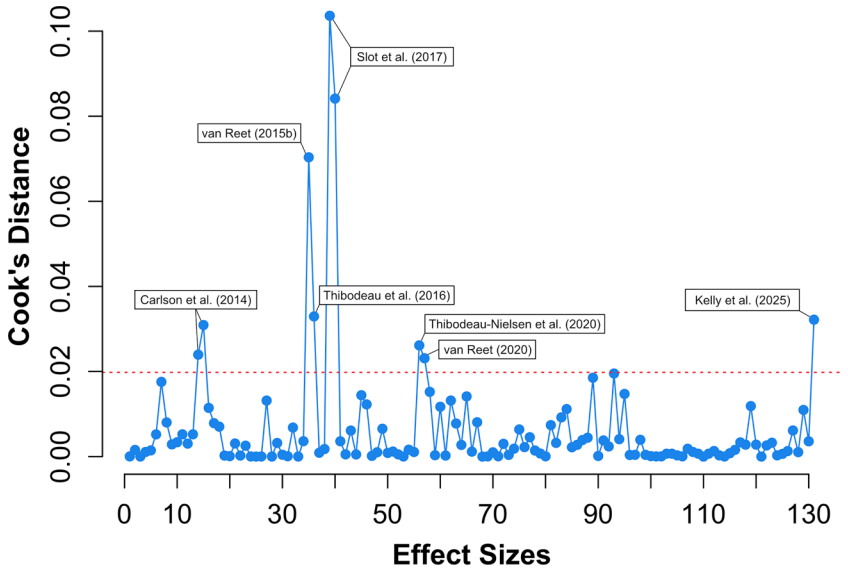

Fig. 5. *Cook's distance plot to identify outlying effect sizes Note.* The dotted line indicates the threshold (i.e., three times the mean Cook's Distance across studies) after which outlying studies were defined. Effect sizes are sorted by year of publication.

The first model assessed the effect of the assessment of children's pretend play as either solitary or social, which did not improve the fit of the overall model to the data, $F(1, 103) = 0.03$, $p = 0.61$. Model 2 tested the effect of the utilised assessment method of pretend play (i.e., observation, task, questionnaire), which also did not improve the fit of the model, $F(2, 127) = 1.02$, $p = 0.36$.

Model 3 tested the impact of the assessed executive function component (i.e., inhibitory control, cognitive flexibility, working memory) on the model, which did not improve its overall fit, $F(2, 123) = 0.19$, $p = 0.82$. Model 4, in turn, tested the effect of the utilised assessment method of executive functions (i.e., task, questionnaire), which did improve the fit of the overall model significantly, $F(1, 128) = 4.78$, $p = 0.03$. Effect sizes in studies that assessed executive functions via a questionnaire ($r = 0.26$, 95 % CI [0.17, 0.35], $t = 5.18$, $p > 0.001$) were significantly larger than in studies that assessed executive functions via performance-based tasks ($r =$

Table 4
Results from main *meta*-analysis and *meta*-regression analyses.

	k	*r*	95 % CI	*Q*	*F*
Main Analysis	131	0.17***	0.13, 0.20	276.19***	–
Outliers Removed [a]	121	0.16***	0.13, 0.20	183.29***	–
Model 1: Conceptualisation of Pretend Play				210.94***	$F(1,103) = 0.27$
Social Pretend Play	46	0.16***	0.11, 0.21		
Solitary Pretend Play	59	0.18***	0.14, 0.22		
Model 2: Measurement of Pretend Play [b]				269.33***	$F(2,127) = 1.02$
Questionnaire	40	0.16***	0.11, 0.21		
Task	49	0.19***	0.14, 0.24		
Observation	41	0.14***	0.08, 0.19		
Model 3: Component of Executive Functions				233.59***	$F(2,120) = 0.10$
Inhibitory Control	71	0.16***	0.11, 0.20		
Cognitive Flexibility	26	0.17***	0.11, 0.24		
Working Memory	29	0.15***	0.09, 0.21		
Model 4: Measurement of Executive Functions				235.40***	$F(1,125) = 2.02$
Questionnaire	15	0.26***	0.17, 0.35		
Task	115	0.15***	0.11, 0.18		
Model 5: Mean Age (centred)				265.20***	$F(2,129) = 2.57$
Model 6: Socioeconomic background				179.99***	$F(2,116) = 0.25$
Low	12	0.15*	0.04, 0.26		
Middle	50	0.16***	0.10, 0.23		
Upper-middle	29	0.20***	0.10, 0.29		
Model 7: Study Design				275.19***	$F(2,128) = 0.06$
Experimental	33	0.16***	0.09, 0.23		
Cross-Sectional	91	0.18***	0.13, 0.22		
Longitudinal	7	0.18***	0.05, 0.30		

Note. [a] Outlying effect sizes removed from Carlson et al. (2014), Kelly et al. (2025), Slot et al. (2017), Thibodeau et al. (2016), Thibodeau-Nielsen et al. (2020), van Reet (2015), van Reet (2020). [b] Only task-based measures were considered.
*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

0.15, 95 % CI [0.11, 0.18], $t = 8$, $p > 0.001$). Yet, regardless of the method of assessment, the relation between pretend play and executive functions remained significant. The amount of residual heterogeneity indicates that there is still significant variability that remains unexplained by the assessed moderator, $Q_E(128) = 238.13$, $p < 0.001$. Moreover, there was a substantial imbalance between the number of included effect sizes ($k = 15$ vs. $k = 115$), which potentially reduces the precision of the overall estimate of studies using a questionnaire and limits a conclusive interpretation.

Model 5 tested the effect of the continuous variable of children's age (mean-centred), which did not improve the overall fit, $F(1, 129) = 2.57$, $p = 0.11$. Furthermore, a sensitivity analysis showed there was no significant difference in the relation between executive functions and pretend play between older (36 months and older) and younger (under 36 months) children (see supplementary material). Model 6 tested the effect of children's socioeconomic background (classified as low, middle, upper-middle), which also did not improve the fit of the overall model to the data, $F(2, 88) = 0.25$, $p = 0.78$. Lastly, model 7 tested the effect of the study design as a moderating variable, which did not improve fit of the model to the data, $F(2, 128) = 0.06$, $p = 0.93$.

Overall, models 1–7 (see Table 4) indicate that only the method of assessment of executive functions impacted the overall relation between pretend play and executive functions. In turn, none of the other assessed variables affect, on their own, the observed relation between pretend play and executive functioning in early childhood.

Quality assessment

Included studies were assessed for quality using the Mixed-Methods Appraisal Tool. Generally, studies met most of the assessed criteria. For instance, all studies utilised appropriate measurements for pretend play and executive functions. Similarly, in the case of randomized controlled trials, randomisation was performed appropriately resulting in comparable groups at baseline. However, only two out of the four included randomized controlled trials utilised blinding of researchers in their design (Adam et al., 2022; Thibodeau et al., 2016). Moreover, eleven studies (42 %) failed to disclose the existence or extent of missing data in their dataset, i.e., whether or not all recruited children provided scores for both pretend play and executive functions. Lastly, nine studies (35 %) did not account for the impact of any confounding variables, such as children's language skills, in their analysis of the relation between executive functions and pretend play. The full quality assessment is provided in the supplementary materials.

Publication bias

Methods of detecting publication bias indicated no bias within the examined evidence on the relation between pretend play and executive functions in early childhood. Firstly, *meta*-analysis results did not differ significantly depending on publication status (i.e., published vs. unpublished), $F(1, 129) = 1.03$, $p = 0.31$. Analysis of the *p*-curve data showed evidential value (see Supplementary Fig. 2), based on the reported *p*-values in primary studies, indicating no publication bias. Similarly, visual inspection of the contour-enhanced funnel plot indicated no asymmetry (see Fig. 6), which was confirmed by a three-level Egger's regression test ($p = 0.08$). Further corroborating these results, the three-level trim-and-fill analysis indicated no asymmetry, given an $L_0^+ = 2.21$, below the recommended threshold of 3.

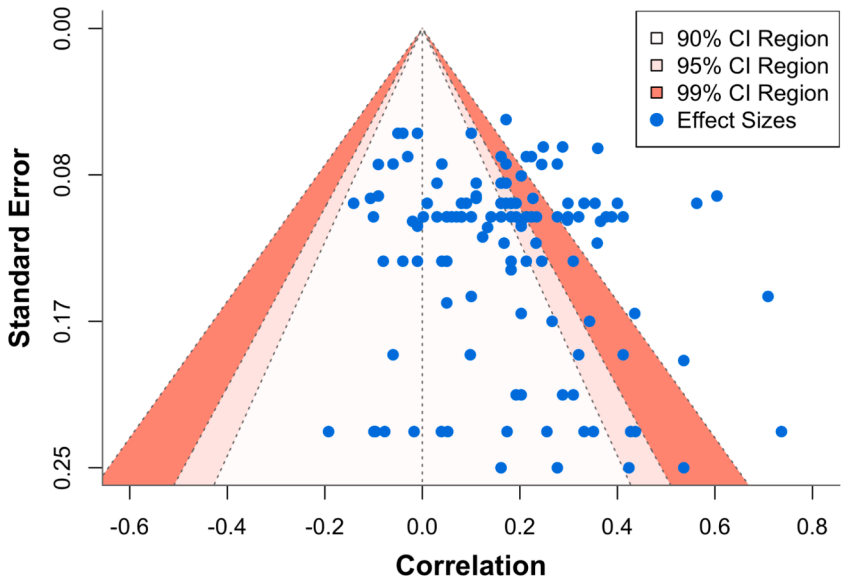

Fig. 6. Contour-enhanced funnel plot of all included effect sizes *Note*. All included effect sizes are depicted ($k = 131$).

Discussion

To the authors' knowledge, this study presents the first *meta*-analysis on the relation between pretend play and executive functions in early childhood. Its first aim was to quantitatively assess the relation between pretend play and executive functions, which identified a small yet significant average effect size. Notably, this effect remained significant across all of the tested moderators, indicating a robust relation between children's pretend play and executive functions regardless of their measurement, the study design, children's age, or socioeconomic background. As such, the current study goes beyond the qualitative assessments of previous reviews (e.g., Gleason & White, 2023; Lillard et al., 2013) by providing a quantitative summary that indicates a small, yet significant and robust positive relation between pretend play and executive functions. The effect size in this study corresponds to previous *meta*-analyses on correlates of pretend play, such as children's language (Quinn et al., 2018), and social development (Smits-van der Nat et al., 2024). As such, the current review further adds to the evidence-base on the positive role of pretend play in children's development. The second aim of this study was to review conceptualisations and assessment methods of executive functions and pretend play. Although studies' conceptualisations largely overlapped, various assessment methods, including task-, questionnaire-, and observation-based approaches, in both domains were identified. This is mirrored in the significant amount of heterogeneity within the quantitative assessment of this field's evidence base and indicates a need for a more standardised approach in the study of executive functions and pretend play.

Bidirectional relation

In general, the findings of this *meta*-analysis support theoretical perspectives highlighting the shared basis of pretend play and executive functions in early childhood (Carlson et al., 2014; Gleason & White, 2023). Pretend play offers several cognitive challenges: It requires children to separate between pretend and reality (e.g., a pen, an aeroplane), hold in mind these dual representations and be able to flexibly choose between the two. As such, executive functions are necessary to engage in pretend play, while at the same time pretend play provides a context in which to practice and refine these skills (Foley, 2017). Therefore, the relation between executive functions and pretend play, based on the findings from this review, may be best conceptualised as bi-directional (see Fig. 7; Carlson et al., 2014; Gleason & White, 2023; Foley, 2017). As children's executive functioning matures, they can engage in more and more complex pretend play. For example, with increased planning skills, they can organise their pretend play better; with improved working memory, they can sustain a richer role repertoire; with improved cognitive flexibility, they can better coordinate their play with their peers. At the same time, pretend play provides a cognitively stimulating context via posed challenges (e.g., maintaining a distinction between pretend and reality) and potential rich social interactions within play for the practice and acquisition of domain-general executive functions (Ibbotson, 2023). Moreover, by being linked via themes (e.g., playing house, playing doctor), objects (e.g., toy kitchen, dolls), or play partners (e.g., parents, siblings) to children's everyday experiences, pretend play may offer a transfer of executive function skills practiced in play to real life circumstances.

Moderating aspects of the relation between pretend play and executive functions

The bi-directional model of pretend play and executive functions provides a simple theoretical framework of their relation based on the findings of the current study and in line with previous conceptualisations (e.g., Carlson et al., 2014; Gleason & White, 2023; Foley, 2017). Nonetheless, further research, specifically in regard to potentially moderating or mediating factors within this model, is warranted. Notably, within the current analysis, the relation between pretend play and executive functions remained significant across any of the assessed moderators. Yet, none of the assessed variables sufficiently explained the variability between effect sizes, which suggests that there are potentially other factors explaining the variance found within the current evidence-base linking pretend play and executive functions. The following discussion seeks to further explore the assessed moderators and suggest areas for future research to further contextualise the bi-directional model of pretend play and executive functions in early childhood.

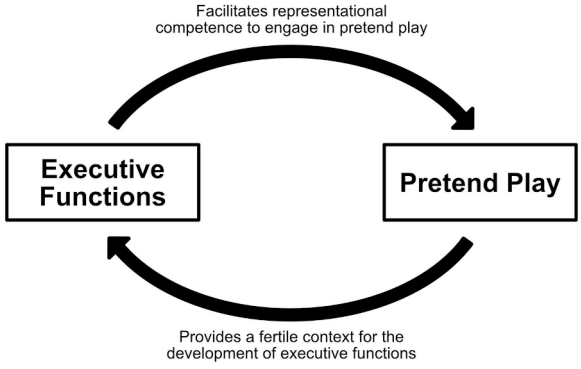

Fig. 7. A model of the bidirectional relation between executive functions and pretend play.

Age

The relation between pretend play and executive functions was not attenuated by age, indicating that, within the current evidence base, both constructs are consistently linked throughout early childhood. This is noteworthy given the dynamic development of both pretend play and executive functions in this period. This finding mirrors results from other *meta*-analyses on pretend play and language, or social competence which found no or weak moderating effects of age (Quinn et al., 2018; Smits-van der Nat et al., 2024). It further corresponds to the theoretical perspective from Vygotsky (1967) of pretend play being a source of development throughout the preschool years. Yet, it should also be noted, that only three studies employed a longitudinal design (i.e., Slot et al., 2017; van Reet, 2014; White et al., 2021). While two other studies (i.e., Thibodeau-Nielsen & Gilpin, 2020; Thibodeau-Nielsen et al., 2020) utilised a longitudinal design, their follow-up measurement was outside the age range of the current review (i.e., first grade). As such, the current evidence base largely describes concurrent associations between pretend play and executive functions across early childhood but lacks longitudinal examinations.

Moreover, only three studies (Rutherford & Rogers, 2003; Slot et al., 2017; van Reet, 2020; Yeung et al., 2019), and one unpublished study (Kelly et al., 2025) examined pretend play and executive functions in children younger than 36 months. As such, the current review, which aimed to examine the relation of executive functions and pretend play across early childhood (i.e., 12 to 72 months), is limited as most of the included evidence is on children between 3 and 6 years. This is an important research gap, as both executive functions and pretend play have their developmental onset before 36 months. Children begin to pretend, using simple object substitutions or imitative behaviours, around 18 months of age (Gleason & White, 2023). Similarly, early executive functioning, such as the ability to remember the location of a hidden object, or delay gratification, emerges during infancy and toddlerhood before the preschool years (Morgan et al., 2024). Additional longitudinal studies with a specific focus on the toddlerhood period are therefore needed to further explore the developmental progression of the relation between executive functions and pretend play in early childhood.

Executive functions components

The fact that the relation between executive functions and pretend play is not moderated by the specific executive component being assessed indicates that pretend play is not related to one specific executive skill over another but instead is associated with executive functions in general. This reflects proposed developmental models of executive functions, which posit that clear differentiation between executive skills (e.g., inhibition, working memory, cognitive flexibility) may only gradually emerge throughout early childhood (Miller et al., 2023; Willoughby et al., 2012). Furthermore, this result mirrors findings from similar *meta*-analyses exploring the relations of factors of children's environment to their executive functions (e.g., Devine & Hughes, 2014; Emslander & Scherer, 2022; Valcan et al., 2018). A recent *meta*-analysis on executive functions and math skills, for instance, showed only negligible differences between inhibitory control, working memory, and cognitive flexibility in their relation to math skills in early childhood (Emslander & Scherer, 2022).

Social aspects in children's pretend play

The moderation analysis indicated no differences between studies measuring pretend play via performance-based tasks in a solitary context (e.g., Pretend Actions Task, Toy Phone Task) or studies measuring pretend play via free-play observation in a social context (e.g., Maturity of Pretend Play Observation Tool) on the cumulative estimate of the relation between pretend play and executive functions. Yet, this basic distinction may not necessarily capture the nuanced effects of social vs. solitary pretend play. Children with a higher tendency to engage in social pretend play may perform equally well on a measure of pretend play in a performance-based, solitary context. Similarly, children may play by themselves (i.e., solitary play) even within social settings (e.g., in early education, toddler groups). As such, the current analysis cannot adequately inform distinctions between the different developmental contributions of social or solitary pretend play. White et al. (2021), for instance, utilising a longitudinal, observational approach identified that social, but not solitary pretend play leads to improvements in children's inhibitory control from the beginning to the end of preschool. Similar research is needed to further explore social dimensions and their distinct developmental benefit in pretend play. To this end, observational schemes, but also performance-based measures which can distinguish between children's tendency to engage in solitary or social pretend play have been developed and may guide future research (e.g., Jaggy et al., 2020; Thompson & Goldstein, 2019).

Additionally, research is needed on the role of play partners in children's pretend play. Different play partners may engage in children's pretend play differently, potentially influencing the relation between pretend play and executive functions. An early study, for instance, showed that toddlers (28 months) engaged significantly more when playing with their mother, than when playing alone (O'Connell and Bretherton, 1984). More recent research, in turn, corroborated these findings, indicating that the quality of children's play can effectively be scaffolded and improved via teacher or parental involvement (Damast et al., 1996; Duss et al., 2024; Moore & Russ, 2008). Less research, however, has investigated the role of adult involvement specifically in the relation between pretend play and executive functions.

These findings are related to research that shows that high-quality caregiving plays a key role in promoting the development of executive functions (Fay-Stammbach et al., 2014; Valcan et al., 2018). For instance, autonomy-supportive parenting behaviours, i.e., responsive, and stimulating adult support that encourages and accompanies children's exploration of their social and physical environment, have been related to children's executive functioning (Distefano & Meuwissen, 2022). Conversely, unresponsive, or unstable parental behaviours have been shown to predict delays in the development of executive functioning (Valcan et al., 2018). Accordingly,

further research on how parental behaviours impact children's pretend play and subsequently their executive functioning is needed. In a recent study, Shorer et al. (2025), for example, showed positive effects on children's emotional expression when mothers are prompted to engage their children playfully, indicating a potential role of parental playfulness in the development of self-regulation. Similar experimental designs could also be applied to the study of executive functions in future research.

Aspects related to the study design

Similar to other reviews on executive functions, this *meta*-analysis is limited by the diversity of assessment methods of executive functions used in the primary studies. Over forty unique measures of executive functions were identified across the twenty-six included studies. Some measures appeared in multiple studies (e.g., grass-snow task, forward digit span), while others (e.g., generativity task, peg tapping) were employed by only a single included study. As such, it is difficult to estimate how much measurement effects were contributing to the identified, shared relation between executive functions and pretend play. Only conceptualisation of pretend play (i.e., social, solitary), executive function component, and method of measurement (i.e., task, questionnaire, observation) were included as potential moderators. Yet, other aspects in the design or structure of the measures being used, that were not accounted for, might have driven the identified relation between executive functions and pretend play. For instance, Lillard et al. (2013) noted that pretend play tasks are often essentially based on executive functions, which could have positively inflated the executive function-pretend play relation. Correspondingly, a moderation analysis, which sought to contrast measures using pretend play observations and pretend play tasks, did identify higher correlations for tasks than observations, however, this difference was not significant. Lastly, past critiques have highlighted methodological limitations, such as the lack of researcher blinding during data collection (Lillard et al., 2013; Smith, 2010). To limit the risk of experimenter bias, we focused exclusively on correlational data. Nonetheless, potential methodological flaws within the primary studies may still have contributed to an inflated overall effect.

Moderation analyses allowed us to distinguish between the different assessment methods of executive functions and pretend play. While there was no difference for measures of pretend play, the moderation analysis of executive function measures indicated that executive functions questionnaires yielded significantly higher correlations to pretend play scores than performance-based tasks. It should be noted, however, that both assessment methods showed a significant relation between pretend play and executive functions. Furthermore, there were only three studies utilising a questionnaire (Adam et al., 2022; Kelly et al., 2025; Thorne et al., 2024), compared to 23 studies with a task-based approach, which may affect the precision of the moderation analysis. As such, there is a need for further research to substantiate this finding.

Executive function questionnaires generally conceptualise executive functions globally and seek to provide an ecologically valid rating of children's executive functioning as observed by caregivers or educators. Conversely, task-based measures typically seek to isolate a specific aspect of executive functioning, such as inhibitory control or cognitive flexibility. Consequently, both methods of measurement may tap into distinct dimensions of the general executive functioning construct, which may be differently related to pretend play. For example, items like *"use everyday objects to solve problems without being shown"*, or *"seem to forget what they were doing, mid-way through"* from the Early Executive Functioning Questionnaire (Hendry & Holmboe, 2021), tap into planning and organization aspects of executive functions that are rarely assessed in executive functioning task for toddlers and preschoolers but may be highly relevant skills in pretend play. As such, the results from the current analysis corroborate recent research indicating that tasks and questionnaires of executive functions should not be used interchangeably but instead be chosen based on theoretical considerations (Soto et al., 2020; Wallisch et al., 2018).

Given limited evidence of convergent validity between questionnaires and task-based approaches (O'Meagher et al., 2019; Spiegel et al., 2017), there have been concerns regarding the continued reliance on executive functions questionnaires (Soto et al., 2020). In the current review, both methods of measurement were included to comprehensively capture the entirety of this field of research. Studies utilised either the preschool version of the Behavior Rating Inventory of Executive Function (BRIEF-P; Gioia et al., 2002) or the Early Executive Functions Questionnaire (EEFQ; Hendry and Holmboe, 2021). Questionnaires have been developed to effectively address current challenges in studying executive functions in young children, i.e., a lack of age-appropriate tasks, difficulties in reliable data collection, and difficulties in recruiting sufficiently powered samples. They may, therefore, serve a particular role in studying children under three or hard-to-reach populations. The EEFQ for instance was developed for infants and toddlers between 9 and 30 months of age (Hendry and Holmboe, 2021). Nonetheless, questionnaires are also limited in that they potentially introduce subjective biases into the measurement of executive functions. Therefore, standardised performance-based tasks are seen as the gold-standard in the assessment of executive functions – as evidenced by the large majority of studies in this review utilising task-based approaches.

Limitations

The findings from the current review should be contextualised by a number of research limitations. First, this *meta*-analysis is necessarily limited by the quantity and quality of its included primary studies (Corker, 2022). For instance, a limited number of studies employing a longitudinal design, or sampling children from lower-class backgrounds may have reduced statistical power to detect moderating effects. Moreover, the variation regarding the measurement of pretend play and executive functions in primary studies may have inflated heterogeneity across studies. This task variability is a persistent challenge to executive function research (Carlson et al., 2016) and, specifically in this review, also extends to the assessment of pretend play. Furthermore, the variability in assessment methods challenges a clear interpretation of potential age-related changes in the development of executive functions and pretend play. Recent tasks, such as the Early Childhood Inhibitory Touchscreen Task (Holmboe et al., 2021), have been developed to be used across different age groups. Similarly new observational coding schemes, or questionnaires that are based on a developmental trajectory of

pretend play across early childhood have been developed (Hoicka & Prouten, 2024; Thompson & Goldstein, 2022). It should also be noted that this review only included studies providing a correlational effect size on the relation between pretend play and executive functioning in early childhood. As such, longitudinal studies, whose Time 2 measurement was outside this age range (i.e., > 72 months), as well as most intervention research, which uses pretend play as an intervention to foster children's executive functioning (Muir et al., 2023), was not considered in the current review and *meta*-analysis yet should be explored in future *meta*-analyses.

Secondly, this review was necessarily limited by the potential moderators not included. Other aspects of children's early environment can have significant effects on their development of executive functions and pretend play, such as parenting behaviours (e.g., autonomy-supportive; Distefano & Meuwissen, 2022), or children's language skills (Quinn et al., 2018; Shokrkon & Nicoladis, 2022;). However, these factors could not be statistically controlled for in the present three-level *meta*-analysis, which models dependencies among multiple effect sizes within studies, but does not allow for the inclusion of participant-level covariates such as language ability. Most included studies did obtain a measure of children's verbal or comprehension skills. Parenting behaviours, on the other hand, are not routinely included in the study of executive functions and pretend play yet may play a significant role in their shared relation in early childhood. As such, additional research is needed to further examine the equifinality vs. epiphenomenon hypotheses on pretend play and executive functioning (Lillard et al., 2013), i.e., is pretend play a possible way to improve executive functions or is it merely a byproduct of some other behaviour that fully explains the relation between executive functions and pretend play?

Thirdly, this study is limited by the sample homogeneity in the included primary studies. It has been pointed out previously that Western middle-class families, specifically US families, are overrepresented in the study of pretend play (Lillard & Taggart, 2019). Similarly, the field of executive functions has predominantly been based on research conducted in White, middle-class contexts (Miller-Cotto et al., 2022). The current review substantiates these assertions. Only one out of the 26 included studies were situated outside of a WEIRD (i.e., western, educated, industrialised, rich, democratic) context (i.e., Metaferia et al., 2020). Moreover, only four studies were focused on lower-income families, compared to 13 studies which included children from middle-to-upper-income backgrounds. A large majority of studies were from the US. Importantly, these limitations affect studies using questionnaire and task-based approaches. As such, the findings of this *meta*-analysis are inherently limited and may not generalise to other contexts. Further research that adopts a culturally responsive lens (Miller-Cotto et al., 2022) and more diverse samples are needed. Recent recommendations, i.e., to use online methods, to increase collaboration, or to use culturally responsive theory to guide data collection (Doebel & Frank, 2023), may be important to broaden the current evidence base.

Implications for future research.

Despite these limitations, the current review offers several implications for future research. First, it indicates a growing interest in the study of pretend play in general and its relation to executive functions specifically. Most studies included in this *meta*-analysis (22 out of 26) were published or conducted after the review from Lillard et al. (2013), and thus, were not included in their original appraisal. Moreover, there are a number of other recent studies on pretend play and executive functions, that due to inclusion- and exclusion criteria, could not be included in the present analysis (e.g., Goldstein & Lerner, 2018; Veraksa et al., 2021; Walker et al., 2020). Secondly, this *meta*-analysis provides an aggregate, quantitative assessment of the relation between pretend play and executive functions, which can inform sample calculations and ensure sufficient statistical power in future studies. Thirdly, this review compiles existing measures of pretend play and executive functions that can inform future study protocols. Moreover, it provides an aggregate definition of pretend play, i.e., an intentional activity in play where children create imaginative scenarios that deviate from reality and in which the meaning, attributs, and identity of objects, environments, or people (including the self) remain malleable. As such, this review may be an important guidepost in the design of future research.

Thirdly, this review re-iterates recommendations made previously in the study of executive functions and pretend play by shifting the focus of inquiry from *whether or not* pretend play is related to executive functioning to *how* pretend play is related to executive functioning (and vice versa) in early childhood (e.g., Berk & Meyers, 2013; Thibodeau-Nielsen et al., 2020; White et al., 2021). To this end, the current review proposes a bi-directional model of pretend play and executive functions (see Fig. 7) and explores several potentially moderating variables to further contextualise their relation. Specifically, this study proposes extending the current evidence base into earlier periods of development (i.e., toddlerhood). Moreover, it recommends an exploration on the role of play partners, including parents, in the relation of pretend play and executive functions. Aspects, such as parenting behaviours in play (e.g., autonomy-supportive behaviours; Distefano & Meuwissen, 2022), which have shown to benefit children's development of executive functions, could be further explored within the relation of pretend play and executive functions. Lastly, it recommends more experimental or longitudinal studies to further explore the interplay of pretend play and executive functioning in early childhood. Similar studies (e.g., Thibodeau-Nielsen & Gilpin, 2020; Thibodeau-Nielsen et al., 2020) have been conducted previously with older children and could guide additional explorations in toddlers and preschool children.

Conclusion

The current study provides an initial quantitative assessment of the relation between pretend play and executive functions, as well as an aggregate definition and compilation of measures of pretend play, that may inform future research. This study finds that pretend play is linked to executive functions in early childhood, indicating that children's pretend play can provide a fertile context for the development of executive functioning. Furthermore, this study adds to the current evidence base of the correlates of pretend play in development to include executive functions, which previously has only been examined *meta*-analytically in relation to children's language and social development (Quinn et al., 2018; Smits-van der Nat et al., 2024). Moreover, this review finds that studies using executive functions questionnaires yielded significantly higher correlations than studies using performance-based measures of executive functions. Other moderation analyses did not identify significant moderators of the overall relationship between executive

functions and pretend play. Further research on potentially moderating factors, research with younger children (i.e., toddlerhood), and research in more diverse settings are called for.

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This study was registered with the Open Science Framework (OSF; osf.io/v28fp). Research material are publicly accessible on its OSF project page (osf.io/tup39). The data from Kelly et al. (2025), included in this review, is from a yet to be published study from our lab. Sensitivity analyses with this study removed are reported in the supplementary materials. No other conflicts of interest are to be disclosed.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dr.2026.101249.

Data availability

All data and material presented in this article are publicly available on this study's OSF project page (osf.io/tup39).

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