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# The Relationship between Learning Potential in Preschool Children and their Cognitive Abilities

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A B S T R A C T

Learning potential can be used to assess and provide direction for action in diverse populations in modern educational settings. This study examined the relationship between the EHPAP dynamic evaluation scale and cognitive abilities (linguistic development, specific cognitive abilities, and executive functioning) in typically developing preschool children. Linear regression models indicated that children's cognitive abilities formed part of the prediction of their independent performance in tasks before and after mediation. The abilities that formed part of the predictions were related to general linguistic development, specific cognitive functions, and executive functioning. Age as a predictive factor only contributed to verbal planning. This study examined the contribution of these variables in different EHPAP scales.

## La relación entre el potencial de aprendizaje en niños de preescolar y sus habilidades cognitivas

R E S U M E N

El potencial de aprendizaje se puede utilizar para evaluar y orientar la acción en diversas poblaciones en entornos educativos modernos. Este estudio analiza la relación entre la escala de evaluación dinámica EHPAP y las habilidades cognitivas (desarrollo lingüístico, habilidades cognitivas específicas y funcionamiento ejecutivo) en niños en edad preescolar con un desarrollo típico. Los modelos de regresión lineal indican que las habilidades cognitivas de los niños forman parte de la predicción de su desempeño independiente en tareas antes y después de la mediación. Las habilidades que formaban parte de las predicciones estaban relacionadas con el desarrollo lingüístico general, las funciones cognitivas específicas y el funcionamiento ejecutivo. La edad como factor predictivo solo contribuye a la planificación verbal. Este estudio analiza la contribución de estas variables en diferentes escalas EHPAP.

Dynamic assessment (DA) has indicated the influence of learning experiences on the performance of cognitive tasks. Conceptually, dynamic assessment originated in the work by Vygotsky (1978). The sociocultural approach suggests that higher cognitive functions may be incentivized through social interaction with an expert working in the Zone of Proximal Development (ZPD). This zone represents a child's potential functioning (as opposed to the level of performance they might reach independently); supported performance may later become autonomous. This approach highlights the contribution of interactions with experts in people's learning processes.

This interaction should be active so that the learner modifies their cognitive functioning and extracts principles that subsequently encourage better, independent performance in similar situations. This highlights the function of another important concept in DA, which is the Mediated Learning Experience (MLE) (Feuerstein et al., 1986). The changes seen in learners—individual cognitive functioning and actions aimed at learning in the situation being evaluated—are defined as the capacity of modifiability, which is indicative of future success (Lukovic´ et al., 2022). Bringing together the concepts of ZPD and MLE, Daneshfar and Moharami (2018) defined dynamic assessment as the creation of a zone of proximal development in which the mediator (expert) mediates cognitive processes to encourage a more advanced level of mental functioning in the learner.

There are various models that guide dynamic assessment (Musci & Brenlla, 2017). One is the curriculum-based model (CBDA) from Haywood and Lidz (2007). The instrument for dynamic assessment produced from this approach (Application of Cognitive Functions Scale – ACFS) evaluates universal cognitive skills which underlie learning and are related to the execution of a broad range of

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academic tasks, specifically, skills in classification, auditory memory, visual memory, series, perspective-taking, and verbal planning.

The ACFS was adapted into Spanish by Calero et al. (2009), who developed the EHPAP scale (*Evaluación de Habilidades y Potencial de Aprendizaje para Preescolares* [Evaluation of Preschoolers' Learning Abilities and Potential]. This scale has been used in our field, for example, in cases of the presence of disorders or disability (Valencia-Naranjo & Robles-Bello, 2017, 2020), children with different levels of school performance (Calero, Carles, et al., 2010), and children from minority cultural and linguistic backgrounds (Carles Gassin et al., 2011).

A broad field of dynamic assessment activities includes evaluating skills in children from minority cultural and linguistic backgrounds to identify whether their performance may be associated with possible deviations or differences in performance (Orellana et al., 2019; Patterson et al., 2020), identifying strategies for encouraging acquisition of academic skills (Ebadi & Saeedian, 2019; Kushki et al., 2022; Shobeiry, 2021; Stad et al., 2019; Touw et al., 2020; Tsesmeli & Stoumpou, 2021; Zarei & Khojasteh, 2020), and even encouraging development in highly-capable children (Renzulli, 2021). Improving our understanding of the relationship between performance in EHPAP and preschool children's cognitive abilities will make it easier to use dynamic assessment instruments in our field, with these diverse applications, helping to develop an area of growing interest. As far as we are aware, there are no studies examining the relationship between cognitive abilities (e.g., working memory, executive functioning) and performance in these tasks, either in relation to mediation or post-assessment performance.

The usual format in dynamic assessment is test-mediation test. This means a prior test examining a child's independent performance, followed by a teaching phase (mediation) in which the expert provides a brief period of instruction, guidance, support, or assistance (about 20 minutes); lastly, there is a re-evaluation phase applying the same, or a parallel version of the initial test. The scores that can be extracted are related to prior performance (pre) and performance after mediation (post), and the gain or the difference between the pre- and post-scores. In the present study, children's cognitive abilities are expected to contribute to both pre- and post-performance. There is particular interest in children's post-mediation performance, when they perform autonomously following a short intervention (mediation) intended to help them improve how they perform the task.

As mentioned above, the tasks included in the EHPAP relate to the development of skills that underlie learning. One of the skills that encourages learning is executive functioning. Miyake and Friedman (2012) broadly define executive functioning as a set of self-regulatory cognitive processes that facilitate goal-directed behaviour and coping in new or complex situations. Initially, the relationships between learning and executive functioning were unidirectional, that is, from executive functioning to academic achievement (Best et al., 2011) or school readiness (Shaul & Schwartz, 2014). Progressively, studies suggest that the relationship between learning and executive functioning should be understood from a bidirectional perspective, with mutual influence between the two factors (Wolf and McCoy, 2019). The development of these self-regulatory processes during the preschool period is related to the acquisition of learning-related behaviours. In these linkages, the quality of the interactions that the child establishes with adults plays a relevant role (Schmerse, 2020).

Assessment of executive functioning can be carried out through direct procedures (e.g., task development), observational strategies (e.g., in the classroom context), or through the assessment of close adults (e.g., parent report). Of these three strategies, McCoy (2019) highlights the ecological character of the assessment through parent reports and its relevance when assessing the involvement of executive functions in the learning process given the special characteristics (e.g., group work, "noisy" environments, turn control, etc.) of these environments, different from the conditions required when direct procedures are applied in the assessment.

In this study we were also interested in the contribution of other cognitive abilities and skills in the pre- and post-mediation phase of the EHPAP. The organisation of cognitive functions in young children has been the subject of much debate. One of the issues raised is the degree of differentiation of these functions at early ages. Plym et al. (2021) review some of these studies in their paper and conclude that in typically developing children cognitive skills show a process of differentiation (albeit with important relationships between them) beyond the basic distinction between verbal and non-verbal skills. Thus, the verbal factor involves tasks requiring verbal reasoning along with skills related to vocabulary, expressive and receptive language, or verbal memory. The non-verbal factor would comprise skills related to attention, non-verbal reasoning, short-term memory, visual perception, visuo-motor skills, and processing speed.

To summarize, the objectives of the present study are: (1) to determine whether mediation improves normotypical preschoolers' (aged 3-6 years old) performance in the EHPAP subscale and (2) to examine the contribution of cognitive abilities in predicting the progression during mediation and the post-mediation scores.

## Method

### Participants

The participants were 151 children (75 girls, 76 boys) aged between 3 and 6 years old ($n_{3años}$= 29, $n_{4años}$= 43, $n_{5años}$=79). The sample was incidental, the participating children were enrolled in the three primary schools that participated in the study (each school with two preschool classes). In order to access this population and after obtaining the favourable consent of the Ethics Committee of a Spanish university, the collaboration of the Provincial Delegation of Education, school principals, as well as the parents or legal representatives of the children was requested. Likewise, the teachers of the pre-school lines of each school were informed, their doubts were answered, and their collaboration was requested. Once these permissions were obtained, pre-school teachers were contacted in order to start the evaluation without interrupting teaching. These schools were located in medium socio-economic neighbourhoods.

### Instruments

*Evaluation of Preschoolers' Learning Abilities and Potential* (EHPAP) *[Evaluación de Habilidades y Potencial de Aprendizaje para Preescolares]* (Calero et al., 2009).

The main components are the subscales of classification (CL), auditory memory (AM), visual memory (VM), series (SER), verbal planning (VP), and perspective-taking (PT). In the classification scale children group geometric figures by shape, color, and size. The maximum score (MS) is 12 points. The auditory memory task evaluates the number of details included and the sequence story is repeated in (MS = 17 points). Visual memory assesses the number of elements remembered and the strategies used to remember objects presented visually (MS = 12 points). Series evaluates the number of sequences completed and valid explanations for the choices made (MS = 18 points). In perspective taking, the child guides the expert in drawing a human figure (MS = 16 points), assessing the verbal and non-verbal elements of co-operation and guidance in performing the task. The verbal planning task involves the child explaining how to do an everyday task (MS = 15 points), assessing the stages defined, whether there is an overall plan, and the use of planning or sequencing words.

A principal components analysis ($N$ = 176 preschoolers) conducted by Carles Gassín (2012) on pretest scores identified

six components corresponding to the scale's cognitive functions, explaining 39.2% of the total variance. Cronbach's alpha was .793 (a range of .780-.806). Discriminant validity was assessed by making a differential diagnosis between preschoolers with DS and preschoolers with no known disability (Calero García, Robles-Bello, et al., 2010), as well as between children with high and low academic performance (Calero, Carles, et al., 2010). The EHPAP, much like the ACFS, provides no normative data.

***Navarra Oral Language Test*** *[Prueba de lenguaje oral de Navarra revisada, PLON-R]* (Aguinaga et al., 2005)

This test evaluates the development of oral language between 3 and 6 years of age in phonology, morphology-syntax, content, and use of language. It gives an overall score for performance in the basic scales of form, content, and use. Puertas González et al. (2019) indicate that the Cronbach's alpha of the test is above .80. Content validity was examined using expert judgement.

***Woodcock-Muñoz Batería III*** **(WM_BIII)** (Muñoz-Sandoval et al., 2005)

This is the Spanish version of the Woodcock-Johnson III Battery. It is applicable between the ages of 2 and 90 years old. The cognitive skill tests operationalize various aspects of seven of the broad theoretical skills: long-term recall, short-term memory, processing speed, auditory processing, visual processing, comprehension/understanding, and fluid reasoning. For the present study, the tests used for the battery were retrieval fluency (long-term recall), spatial relationships (visual-spatial perception), concept formation (fluid reasoning), processing speed, and auditory working memory (short-term memory). According to the information collected in the test manual, the internal consistency reliability coefficients in the calibration data for the age groups considered (3-6 years) and in the different tasks used offer values between .80 and .90. The confirmatory factor analysis maintains the initial structure of the test.

***Behavior Rating Inventory of Executive Functioning*** **(BRIEF-P)** (Giola et al., 2016)

This evaluates executive functions between 2 and 6 years of age. It provides an overall score, scores for the subscales, and scores in three composite indices—Inhibitory Self-Control index (BRIIC) (made up of the inhibition and emotional control scales); Flexibility index (BRIFL; made up of the flexibility and emotional control scales); and the Emergent Metacognition index (BRIEM; made up of the working memory and planning/organization scales). These three indices were the scores used in this study. The reliability results of the scales and clinical indices of the BRIEF-P range between .95 and .96. In addition, the exploratory factor analysis, when the informants are parents, coincides with those obtained in the original version, explaining 90.37% of the variance (Bausela-Herrera & Luque-Cuenca, 2017).

## Data Analysis

Differences between the scores before (pre) and after (post) mediation were examined by applying a paired-measure *t*-test, hypothesizing higher post-scores. The possible contributions of cognitive skills related to general cognitive functioning, development of linguistic skills, and executive functioning in predicting pre- and post-mediation scores in the EHPAP subscales were assessed using regression analysis applied to those scores. The predictor variables were related to 5 of the basic cognitive abilities outlined in *Batería III* (Frank de Verthelyi, 2001): short-term memory (STM), visual processing (VPro), retrieval fluency (RF), fluid reasoning (FluidR), and processing speed (ProS). Auditory processing ability and comprehension, also suggested as basic abilities, were included through the scores from the PLON test. Executive functioning was assessed via the parental report (BRIEF-P), using the indices of Emergent Metacognition (BRIEM), Flexibility (BRIFL), and Inhibitory Control (BRIIC). Participants' age was also included as a predictor.

This study does not include a control group and, in this sense, it is more difficult to verify the contribution of possible extraneous variables such as the practice effect. However, Haywood and Lidz (2007) and Swanson and Lussier (2001) suggest that the results obtained after the intervention are superior to those obtained by retesting alone. Another set of extraneous variables are related to the effects of other interventions received by the children and/or the maturation process. In this sense, these possible effects are limited by the pretest/intervention/posttest format of each task being administered on the same day and within a relatively short period of time.

Prior to the regression analysis, compliance with the assumptions of linear regression was verified, identifying the presence of linearity by visual representation and homoscedasticity through the White test, and independence of errors with the Durbin-Watson test. Non-compliance was identified in relation to normality (using the 1-sample Kolmogorov-Smirnov test), in the CL prediction model (pre- and post-mediation phase) and in the prediction of Ser and VP after mediation. Therefore, a regression analysis was developed using a simulation procedure (3,000 samples) including in the first phase all variables considered in this study. In the second phase, the analysis was repeated with the variables included at the last step of the stepwise regression analysis. The results from these simulation procedures suggest that the variables of interest maintain their significant contribution to the prediction of the variables of interest.

## Procedure

The study was approved by the University of Jaen Ethics Committee (code: MAR.18/12.TES). All procedures involving human participants were in line with the ethical standards laid out by the university research committee and with the 1964 Helsinki Declaration and its subsequent updates or similar ethical standards. Informed consent was sought from the legal guardians of all participants in the study. The EHPAP subscales and other instruments were applied once signed informed consent was received.

## Results

The analysis was performed using SPSS version 24.0. The data produced from the EHPAP subscales were converted into percentages in accordance with the EHPAP manual. Before doing the statistical analysis, kurtosis and asymmetry were assessed, giving values within the acceptable range between -2 and +2 (Field, 2005).

The differences between the pre- and post-mediation scores were examined using a paired-sample *t*-test. The results from each subscale indicated that the differences in means were statistically significant, $t_{CL}(150) = 16.890$, $p < .001$; $t_{AM}(150) = 13.033$, $p < .001$; $t_{VM}(150) = 12.081$, $p < .001$; $t_{Ser}(150) = 7.356$, $p < .001$; $t_{PT}(150) = 10.389$, $p < .001$; $t_{VP}(150) = 11.669$, $p < .001$. The post-mediation scores were higher in each subscale. The effect sizes (Cohen's *d*) achieved through these contrasts are in the medium and large effect sizes (see Table 1).

The second objective was to determine whether children's cognitive abilities formed part of the prediction of the pre- and

**Table 1.** Descriptive Statistics and Paired-Samples *t*-test for the EHPAP Subscales

| | *M* Pre (*SD*) | *M* Post (*SD*) | *t* | *d* |
|---|---|---|---|---|
| Classification | 38.576 (29.523) | 65.729 (23.737) | 16.890** | 1.374 |
| Auditory memory | 40.008 (24.005) | 61.005 (26.083) | 13.033** | 1.061 |
| Visual memory | 53.477 (17.856) | 68.101 (18.801) | 12.081** | 0.983 |
| Series | 73.289 (32.867) | 80.8678 (27.349) | 7.356** | 0.599 |
| Perspective-taking | 49.959 (28.908) | 62.128 (26.821) | 10.389** | 1.030 |
| Verbal planning | 53.289 (26.190) | 68.211 (24.866) | 11.669** | 1.141 |

*Note.* *M* = mean; *SD* = standard deviation; *d* = Cohen's *d*.
** $p < .001$.

**Table 2.** Results of Linear Regression Analysis of the Pre-Mediation Scores in the EHPAP Subscales

| | Model | Adjusted $R^2$ | Change in *F* | Predictor in step | β Coefficient (final model) |
|---|---|---|---|---|---|
| Classification | Model 1 | .160 | 29.610** | STM | .407 |
| Auditory memory | Model 1 | .160 | 29.664** | STM | .223 |
| | Model 2 | .201 | 8.507* | PLON | .214 |
| | Model 3 | .240 | 8.617* | BRIEM | -.196 |
| | Model 4 | .261 | 5.171** | VPro | .192 |
| Visual memory | Model 1 | .235 | 47.159** | FluRec | .379 |
| | Model 2 | .286 | 11.621** | STM | .260 |
| Series | Model 1 | .441 | 119.217** | VPro | .511 |
| | Model 2 | .486 | 14.013** | FluRec | .269 |
| Perspective taking | Model 1 | .222 | 43.697** | VPro | .422 |
| | Model 2 | .248 | 6.253* | BRIFL | -.185 |
| Verbal planning | Model 1 | .148 | 26.962** | VPro | .391 |

*Note.* FluRec = recall fluency – WM_BIII; STM = working memory – WM_BIII; VPro = spatial relationships – WM_BIII; BRIEM = emergent metacognition index–BRIEF-P; BRIFL = flexibility index –BRIEF-P.
* $p < .05$, ** $p < .01$.

post-scores in each subscale. The cognitive abilities were related to children's executive functioning through the BRIEF-P questionnaire; the level of linguistic development was assessed via PLON, and the Woordcock-Muñoz *Batería III* (WM_BIII) tests for working memory, concept formation, cross, retrieval fluency, and spatial relationships.

Stepwise regression analysis for CL with pre-mediation scores (see Table 2) indicated auditory working memory as a predictor variable, explaining 16% of the variance. For auditory memory (AM), the predictor variables were working memory (STM), overall language development (PLON), the Emergent Metacognition Index from the BRIEF-P (BRIEM), and spatial relationships (VPro) with $R^2_{adjusted}$ = .261. Performance in the visual memory (VM) subscale of EHPAP, with 28.6% of the variance explained, was predicted by recall fluency and auditory working memory. The predictor variables for the Ser subscale were spatial relationship (VPro) and recall fluency (FluRec), with $R^2_{adjusted}$ = .486. Regarding the complementary scales, performance in perspective taking (PT) was predicted by spatial relationships and the BRIEF-P flexibility index (BRIFL), explaining

**Table 3.** Result of Linear Regression Analysis of the Post-Mediation Scores in the EHPAP Subscales

| | Model | Adjusted $R^2$ | Change in *F* | Predictor in step | β Coefficient (final model) |
|---|---|---|---|---|---|
| Classification | Model 1 | .226 | 44.809** | STM | .481 |
| Auditory memory | Model 1 | .290 | 62.397** | STM | .223 |
| | Model 2 | .365 | 18.590** | FluRec | .214 |
| | Model 3 | .400 | 9.668* | PLON | -.196 |
| | Model 4 | .419 | 5.691* | BRIFL | .192 |
| Visual memory | Model 1 | .273 | 57.341** | FluRec | .432 |
| | Model 2 | .331 | 13.843** | PLON | .230 |
| | Model 3 | .362 | 8.153* | STM | .205 |
| | Model 4 | .377 | 4.517* | BRIIC | .142 |
| Series | Model 1 | .468 | 133.194** | VPro | .541 |
| | Model2 | .508 | 12.875** | FluRec | .252 |
| Perspective taking | Model 1 | .327 | 74.036** | VPro | .435 |
| | Model 2 | .350 | 6.164* | FluRec | .173 |
| | Model 3 | .363 | 4.036 | BRIFL | -.139 |
| | Model 1 | .114 | 20.325** | FluRec | .391 |
| Verbal planning | Model 2 | .144 | 6.287* | Age | |
| | Model 3 | .179 | 4.196 | PLON | |

*Note.* FluRec = recall fluency –WM_BIII; STM = working memory – WM_BIII; VPro = spatial relationships – WM_BIII; BRIFL = flexibility index –BRIEF-P; BRIEM = emergent metacognition index –BRIEF-P; BRIIC = inhibitory control index –BRIEF-P
* $p < .05$. ** $p < .01$.

24.8% of the variance. The remaining complementary scale, verbal planning (VP), indicated spatial relationships as the factor involved in the prediction, explaining 14.8% of the variance.

The variable that predicted performance in post-mediation in CL was auditory working memory (STM), with 22.6% of the variance explained. This percentage increased in AM to 41.9% with the contribution of the variables auditory working memory, recall fluency, general linguistic development, and the BRIEF-P flexibility index (BRIFL). The variables that formed part of the model for VM were recall fluency, general linguistic development, auditory working memory, and the BRIEF-P inhibitory control index (BRIIC), with $R^2_{adjusted}$ = .377. Ability in series (Ser) following mediation was predicted by spatial relationships and recall fluency, with 50.8% of the variance explained. In the PT subscale, the variables involved in the prediction were spatial relationships, recall fluency, and the flexibility index (BRIFL). The variance explained was 36.3%. For verbal planning, the variables involved in the prediction were recall fluency, participant age, and language development, explaining 17.9% of the variance. Table 3 summarizes the results of the regression models.

## Discussion

Dynamic assessment (DA) emphasizes the learning process and the individual's ability to modify cognitive functions (Tzuriel & Groman, 2017). These assessments capture current learning processes rather than the product of prior learning. According to Petersen et al. (2018), their possible applications include being able to complement standardized assessments, or to be used when there are no validated instruments (e.g., in populations where instruments do not have thresholds established).

The EHPAP is one dynamic assessment instrument (Calero et al., 2009) which falls within the curriculum-based model (CBDA) of Haywood and Lidz (2007). One of EHPAP's benefits is maximizing social interaction, providing an assessment context for preschool children that is similar to their learning environments, limiting possible biases in the assessment (Wiedl et al., 2014). In addition, DA provides information about cognitive functioning and learning potential variables that can guide subsequent education activities (Calero, Carles, et al., 2010). These characteristics make EHPAP an important instrument because of the interculturality in our society, the interest in taking early actions that encourage children's development from an early age, and approaches that promote inclusive schooling.

The first objective of the present study was to examine the effectiveness of mediation on the subscales. The results were in line with our hypothesis, with significantly higher scores post-mediation (compared to pre-mediation) in all EHPAP subscales. Similar results have been reported in previous work on EHPAP (Calero, Carles, et al., 2010; Carles et al., 2011; Valencia-Naranjo & Robles-Bello, 2017, 2020).

The second objective was to ascertain the possible contribution of cognitive variables in predicting pre- and post-mediation scores. The predictor variables were related to the five basic cognitive abilities outlined in WM_BIII: short-term auditory memory (STM), visual processing (VPro), recall fluency (FluRec), fluid reasoning (FluidR), and processing speed (ProS). The skills of auditory processing and comprehension that Frank de Verthelyi (2001) also suggested as basic skills were included through the scores in the PLON test. Executive functioning was also assessed via the parental (BRIEF-P) report, using the indices of emergent metacognition (BRIEM), flexibility (BRIFL), and inhibitory control (BRIIC). The final possible predictor considered was the participants' age.

Wang et al. (2021) suggested that for typically developing preschool children categorization tasks present challenges in consistently conceptualizing and using categories when grouping them together. Performance in classification (CL) requires an explicit learning process focused on forming a hypothesis about different categories (e.g., shape, size, color) and need reasoning abilities (Valencia-Naranjo & Robles-Bello, 2017, 2020). The mediation of the EHPAP CL subscale was aimed at facilitating grouping together of elements' visual characteristics (shape, size, and color).

The variable that contributed to the prediction of pre- and post-mediation performance was auditory working memory. This is in line with the findings by Kyllonen and Christal (1990), who associated working memory and fluid intelligence. For some authors (e.g., Wongupparaj et al., 2015), this relationship is established through the involvement of an individual's executive abilities, particularly through the capacity to update information. In line with that result, the inclusion of executive functioning factors in the regression model in this study is not unexpected. However, authors such as Frischkorn et al. (2022) questioned the participation of performance abilities as the link between working memory and fluid intelligence.

The visual memory (VM) assessment looks at how many previously shown items are remembered. These elements are part of preschoolers' usual vocabulary (e.g., domestic animals). One of the predictors of pre-mediation performance was auditory working memory. Forsberg et al. (2022) indicated that the number of items children remember may depend more on the ability to extract meaningful information to remember than on the depth of the recall system. Once information is extracted, recall may be supported by procedures that limit the load on working memory (e.g., access to stored information). The inclusion of recall fluency in the model is consistent with this idea.

Mediation in VM involved teaching strategies that reinforced recall abilities (e.g., repetition, grouping, and using visual images—asking the child to make groups based on shared attributes. Predictions of independent post-mediation performance included the use of prior acquired knowledge (recall fluency), which is considered to represent prior knowledge, knowledge acquired during mediation, and general linguistic understanding (PLON) that makes the strategies easier to use (e.g., grouping). In this regard, Forsberg et al. (2022) found that similar strategies to those used in the mediation phase reduced the load on working memory, allowing more efficient performance. The preschoolers' inhibitory abilities (BRIIC) also participated in this model. This result has also been reported by Traverso et al. (2020), who found that preschoolers' ability to inhibit their responses predicted performance in short-term memory tasks. In this result, the children who benefited the most were those with the least development of emergent metacognition. The other predictor of performance was working memory, in line with the task being associated with remembering previously presented material.

Verbal memory (AM) assessment requires the participant to repeat the elements of a short story after hearing it. The story includes characters that are part of the usual infant vocabulary and a structure linked to a sequence of events. Zanchi and Zampini (2021) noted that competence in telling a story requires micro- and macro-structural aspects. Micro-structural aspects are linked to general linguistic competencies and macro-structural aspects are linked to the capacity for sequential reasoning. This capacity refers to the ability to place events in the proper order to make a story. Children have to understand the sequence of events and include the characters and actions in the proper order to achieve a consistent overall representation (Dicataldo & Roch, 2021). The participation of general language ability in predicting pre-mediation scores may be linked to the microstructural elements of the story. The ability to tell a coherent overall story involves emergent metacognitive cognition (made up of the capacity of working memory and planning and organization abilities) (BRIEM) and spatial relationships. Working memory also contributes to the prediction of performance in this task. During mediation, the structuring elements is supported by

visual stimuli that represent some of the characters in the story and the sequence of events. Post-mediation performance was predicted by children's language development, working memory, and the ability to recall prior information. The mediation's emphasis on sequencing strategies supported by visual stimuli may have contributed to the flexibility index being included as a predictive factor.

The series assessment asks the child to compare elements (e.g., shape, size, color) and identify the relationships between them, recognizing the correct order. This task requires the child to extract the common dimensions of the stimuli and identify the next element in the sequence. The mediation is aimed at helping the child to identify clues when they make a series (e.g., repetition). Zippert et al. (2019) highlighted that tasks involving visually presented series need visual spatial abilities because children have to make out and modify geometric stimuli to identify the pattern and continue the underlying structure. Along these lines, the predictors in the pre- and post-mediation regression models included visual processing ability (VPro). Zippert et al. (2019) hypothesized that knowledge of shapes or familiarity with them would help pattern processing by reducing the load on working memory. This hypothesis was not supported by their study, which attributed their results to the instruments' reliability issues in assessing this knowledge. In the present study, recall of previously acquired information was involved in the prediction of performance. That involvement in the prediction of post-mediation performance may be collecting the effects of the mediation.

The PT task asks the child to teach the other person (the mediator) how to do a drawing. This collaboration involves understanding a situation or event from another's point of view (Emen & Aslan, 2019). The inclusion of VPro in the prediction of pre- and post-mediation scores underscores the importance of visual thinking in interactions in which children coordinate their actions with another person's motor activity (Sacheli et al., 2018). Another factor shared by both regression models was the flexibility index (BRIFL). Collaboration with another person needs the child to identify what help and guidance the other needs (e.g., explaining or sharing information) (Paniagua-Esquivel & Quirós-Ramírez, 2020). Sacheli et al. (2019) noted that offering this help would depend on flexible cognitive control to adapt the possible assistance to a highly variable performance that depends on the previous experience of the person being helped. Mediation in PT offers a model of how to communicate to influence the other's performance, modeling the use of shape, sequence, location, and details to teach the other person how to do a drawing. This learning is related to another predictor of post-mediation performance, recall fluency.

The ability to describe experiences or tell stories in an understandable way using language needs the speaker to choose and structure the content, to use their knowledge of vocabulary and grammar, and to adjust the story appropriately for the listener (Hällström et al., 2021). The inclusion of spatial relationships in the predictive models for performance in tasks with a strong linguistic component, such as verbal planning, is notable. The inclusion of this variable may be related to the support that gestures give the child as they tell the story. Laurent et al. (2020) found that preschoolers who gestured while telling stories made more use of their visual-spatial abilities and produced more extensive stories than children who did not gesture spontaneously. Mediation in VP helped identify the phases of a plan and emphasized the use of planning words while executing the plan. Along these lines, children's general linguistic ability was a predictive factor of post-mediation independent performance. Recall fluency was also involved in this model and is thought to represent the effect of mediation, along with the age of the participants.

## Conclusions and Limitations

Children's cognitive abilities are involved in the prediction of their scores in independent performance in the EHPAP. Regarding the pre-mediation performance, auditory working memory contributed in the two memory tasks (auditory and visual) and in the classification related to reasoning tasks. Visual processing, a skill that is considered particularly important in the early years, was also presented as an important ability in identifying patterns and in perspective-taking tasks involving visual elements. It may also help in emerging development tasks in preschoolers such as verbal planning of a task. Access to stored knowledge is present in tasks where its use facilitates the functioning of working memory. Regarding executive functioning, various indices were involved in predicting performance, particularly in memory and perspective-taking tasks.

Independent post-mediation performance in various tasks was generally related to the predictive factors of the pre-mediation level. However, in these models, performance prediction included recall fluency as a predictive factor. We believe that the involvement of this variable in these models covers the learning achieved during the mediation, without excluding other recalled knowledge noted above. The inclusion of this recall fluency factor as a predictor in all subscales, except CL, is consistent with the effect of mediation identified in the first study objective.

Children's age was considered as a possible predictor in the various regression analysis both pre- and post-mediation. However, it was only involved in the post-mediation prediction in the VP task. Stories from children aged between 3 and 6 years old, induced by a procedure of repeating a story or producing a narrative, was investigated by Venkatraman and Thiruvalluvan (2021). Their results indicated differences based on the children's age, showing a progression in story quality. However, those effects were greater when the task asked a child to produce a story from their own experience (rather than repeating a story). The authors noted that this type of task may be too complex for under-sixes. In line with those results, following mediation, under-sixes may be able to exactly remember they have heard before. Despite that, this level of task complexity (compared to freely telling the story) is limited in younger children.

Future lines of study need to assess whether our results can be extended to other populations. It would be particularly interesting to determine that for children from other cultural or linguistic backgrounds or children who are slower at acquiring abilities. In addition, it would be useful to examine the relationship between EHPAP scores and the acquisition of academic skills.

## Conflict of Interest

The authors of this article declare no conflict of interest.

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