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ARTICLE

Exploring the Influence of Socioeconomic Status on Pragmatic Language: Do Executive Function and Grammar Comprehension Have a Mediating Role?

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Abstract

This study explores the relationships among socioeconomic status (SES), executive function (EF), grammar comprehension (GC), and pragmatic language (PL) in children aged 8–11. By employing a structural equation modelling approach, we aimed to investigate the direct and indirect effects of these variables on PL, a crucial aspect of child development involved in the formation of social relationships and general well-being. Our final sample consisted of 128 children from a heterogeneous socioeconomic context. Participants were assessed using the APL Medea, TROG-2, and TeleFE tests to measure their PL, GC, and EF, respectively. The findings reveal that GC and EF are important predictors of PL, with GC playing an important role in mediating the effects of SES. In conclusion, this study highlights the key role of GC in connecting SES and PL, with strong practical implications for the interventions aimed at mitigating the adverse effects of socioeconomic factors.

Keywords: socioeconomic status; executive function; pragmatic language; grammar comprehension

Resumen

Il presente studio esplora le relazioni tra status socioeconomico (SES), funzioni esecutive (FE), comprensione grammaticale (CG) e pragmatica del linguaggio (PL) in bambini di età compresa tra 8 e 11 anni. Utilizzando un approccio modelli di equazioni strutturali, abbiamo indagato gli effetti diretti e indiretti di queste variabili sulla pragmatica del linguaggio, una componente cruciale in età dello sviluppo coinvolta nella formazione delle relazioni sociali e nel benessere generale. Il campione finale era composto da 128 bambini provenienti da un contesto socioeconomico eterogeneo. I partecipanti sono stati valutati con l'APL Medea, il TROG-2 e TeleFE per misurare rispettivamente la componente pragmatica del linguaggio, la comprensione grammaticale e le funzioni esecutive. I risultati evidenziano che la CG ed le FE sono predittori significativi della pragmatica del linguaggio, e che la comprensione grammaticale svolge un ruolo importante nella mediazione

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degli effetti del SES. In conclusione, lo studio sottolinea il ruolo centrale della comprensione grammaticale nel collegare lo status socioeconomico al linguaggio pragmatico, con importanti implicazioni pratiche per interventi mirati a mitigare gli effetti negativi dei fattori socioeconomici.

Parole chiave: status socioeconomico; funzioni esecutive; pragmatica del linguaggio; comprensione grammaticale

1. Introduction

The present study aims to examine the intricate relationships among socioeconomic status (SES), executive function (EF), grammar comprehension (GC), and pragmatic language (PL) in school-aged children. PL, which involves the use and understanding of language within context, is essential for effective communication and overall well-being. Prior research highlights that both EF and GC are foundational for PL, with SES shown to influence cognitive and core language skills, such as GC (e.g., Lawson et al., 2018; Matthews et al., 2018; Pace et al., 2017; Wilson & Bishop, 2021). However, the direct impact of SES on PL remains less explored, with recent studies suggesting a minimal or absent influence (Bosco & Gabbatore, 2017; Qasem et al., 2022; Schulze & Saalbach, 2022). We hypothesise that while SES may not directly affect PL, it significantly shapes both GC and EF, which, in turn, mediate PL performance. By exploring these connections, this study aims to enhance our understanding of how these factors interact, offering insights for targeted interventions that support children's PL abilities, which, in turn, can enhance their social skills and overall well-being. These findings are significant, emphasising the need to address SES-related disparities to promote children's development across various domains. We decided to focus on this age range since EF skills, particularly flexibility, are more developed at this age, providing a stable basis for assessing their impact on PL (Ferguson et al., 2021). Furthermore, focusing on this age group helps minimise potential biases in interpreting the results, as children in this range generally possess adequate basic language skills (e.g., Cadime et al., 2019).

1.1. Definition of pragmatic language

PL refers to the use of language within the context of communication (Ariel, 2010). This comprehensive definition encompasses a variety of skills and capacities, including the ability to sustain a conversation, provide pertinent responses, adhere to politeness norms, comprehend implied meanings, and understand non-literal language such as jokes, sarcasm, and irony (Matthews et al., 2018). Early milestones of PL development include recognising others' intentions and engaging in joint attention by 9–18 months, which supports foundational social interaction skills (Alduais et al., 2022). As children grow, they develop abilities to adjust language based on listener needs and context, such as making polite requests or understanding conversational cues by age 4 (Longobardi et al., 2017). Pragmatic competence continues to develop and refine through childhood and adolescence, with children progressively refining their pragmatic abilities as they engage with diverse social settings and conversational partners (O'Neill, 2007). Vocabulary and grammar play essential roles in supporting children's development of PL. As children's vocabulary and grammar skills grow, they become better able to adjust their language in different social settings and understand others' perspectives, both of which are crucial for

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effective communication (Alduais et al., 2022; Longobardi et al., 2017; Matthews et al., 2018). While PL and core language skills (grammar and vocabulary) are closely related, it is important to note that they alone are not enough for a comprehensive understanding of language (Matthews et al., 2018; Wilson & Bishop, 2021). In addition to decoding processes, encompassing vocabulary and grammatical skills, language comprehension is also dependent on pragmatic processing, which involves forming a nuanced understanding of the speaker's intended communication within the given context (Ariel, 2010).

PL plays a crucial role in child development, given its significance in the development of social relationships, adaptation to various contexts, and overall well-being (Camia et al., 2021). Studies on children with autism spectrum disorder (ASD) and children with traumatic brain injuries (TBIs) support these findings. Indeed, impairments in PL have been found to be associated with deficits in social skills in children with ASD and in children with TBIs (Eigsti et al., 2011; Hendrix et al., 2020). Moreover, PL ability has been identified as a mediator in the relationship between hyperactivity/inattention problems and social skills problems (Leonard et al., 2011). In a longitudinal study involving children diagnosed with developmental language disorder, it was found that those children displaying a persistent pattern of high levels of emotional and peer problems from childhood to adolescence had significantly lower PL scores at age 11 (Conti-Ramsden et al., 2019). Furthermore, regardless of diagnosis, a study by Pierpont et al. (2018) revealed that better PL predicts stronger social skills. Hence, it can be concluded that proficiency in PL is essential for an individual's social functioning and, consequently, their well-being.

1.2. Relationship between pragmatic language and executive function

EF constitutes a set of neurocognitive abilities that facilitate the conscious, top-down control of attention over thoughts, actions, and emotions (Friedman & Miyake, 2017; Zelazo & Carlson, 2020). There is a widely accepted consensus indicating three core EF abilities, as foundational to behavioural, cognitive, and emotional self-regulation skills: inhibition (inhibitory control and suppression of interference), (updating of) working memory, and cognitive flexibility (Diamond, 2013; Gandolfi et al., 2014; Gärtner & Strobel, 2021; Miyake et al., 2000). Working memory and inhibition show early signs of development in infancy, undergo substantial growth between ages 3 and 5, and continue developing until 18–20 years, while cognitive flexibility emerges between ages 3 and 4, refines around 7–9 years, and reaches adult-like levels by 12–15 years (Ferguson et al., 2021). EF development has been broadly studied in relation to language development. There is no consensus on whether EF influences language development or the reverse, though research suggests that EF and language skills are distinct yet correlated domains (Gooch et al., 2016; Slot & von Suchodoletz, 2018). For example, Romeo et al. (2022) found that the reciprocal influence between language and EF was balanced at ages 4–5, with no direction being significantly stronger than the other. Less is known about the developmental trajectories of PL and EF. Currie and Muijselaar (2019) examined the longitudinal connections among inference-making, vocabulary and verbal working memory in typically developing children aged 4–9 and found that vocabulary, rather than verbal working memory, supports the development of inference-making. It is worth noting that they did not consider other components of EF, and further research is needed to understand the relationship between EF and PL. When considering the concurrent relationship between the pragmatic component of language and EF, a directional pattern

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from EF to PL seems to emerge in both typically developing children and those with developmental disorders (Filipe et al., 2020; Nilsen et al., 2021; Ouerchefani et al., 2024; Razavi et al., 2019). Specifically, the influence of EF on PL could be understood in terms of its role in facilitating effective communicative exchanges. This involves inhibiting one's speech to sustain alternating turns in a conversation, pre-planning verbal expressions, organising information to construct coherent narratives, demonstrating flexibility in arguments, and continuously managing and updating a large amount of information encompassing both linguistic and contextual elements (Matthews et al., 2018). Research involving patients with prefrontal cortex damage suggests that deficits in EF are predictors of the impaired ability of patients to comprehend non-literal meanings (Ouerchefani et al., 2024). A relationship between EF and PL also emerges from studies with ASD children. Razavi et al. (2019) identified a significant negative correlation between EF and PL, implying that better executive functioning performance is associated with fewer difficulties in the appropriate use of language in social situations. Similar findings were reported by Filipe et al. (2020) in a study involving children with ASD without cognitive disability and a typical development control group. The results revealed that EF mediates the relationship between group and PL. Furthermore, the poor PL skills observed in ASD children were associated with their difficulties in the EF. Consistent with these results, Nilsen et al. (2021) found that EF moderates the associations between shyness and PL.

1.3. The role of socioeconomic status in executive function and language development

It is widely acknowledged in the literature that SES significantly influences a variety of neurocognitive domains, including language, memory, EF, and social–emotional processing (Lawson et al., 2018; Pace et al., 2017; Ursache & Noble, 2016). The impact of SES on neurocognitive development is multifaceted, encompassing factors such as the diversity and complexity of vocabulary and grammar provided by caregivers, as well as the availability of learning materials such as books, where low-SES children often face restricted access to language and cognitive stimulation resources (Pace et al., 2017; Ursache & Noble, 2016).

Specifically, children from lower SES families tend to perform worse on different EF tasks, including working memory, inhibitory control, and attention shifting (Farah et al., 2006; Noble et al., 2007; Sarsour et al., 2011). Moreover, lower SES has been found to be associated with worse performance on many types of language skills, including vocabulary, phonological awareness, single-word decoding, reading comprehension, and grammar (for review and meta-analyses, see Letourneau et al., 2013; Pace et al., 2017). Studies focusing on the influence of SES on EF and language suggest that linguistic input in the home environment and family stress may be important mediators of the effects of socioeconomic disadvantage on the brain regions responsible for language and EF, respectively (Merz et al., 2019). Romeo et al. (2022) found that language mediated the association between SES and EF skills at age 3, and this model outperformed the reverse-direction mediation. However, they did not analyse mediation at later ages, leaving open the possibility that the influence of SES may differ as children develop, with EF mediating the effect of SES on language abilities. This highlights the importance of exploring various pathways in understanding the relationship among SES, EF, and language at different developmental stages.

Regarding the specific effects of SES on PL, studies are still limited, and the results are mixed. Bosco et al. (2013) found that SES has a moderate effect on children's pragmatic

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competence with higher SES children scoring higher on pragmatic tasks; however, more recent studies (Bosco & Gabbatore, 2017; Qasem et al., 2022; Schulze & Saalbach, 2022) have identified only a partial or even no influence of SES on PL.

Frequently, families of lower SES are migrant families who speak a minority language at home (Bellocchi & Bonifacci, 2023). Although many studies not accounting for SES have found an effect of exposure to multiple languages on PL abilities (van Wonderen et al., 2023), the observed advantages or disadvantages in pragmatic skills may not be due entirely to the exposure to multiple languages itself. Instead, they may reflect the influence of SES factors (Bellocchi & Bonifacci, 2023). To examine the distinct effects of SES and multilingual background (MB) – including aspects of bilingualism or multilingualism – on PL, it is essential to gather information, such as proficiency levels, the type and extent of language exposure, and the age of acquisition. Furthermore, a sample in which bilingualism and multilingualism span the full range of the socioeconomic spectrum is crucial. In this study, we focus on investigating the effects of SES on PL within a heterogeneous socioeconomic sample, where children facing greater socioeconomic challenges often come from MBs.

1.4. Aim of the study and hypotheses

The aim of the present study is to investigate the direct and indirect effects of SES, GC, and EF on PL. We hypothesise (H1) that GC and EF directly influence PL. Our hypothesis is supported by evidence that core language skills, such as grammar, are essential for PL (Ariel, 2010; Matthews et al., 2018; Wilson & Bishop, 2021) and by studies highlighting the critical role of EF in supporting PL (Filipe et al., 2020; Nilsen et al., 2021; Ouerchefani et al., 2024; Razavi et al., 2019). We chose to include GC in our study, as our focus is on pragmatic comprehension and knowledge rather than pragmatic production. Our second hypothesis (H2) is that SES influences both GC and EF, as shown in research on SES effects on cognitive and linguistic skills (Farah et al., 2006; Merz et al., 2019; Noble et al., 2007; Pace et al., 2017). We also hypothesise that SES does not directly influence PL (H3). This is in line with recent studies suggesting minimal or no direct effect of SES on PL (Bosco & Gabbatore, 2017; Qasem et al., 2022; Schulze & Saalbach, 2022). Lastly, we aim to explore whether EF and GC mediate the relationship between SES and PL. Although research in this area is limited, we hypothesise (H4) that both GC and EF mediate the influence of SES on PL, given their hypothesised effect on PL (H1) and the effect of SES on both GC and EF (H2).

2. Method

2.1. Participants

The initial sample consisted of 150 children. Eighteen children were excluded as they had a confirmed diagnosis of a neurodevelopmental disorder, or they were under evaluation for such a diagnosis. Four children were excluded because they did not possess sufficient proficiency in the Italian language. The final sample comprised 128 children aged 8–11 (69 females, M_{age} = 9;7, DS = 0;6). All children were recruited from a school situated in a district of a Northern Italian town characterised by a significant immigrant population and a heterogeneous SES. In our sample, 60 children had an MB and represented the most socioeconomically disadvantaged group, reflecting the characteristics of the area where the data were collected.

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2.2. Materials

APL Medea. APL Medea is an assessment battery for PL skills standardised in Italy for children aged between 5 and 14 years. In this research, the "Metaphors" test, categorised into "Verbal Metaphors" and "Figurative Metaphors," along with the "Understanding of the Implicit Meaning" test, which evaluates the ability to infer non-explicit content, were administered. The Cronbach's alpha index reported in the manual is .92, indicating excellent reliability.

Verbal Metaphors. The "Verbal Metaphors" subtest consists of four items. Each item is a metaphorical expression, for example, *Marco oggi si sente un leone* ("Marco feels like a lion today"). The child is asked to interpret the meaning of each sentence. Items are scored based on the child's comprehension: 0 if the meaning is completely unclear, 1 if partially understood, and 2 if fully grasped. The maximum achievable score on the subtest is 8. Scores were assigned following the manual's guidelines.

Figurative Metaphors. The "Figurative Metaphors" subtest comprises four items. Each item presents a metaphorical expression, which the experimenter reads aloud to the child. The child is then prompted to select the corresponding image from four alternatives. A score of 2 is awarded for a correct answer, while a score of 0 is assigned for an incorrect response, as only one answer is deemed correct. The maximum achievable total score is 8.

Understanding of the Implicit Meaning. The subtest "Understanding of the Implicit Meaning" comprises three short stories with implicit meanings, presented orally by the experimenter. To mitigate the effects of working memory, the stories were also included in the child's response protocol. Each story is followed by a set of questions: five for the first and second stories, and four for the third. Responses are scored on a scale of 0 for entirely incorrect, .5 for partially correct, and 1 for fully correct answers. The maximum achievable score for this subtest is 14, with scores assigned according to the manual's instructions.

TROG-2. The Test for Reception of Grammar – Version 2 (TROG-2; Bishop, 2009) assesses GC skills and was standardised in Italy for children aged 4–16 years old. It consists of 80 multiple-choice items, each providing four choices. The vocabulary used is simple, focusing on nouns, verbs, and adjectives. Comprehension is assessed through multiple-choice questions, where the participant selects the figure corresponding to the target proposition among three alternatives. Each grammatical contrast comprises a set of four items, and the set is considered successfully completed if all four items are answered correctly. The total score is calculated based on the number of complete sets answered correctly; hence, the maximum achievable score is 20. The Cronbach's alpha index reported in the manual for the English version is .88, indicating good reliability of the test. However, there is no information provided in the manual regarding the reliability of the Italian sample.

TeleFE. TeleFE (Rivella et al., 2023) is a tele-assessment tool designed for evaluating EF in children aged 6–13. It consists of a web platform with tasks that assess inhibition, interference suppression, (updating of) working memory, cognitive flexibility, interference control, and planning (Rivella et al., 2023). In this study, only inhibition, interference suppression, working memory, cognitive flexibility, and interference control were assessed using the Go/No-Go, Flanker, and *N*-Back subtests.

Go/No-Go. In this task, children view a sequence of geometric figures, such as yellow or blue triangles and circles, displayed on the screen. They are instructed to respond to the target stimulus by pushing the spacebar while refraining from responding to non-target stimuli. The total score for inhibition is calculated based on the total accuracy in "no-go"

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trials. The Cronbach's alpha reported by the authors is 0.68 for the No-Go correct responses (Rivella et al., 2023).

Flanker. The Flanker task assesses interference control, which is the ability to ignore irrelevant information; and cognitive flexibility, involving switching between two rules based on stimulus characteristics. The task comprises three blocks. In the first block (blue arrows), participants are required to identify the direction of the arrow in the centre. In the second block (orange arrows), they must identify the direction of the external arrows in a similar manner as in the previous block. In the third block, referred to as the "mixed rules" block, participants encounter a variation: if the arrows are blue, they must apply the rule from the first block, whereas if the arrows are orange, they need to switch to the rule used in the second block. Each block comprises trials where all arrows either point right or left (congruent condition) in 50% of the trials. In the remaining 50%, the centre arrow points in the opposite direction to the surrounding arrows (incongruent condition). The total score for cognitive flexibility is determined by the accuracy of responses in the incongruent condition of the "mixed rule" block. For interference control, the total score is based on the accuracy of responses to the incongruent conditions in both the blue and orange flanker blocks. The Cronbach's alphas reported are .92 and .93 for the congruent and incongruent trials of the single-rule flanker task, respectively, and .91 and .86 for congruent and incongruent trials of the mixed rules flanker task, respectively (Rivella et al., 2023).

N-Back. The *N*-Back task comprises two conditions (colours and shapes), each with two blocks (1-Back and 2-Back), resulting in a total of four blocks. In the 1-Back condition, children are presented with a series of stimuli at the centre of the screen. When a presented stimulus matches the one immediately preceding it, they are required to press the spacebar. In the 2-Back condition, they must press the spacebar if the stimulus matches the one presented two steps earlier. The total score for the 1-Back is calculated based on accuracy in identifying target 1-Back colours and shapes. Similarly, the total score for the 2-Back working memory is determined by the accuracy in identifying 2-Back colour targets and shape targets. The Cronbach's alphas reported by Rivella et al. (2023) are .91 for the 1-Back task and .75 for the 2-Back task.

Socioeconomic status. Parents' occupation. The parents' occupation was classified according to the International Standard Classification of Occupations (ISCO-08) developed by Ganzeboom (2010), which encompasses 10 occupational categories ranging from high-ranking roles to basic occupations. These categories were presented to parents in the informed consent form, where they were asked to indicate their profession by marking an "x" in the respective category.

Parents' education. The parents' educational qualifications were classified according to the International Standard Classification of Education (ISCED-11), developed by the OECD, Eurostat, and UNESCO Institute for Statistics (2015). This classification includes nine levels, encompassing education from pre-school to PhD or post-graduate specialisation school. Parents were presented with these categories in the informed consent form and were asked to indicate their qualifications by marking an "x" in the corresponding category.

Multilingual background. Information on MB was collected by asking teachers to indicate which children were exposed to a language other than Italian at home, as teachers are closely connected with the families. We acknowledge that we did not collect detailed information on the specific languages spoken at home or children's proficiency in their home language.

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2.3. Procedure

The experimental protocol was approved by the Ethics Committee of the University of Genoa. The first author arranged meetings with parents in the school setting to introduce the study, and interested families provided informed consent.

Data from the children were gathered through both group and individual assessment sessions. Each class underwent two group assessment sessions, with each lasting about 45 minutes. During these sessions, the class was split into two groups based on alphabetical order, ensuring a maximum of 10 children in each group. In each session, half the class was assessed on the subtests of the TeleFE battery in the school's computer room under the supervision of a 1–3 supervisor-to-student ratio. All computers in the computer room were equipped with identical processors and operating systems, and each was connected to the Internet via an Ethernet cable. Simultaneously, the other half of the class was evaluated in the classroom using the subtests "Verbal Metaphors," "Figurative Metaphors," and "Understanding the Implicit Meaning" of the APL Medea (Lorusso, 2009) test. The subtests of the APL Medea (Lorusso, 2009) battery were adapted for group assessment, with each child receiving a protocol for recording their responses to the stimuli. They wrote down their responses, which we then coded according to the guidelines provided in the manual. The "Figurative Metaphors" stimuli were displayed using a projector, while the stimuli for the "Verbal Metaphors" and "Understanding the Implicit Meaning" subtests were read aloud by the experimenters.

The sequence of test administration was alternated across classes to maintain balance, with the first half of the class starting with the TeleFE battery in one class and with the APL Medea (Lorusso, 2009) in another class. The sessions were arranged into groups in alignment with the school's needs. Additionally, in a distinct individual session of approximately 25 minutes, the GC of the children was evaluated employing the TROG-2 (Bishop, 2009) test. The assessment sessions were conducted by master's students in psychology, with support from bachelor's students. Verbal assent was requested from the children before an assessment session commenced.

2.4. Data analyses

Data analyses were conducted using the R 4.3.2 version for macOS (R Core Team, 2024). To obtain the socioeconomic index, a principal component analysis (PCA) was carried out using the "princals" function from the "Gifi" (Mair & De Leeuw, 2022) R package, which is specifically designed to handle ordinal data.

For the MB, a score of 1 was assigned based on teacher reports, indicating that a child was exposed to a second language at home, whereas a score of 0 was given if teachers reported that the child was not exposed to a second language at home. The total score from the TROG-2 (Bishop, 2009), along with the scores from the TeleFE and APL Medea (Lorusso, 2009) subtests, were transformed into z-scores. The z-scores from the TeleFE and APL Medea (Lorusso, 2009) subtests were then averaged to derive an overall EF score and an overall PL score, respectively. To mitigate the impact of age, residuals were calculated for the overall EF score, the overall PL score, and the GC through linear regressions.

The association among SES, MB, EF, GC, and PL was explored using a correlation matrix with Pearson's method using the function "corr.test" of the package "psych" (Revelle, 2023). To grasp the underlying structure of relationships among our variables, we employed structural equation modelling (SEM) techniques. SEM integrates path analysis and factor analysis, enabling the estimation of both direct and indirect effects

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among variables. Specifically, we used the "sem" function from the R package "lavaan" (Rosseel, 2012), with clustering by class to account for nested data. As indicators of the model's goodness of fit, we reported the normed chi-squared (χ^2/df), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the standardised root mean square residual. A low chi-squared value indicates a good fit, although it should be considered in relation to the degrees of freedom and sample size. Values above .95 for the CFI and for the TLI typically indicate a good fit to the data, while values below .08 for the SRMR are generally indicative of a good fit (Kline, 2015). We subsequently bootstrapped each model with 5,000 repetitions. To further examine the structure of EF scores and ensure the robustness of our modelling approach, an exploratory factor analysis (EFA) was conducted, revealing a two-factor structure aligned with the theoretical literature (Lee et al., 2013). Despite this multidimensional structure, the model using the overall EF score demonstrated superior fit indices, including the lowest Akaike information criterion and Bayesian information criterion values. These findings suggest that the overall EF score provides the most parsimonious and explanatory representation of the data, consolidating shared variance across EF tasks into a single, interpretable metric. Details of the EFA and structural equation models incorporating the factor-derived scores are provided in the Supplementary Material.

3. Results

3.1. Preliminary analyses

Descriptive statistics of the raw scores obtained from the tests are presented in Table 1.

From the PCA, two factors emerged; however, only the first factor exhibited an eigenvalue greater than 1 (Kaiser, 1991), prompting us to consider solely this factor, which accounted for 68.35% of the variance. The loadings on this factor were .82 for the mother's occupation, .82 for the mother's instruction, .84 for the father's occupation, and .83 for the father's instruction. The variable obtained through the PCA was then

Table 1. Descriptive statistics of the raw scores

	M	SD	Skewness	Kurtosis
1-Back	28.35	4.99	−2.29	5.11
2-Back	20.30	6.12	.14	−.87
Flexibility	20.59	5.95	−.68	.17
Interference control	30.62	9.58	−1.34	1.01
Inhibition	43.16	7.67	−.93	1.77
Verbal Metaphors	3.76	1.59	−.20	−.12
Figurative Metaphors	3.69	2.31	−.09	−1.07
Implicit Meaning	8.67	2.51	−.41	−.71
TROG–2	14.06	3.28	−.45	−.58
SES	.07	2.75	.69	.46

Note: N = 128. *M* = mean; SES = Socio-Economic Status index; SD = standard deviation. (a) 1-Back, (b) 2-Back, (c) Flexibility, (d) Interference Control, and (e) Inhibition = subtests of the TeleFE (Rivella et al., 2023) battery. (a) Verbal Metaphors, (b) Figurative Metaphors, (c) Implicit Meaning = subtests of the APL Medea battery (Lorusso, 2009).

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employed as a SES index in further analyses. Correlations between variables are presented in Table 2. PL is significantly correlated with all the examined variables.

3.2. Structural equation modelling

The results detailing both the direct and indirect effects of the SEM are presented in Table 3.

Table 2. Correlation matrix among the PL, EF, GC, MB and Socio-Economic Status index

Variable	1	2	3	4	5
1. PL	–				
2. EF	.42***	–			
3. GC	.55***	.48***	–		
4. MB	−.28**	−.11	−.22*	–	
5. SES	.27**	.18.	.21*	−.50***	–

Note: N = 128. EF = executive function; GC = grammar comprehension; MB = multilingual background; PL = pragmatic language; SES = Socio-Economic Status index.
*$p < .05$.
**$p < .01$.
***$p < .001$.

Table 3. Direct and indirect effects of the structural equation model

							Estimates[a]	95% CIs	
Paths								LL	UL
GC	on	PL					.37***	.21	.53
EF	on	PL					.17*	.01	.32
SES	on	PL					.14	−.01	.29
SES	on	GC					.21**	.06	.36
SES	on	EF					.18*	.01	.34
SES	with	MB					−.50***	−.62	−.38
EF	with	GC					.46***	.33	.58
EF	with	GC	on	PL			.17**	.08	.26
SES	on	PL	through	GC			.08*	.01	.14
SES	on	PL	through	EF			.03	−.01	.07
SES	on	PL	through	EF	with	GC	.03	−.00	.06

Note: N = 128. CIs = confidence intervals; EF = executive function; GC = grammar comprehension; LL = lower limit; MB = multilingual background; PL = pragmatic language; SES = Socio-Economic Status index. on = direct effect; through = indirect effect; with = correlation; UL = upper limit.
[a]Standardised estimates.
*$p < .05$,
**$p < .01$,
***$p < .001$.

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The goodness-of-fit indices for the model indicate a satisfactory fit: χ^2/df = 1.85, CFI = .98, TLI = .92, and SRMR = .04. The direct effects of GC and EF on PL are statistically significant, whereas the direct effect of SES does not reach statistical significance. SES has a significant indirect effect on PL through the mediating role of GC, while its indirect effect through EF does not reach statistical significance.

Additionally, the indirect effect of SES on PL, through the combined effect of EF and GC, is not statistically significant. The decision to correlate SES and MB is theoretical and does not influence the statistical model. We chose to correlate these two variables because they are closely related. The interrelationships among the variables are illustrated in Figure 1.

4. Discussion

PL is essential for successful social interactions and effective communication. While some research has examined the relationship between SES and PL, the body of evidence remains limited, and findings are inconsistent. Some studies indicate that SES significantly influences pragmatic abilities, while others report minimal or no effects. These mixed results emphasise the need for further investigation to better understand how SES impacts PL development. Additionally, it is crucial to examine whether this relationship operates directly or is mediated by factors such as EFs and GC. A deeper understanding of

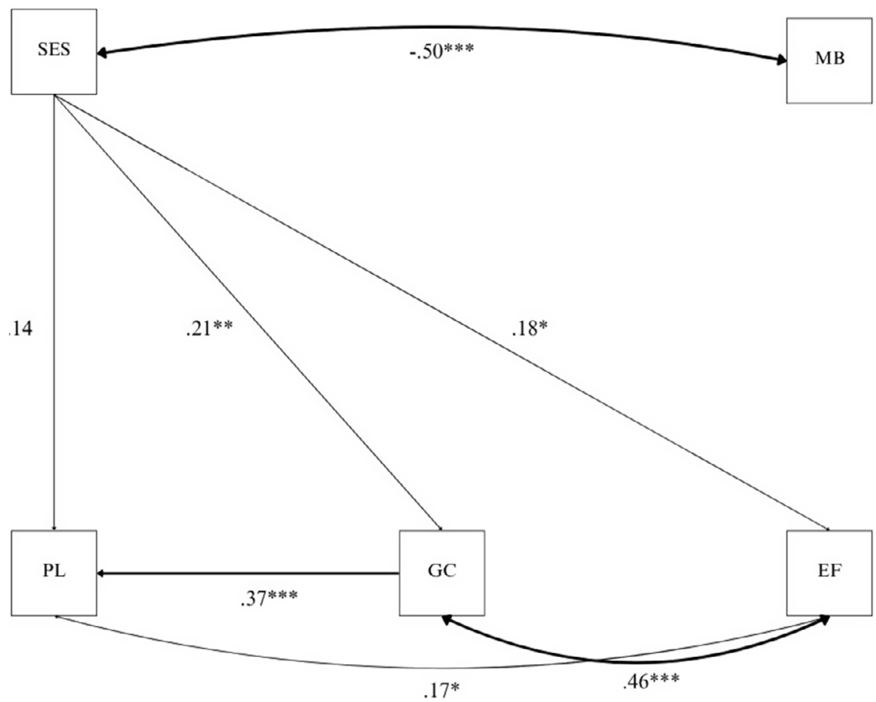

Figure 1. Interrelationships among variables derived from the path analyses.
Note: N = 128. EF = executive function; GC = grammar comprehension; MB = multilingual background; PL = pragmatic language; SES = Socio-Economic Status index. Standardised estimates are presented in the figure. *p < .05, **p < .01, ***p < .001.

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these connections can help address disparities and foster improved outcomes for children from diverse socioeconomic backgrounds. Therefore, the aim of the present study was to investigate the relationships among SES, EF, GC, and PL.

Our findings reveal a complex interplay where EF and GC directly influence PL (H1), while they are both under the direct influence of SES (H2). Moreover, we found that SES does not directly influence PL (H3), but GC mediates this relationship (H4). Our fourth hypothesis was only partially supported, as only GC mediated the relationship between SES and PL, while the mediating effect of EF, as well as the combined mediating effect of both GC and EF, did not reach statistical significance. The observation that EF has a direct influence on PL is supported by studies demonstrating that children with higher scores on EF tasks face fewer challenges in using language appropriately in social contexts (Filipe et al., 2020; Nilsen et al., 2021; Ouerchefani et al., 2024; Razavi et al., 2019), while the direct effect of GC on PL emphasises the importance of core language skills in the development of PL (Wilson & Bishop, 2021). Our finding that SES influences both EF and GC is consistent with research suggesting that SES significantly influences cognitive and core language skills (Farah et al., 2006; Letourneau et al., 2013; Noble et al., 2007; Pace et al., 2017). While higher SES provides access to rich linguistic inputs and cognitive stimuli, fostering development in these areas, lower SES is often associated with increased stress and reduced access to resources, hindering EF and GC development. This finding highlights the importance of creating an enriched environment in schools to mitigate socioeconomic disparities. Such environments can provide critical support in developing both EF and GC, which are essential for enhancing PL skills and, by extension, improving social outcomes for all students.

Our results did not show a direct effect of SES on PL, aligning with recent studies suggesting minimal or no direct influence (Bosco & Gabbatore, 2017; Schulze & Saalbach, 2022). The novelty of our study lies in being, to the best of our knowledge, the first to analyse the mediation effects of EF and GC in the relationship between SES and PL. Building on these insights, our findings extend the discussion by illustrating that GC mediates the relationship between SES and PL. The finding that GC, but not EF, mediates the relationship between SES and PL suggests that direct language skills, which are influenced by the language exposure associated with socioeconomic background, are more closely tied to PL and, consequently, to social communication than broader cognitive skills. We acknowledge that children in our sample who face greater socio-economic challenges are often exposed to a language other than Italian at home. Their GC could be influenced not only by their socioeconomic conditions – such as their parents' education and occupation – but also by the fact that at least one parent does not speak Italian as a native language. Consequently, the Italian linguistic experience provided at home may be less linguistically stimulating. This novel insight highlights the complexity of the mechanisms through which SES influences PL and underscores the necessity of adopting a multifaceted approach in intervention strategies. Specifically, while enhancing both EF and GC could be beneficial, our findings particularly underscore the importance of strengthening GC as a more direct method to improve PL skills. This targeted approach could lead to improved social integration and more effective communication for children from varied socioeconomic backgrounds.

Although this study provides important insights, it is essential to acknowledge some limitations. A key limitation is the cross-sectional design, which prevents making causal claims from the mediation analyses. This should be considered when interpreting the results, and future longitudinal studies are needed to better understand the relationships among PL, EF, GC, and SES. Moreover, all data were collected from a single school, which

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may influence the results. Another limitation is the inability to separate the influences of SES from those related to MBs, including aspects of bilingualism and multilingualism. Research by Bellocchi and Bonifacci (2023), which aimed to separately investigate the effects of SES and bilingualism on language skills, uncovered divergent impacts. They found that bilingual children performed worse than monolinguals on verbal knowledge and morphosyntactic comprehension, while children with lower SES scored worse on verbal knowledge, morphosyntactic comprehension, and phonological short-term memory. Although they did not analyse the effects of SES and bilingualism on PL, it is possible that SES and exposure to multiple languages could also influence PL through distinct patterns. In our sample, a significant proportion of children were identified as having an MB, meaning that at least one parent spoke a language other than Italian at home. However, we lacked essential information on factors such as the type and extent of language exposure, proficiency levels, and the specific languages spoken at home. Future studies should aim to address these gaps by gathering more detailed information on bilingualism or multilingualism and focusing on a broader range of socioeconomic contexts. Moreover, future studies should investigate the impact of SES and exposure to multiple languages on various aspects of PL abilities.

Another limit of the present study is the use of group sessions for the TeleFE (Rivella et al., 2023) and APL Medea (Lorusso, 2009) assessments, contrasted with individual sessions for the TROG-2 (Bishop, 2009), which introduces variability that may affect the results. Finally, the Theory of Mind, which appears to play a role in the relationship between EF and PL, was not investigated in this study (Cardillo et al., 2021). Additionally, supplementary analyses revealed slight variations in the direct and indirect effects across models using the factor scores computed from the EFA, and the overall EF score. Notably, the model with the overall EF score demonstrated superior fit indices, supporting its use as a parsimonious and cohesive representation of shared EF variance. This reinforces the relevance of a global EF measure in understanding the interplay among SES, EFs, and PL, while still acknowledging the unique insights offered by examining individual EF components.

In conclusion, this study contributes to a deeper understanding of the factors influencing PL abilities in children. These insights have important implications for educational practices and policy, suggesting that targeted interventions aimed at improving GC and EF, along with educational strategies that emphasise enriched language exposure, hold promise for promoting equitable learning outcomes and enhancing social integration across diverse student populations.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/S0305000925000236.

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