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VOCABULARY

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 **Individualized Professional Development Program Designed by Speech-Language Pathologists to Increase Vocabulary Strategies in Low Socioeconomic Status Preschools: A Multiple Case Study**

 **Programme de perfectionnement professionnel personnalisé conçu par des orthophonistes pour augmenter l'utilisation de stratégies soutenant l'apprentissage du vocabulaire auprès d'enfants d'âge préscolaire issus de milieux défavorisés sur le plan socio-économique : une étude de cas multiples**

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Abstract

The purpose of this study was to evaluate the effectiveness of a professional development program designed by speech-language pathologists to increase teachers' use of vocabulary strategies in low socioeconomic status preschools. Specifically, the teachers received a 12-week intervention, individualized in terms of the number and type of strategies taught and the length of training for each strategy. A book reading activity was used to practise the use of these strategies. Two parameters were evaluated to assess the effectiveness of this program: (a) use of the targeted strategies in a trained activity (book reading) and (b) generalization (teachers' application of the learned strategies to activities not directly trained in the program). To do this, a multiple case study was conducted with five preschool teachers. Following a multiple baseline design, visual analyses and Tau statistics were used. The results showed a statistically significant increase in the use of targeted strategies in book reading, with large effect sizes regardless of the teacher or strategy taught. However, despite their mastery in book reading and theoretical information about how to generalize these practices, none of the teachers generalized the use of the strategies to other activities not targeted by the program. The results of this study underline the importance of providing intensive in situ training programs tailored to teachers' needs, including multiple opportunities for practice in different activities.

Abrégé

L'objectif de la présente étude était d'évaluer l'efficacité d'un programme de perfectionnement professionnel conçu par des orthophonistes pour augmenter l'utilisation de stratégies soutenant l'apprentissage du vocabulaire chez des enseignants et enseignantes travaillant dans des écoles défavorisées sur le plan socio-économique. Plus précisément, des enseignants et enseignantes ont participé à une formation personnalisée de douze semaines dans laquelle le nombre, le type et le temps de formation accordé à chaque type de stratégies variaient. Les enseignants et enseignantes ont pratiqué les stratégies leur étant enseignées dans une activité de lecture de livres. Deux paramètres ont été utilisés pour évaluer l'efficacité du programme de perfectionnement professionnel : (a) l'utilisation des stratégies enseignées dans l'activité utilisée pour se pratiquer (c.-à-d. la lecture de livres) et (b) la généralisation de l'utilisation de ces stratégies (c.-à-d. l'utilisation des stratégies enseignées dans des activités qui n'ont pas été directement ciblées par le programme). Pour y arriver, une étude de cas multiples a été menée auprès de cinq enseignants et enseignantes travaillant dans des classes de niveau préscolaire. Un devis à niveaux de base multiples et intégrant des analyses visuelles et des statistiques Tau a été utilisé. Les résultats ont révélé une augmentation statistiquement significative de l'utilisation des stratégies enseignées lors de l'activité de lecture de livres, avec de larges tailles de l'effet indépendamment de l'enseignant ou enseignante ou de la stratégie. Cependant, malgré leur maîtrise des stratégies enseignées dans l'activité de lecture de livres et leurs connaissances théoriques sur la manière de les utiliser dans d'autres activités, les enseignants et enseignantes n'ont pas généralisé leur utilisation à des activités qui n'étaient pas ciblées par le programme de perfectionnement professionnel. Les résultats de cette étude soulignent l'importance de proposer des programmes de perfectionnement professionnel intensifs in situ, personnalisés aux besoins des enseignants et enseignantes et qui incluent de nombreuses occasions de pratique dans différentes activités.

Developing lexical skills from an early age is of paramount importance. Indeed, early vocabulary skills predict a child's future reading skills (Dickinson & Porche, 2011; RamsOOK et al., 2020; Suggate et al., 2018) and therefore their future academic success (RamsOOK et al., 2020; Suggate et al., 2018). Children's vocabulary is linked to the language used by adults, usually parents, interacting with them.

It is now clear that language spoken to children is positively associated with socioeconomic level (Fernald et al., 2013). The language input of parents from disadvantaged backgrounds tends to be more directive with less varied vocabulary and less complex syntactic structures than that of more advantaged parents (Huttenlocher et al., 2010; Schwab & Lew-Williams, 2016). Exposure to this type of limited language input results in notably reduced vocabulary levels in children (Hoff, 2013; Rowe, 2012).

Consequently, vocabulary support is a key component of early language prevention approaches to child development, particularly for those growing up in disadvantaged circumstances. As access to language services and providers is limited for socioeconomically disadvantaged parents (Davidson et al., 2022), and as children attend school regularly and intensively, working with teachers would be a great opportunity to support the vocabulary development of all children. Preschool teachers are seen as particularly privileged interlocutors. International literature has documented an increase in children's vocabulary use following an increase in teachers' use of vocabulary support strategies in the classroom (Kane et al., 2023; McLeod et al., 2019; Sembiente et al., 2023). Given its importance to children's development, several studies have focused on how children learn new vocabulary and the best strategies to support this learning.

How Can Teachers Support Children's Vocabulary Growth in Preschool?

Learning a word involves associating a lexical label with the concept to which it refers (Nation, 2014). To do this, children need multiple exposures to words in different linguistic contexts so that they can receive a variety of semantic, linguistic, or context-related cues (Ambridge et al., 2015; Goodman et al., 2008). This association can be facilitated by various strategies (e.g., definitions, open-ended questions, relating, and sentence completion). An initial strategy of defining a word provides an explicit approach to teaching word meanings (Wasik et al., 2016). Its use in classrooms with disadvantaged children enables them to significantly increase word learning compared to others who do not receive any explanation of the words they hear in class (Beck & McKeown, 2007).

A second strategy for children to consolidate their learning of new words is to use new words in a meaningful context by relating them to their own experience or knowledge (Harris et al., 2011). Children also need opportunities to use new words in rich and varied conversations (Wasik et al., 2016). Some strategies, such as sentence completion and open-ended questions, make this possible because they prompt children to produce new vocabulary words. For example, van der Wilt and colleagues (2022) highlighted a positive correlation between typically developing children's vocabulary growth and teachers' use of open-ended questions. Although these strategies support vocabulary learning, they also appear to support other areas of language such as morphosyntax and narrative skills, as well as contributing to overall cognitive development.

Current Use of Vocabulary Learning Strategies in Kindergarten

Despite their importance in vocabulary support, vocabulary learning strategies are not widely used in preschool classrooms (Al Otaiba et al., 2008; Dwyer & Harbaugh, 2020), and even less so with children who need the most support (Barnes et al., 2017; Pentimonti & Justice, 2010). For example, the quality of teachers' comments differs according to the children's basic language level, following the pattern of a Mathieu effect (Barnes et al., 2017). One possible explanation is that teachers do not feel adequately prepared to deal with the language needs of these children (Moats, 2009). It may also be more difficult to engage in rich interactions with children with lower language levels who are known to be less active in initiating and participating in social interactions (Vuksanovic, 2015). It is, therefore, essential to focus on how to increase and improve the use of these strategies, especially in environments such as preschools in socioeconomically disadvantaged neighbourhoods, which may accommodate large numbers of children with low language levels.

How Can Teachers Be Trained to Use These Strategies?

A growing body of research has implemented and evaluated the effects of language-focused professional development (PD) programs aimed at increasing language support for children in early childhood (Cabell et al., 2011; Girolametto et al., 2003; Neuman & Cunningham, 2009). Nevertheless, the effect size associated with the outcomes of supportive language practices remains low (Markussen-Brown et al., 2017). Most of these studies used an experimental randomized control trial design (Biel et al., 2020), which, because of standardization issues, limited the opportunity to individualize the PD: Participants all

followed the same PD of the same duration and intensity. One hypothesis for the weak positive impact on practice is the lack of individualization offered in PD programs. Individualization would allow for the consideration of each person's individual needs to assimilate new practices (Markussen-Brown et al., 2017).

A recent study (Hreich et al., 2022) took into account these interindividual differences by proposing PD that included variation in the time spent on training in the use of each strategy varied according to each preschool teacher's learning needs. A multiple single case experimental design (SCED) was required for program individualization. The results of the study were quite promising, showing a significant increase in the use of trained language support strategies during the intervention (Hreich et al., 2022).

However, due to the global pandemic, Hreich et al. (2022) were not able to conduct multiple baselines postintervention to assess maintenance. In consequence, the significant increase in each strategy was very specific and was only observed at the end of the intensive training periods dedicated to each strategy. Furthermore, the study only provided information on the increase in language support strategies during the activity specifically targeted by the program, that is, book reading. Finally, the study was conducted in a favorable socioeconomic context, specifically within a private French school in Lebanon. It did not address the issue of language support in contexts of social and economic vulnerability, whereas socioeconomic disadvantage is widely recognized as a risk factor associated with lower quality classroom interactions, including weaker language support (LoCasale-Crouch et al., 2007; Pianta et al., 2005).

Therefore, it is challenging to conclude whether there was a lasting change in language support practices at the end of the intervention. It is also impossible to determine whether the effects were limited to book reading or whether the use of the taught strategies generalized to all activities throughout the school day. However, to have a positive impact on children's language development, it is essential to promote quality language through the use of these strategies in sufficient quantity (Anderson et al., 2021). It is therefore important to use them frequently throughout the school day. Additionally, it is worthwhile to investigate if the methodology of the pilot study allows for an increase in language support strategies in more vulnerable contexts. For this reason, in this study we replicated and extended the research protocol in a context of social and economic vulnerability, documenting the use of vocabulary support strategies during both targeted and nontargeted activities.

Objectives and Hypotheses

The aim of this study was to replicate and extend the effects of a PD program inspired by the pilot study by Hreich et al. (2022) designed to increase the use of vocabulary strategies among preschool teachers. Our study's program differed from Hreich et al.'s (2022) program in three essential ways. First, our intervention offered combination training sessions to prevent the neglect of previously taught strategies. Second, we had the capability to assess the utilization of these strategies upon program completion thanks to postintervention baseline data, whereas in Hreich's study those measures could not be carried out due to the global pandemic. Third, measures were taken to evaluate the use of the strategies in activities other than those specifically targeted by the program (the generalization effect).

The following research questions were formulated:

1. On the basis of all postintervention measures, will there be a significant increase in the use of the language support strategies taught during the intervention, and will teachers be able to effectively use these strategies in combination?
2. Will the use of these strategies be generalized to activities other than book reading, that are not specifically targeted by the program?

Owing to the program's individualization, based on the adjustment of the number of sessions focused on each strategy according to the time needed to master a strategy, and training in the use of multiple strategies in combination, a significant and substantial increase in the use of language support strategies was expected. Moreover, the language support strategies were not activity-specific but could be applied to any activity. For each strategy, this program provided examples of implementation in activities not targeted by the intervention. Therefore, it was expected that the use of strategies mastered in the activity targeted by the PD program would be generalized to other preschool activities conducted by the participating teacher.

Methods

Experimental Design

A multiple baseline design across behaviours (Kazdin, 2020) was used, complying with the SCED standards (Smith, 2012). Multiple baseline designs involve the evaluation of performance across several baselines (Kazdin, 2020). SCED allowed us to evaluate whether a significant modification in the dependent variables (i.e., use of vocabulary strategies) was related to the independent variable (i.e., intervention;

Smith, 2012). In this type of experimental design, each participant was their own control, and nontargeted strategies were used to determine the specificity of the intervention. Nontargeted strategies served as controls until they were worked on in turn.

In the present study, data during the baseline phase were collected across different behaviours of a given group of individuals, making it particularly interesting for the thorough evaluation of intervention outcomes. This project received approval from the ethical board of the University of Liège, number 1920-101.

Participants

The participants were five preschool teachers, working with children aged between 4 and 5 in four different schools in the province of Liège (Belgium). Three of them had their own class and the other two worked in the same classroom. Class sizes averaged 16 children and ranged from 12 to 19 children. All teachers had a 3-year bachelor's degree in early childhood education, with little training in language development. They were all French speakers and worked in socioeconomically disadvantaged schools, as identified by the French community. They were between 27 and 52 years old and had 6–29 years of experience. These teachers were part of a larger study in which the quality of interactions in their classrooms was assessed using the Classroom Assessment Scoring System tool (Pianta et al., 2008). This standardized tool assesses the quality of emotional support, classroom organization, and instructional support. Each of these domains is characterized by a quality score ranging from 1 to 7. Scores of 1 and 2 were considered *low*, 3–5 *medium*, and 6–7 *high*.

The participants for the current study were selected on the basis of their willingness to participate and their low level of instructional support, that is, scores below 3 (see **Table 1**), because low scores in this domain are indicators of few conversations, few open-ended questions, and little extensive vocabulary. These low scores suggested that there was a need for support to increase the vocabulary strategies used in the preschool. Low instructional support scores are not uncommon and reflect a global trend for all teachers (Slot, 2018). However, participants' scores differed in terms of emotional support and classroom organization. The first teacher (P1) had the highest scores in both areas, with high quality scores. The second and fourth teachers (P2 and P4) had middle-to-high scores for both domains. The last two teachers (P3 and P5) had scores characterized as low-middle quality. Thus, they had different interaction profiles but all had common instructional support needs, an indicator of the need for increased language support.

Vocabulary Strategies Targeted by the Intervention

The strategies proposed in this intervention were targeted because they are known to promote language development (Beck & McKeown, 2007; Harris et al., 2011; van der Wilt et al., 2022; Wasik et al., 2016). There were potentially four vocabulary strategies to learn during the intervention: (a) definitions, (b) inferential questions, (c) relating, and (d) sentence completion.

Definitions

Definitions consist of providing an explanation, synonym, or example that allows children to access word meanings. It is important to emphasize defined words because in order to learn new words, children need to associate lexical labels with their conceptual reference (Akhtar et al., 2001). To draw children's attention to new lexical labels, it is important to repeat them with emphasis before defining them. For example, a teacher might read in a storybook, "The little piggy fell into the pond," and they might choose to define "pond." They might define it by saying, "The POND is an area of water."

Inferential Questions

Inferential questions are open questions that require inferring plausible answers. These questions often begin with "Why," "How," or "What will happen to..." and thus provide respondents with the opportunity to use new vocabulary in multiword utterances and connect words to their referents; as such, the questions can support both expressive and receptive vocabulary development. Fathers' inferential questions predicted their toddlers' vocabulary growth over a year (Rowe et al., 2017). Parents' inferential questions, as well as children's responses to these questions, predicted children's receptive vocabulary growth (Rydland & Grøver, 2024). Interestingly, it was children's responses to parents' inferential questions, rather than parents' questions, that predicted children's vocabulary scores, which may reflect children drawing on and incorporating their growing vocabulary knowledge when responding to inferential questions. For example, a teacher might say, "We can see a ZEBRA disguised as a ghost on the cover of this book. What do you think will happen to this ZEBRA disguised as a ghost?"

Relating

Relating is the capacity to link new word meanings to children's background knowledge or to their own experience. For example, a teacher might say, "This story takes place in a CIRCUS. Just like the CIRCUS we visited a month ago where we saw clowns and ate popcorn."

Table 1**CLASS Scores of Participating Teachers**

Teacher	Emotional support	Classroom organization	Instructional support
P1	6.19	6.75	2.58
P2	5.25	5.00	1.44
P3	3.38	3.08	1.75
P4	5.06	4.33	1.08
P5	3.19	3.58	1.00

Note. CLASS = Classroom Assessment Scoring System; P = participant. Possible scores on each domain range from 1 to 7. Scores of 1 and 2 are considered *low*, 3–5 *medium*, and 6–7 *high*.

Sentence Completion

Sentence completion is a strategy that prompts children to complete a sentence with a targeted word. This process allows children to use new words in appropriate contexts. For example, a teacher might say, “Oh, the little piggy got hurt when he fell in the POND. Running too fast, the piggy fell into the...” and wait for the children to respond “POND.”

Intervention

Prior to the intervention, the first author and the participants had individual meetings. During these meetings, the aim of the study was explained with more information on the importance of language development, teachers’ opportunities to support this development, and the practical modalities of the project (i.e., frequency, duration, etc.). A second meeting was organized to observe the quality of interaction in each class using the Classroom Assessment Scoring System tool (Pianta et al., 2008). As recommended by the tool’s designers, these observations of the quality of the interventions were carried out by a certified observer.

During the preintervention baseline phase, vocabulary strategies seldom used by teachers were identified and prioritized among the four targeted by the intervention. The intervention itself consisted of six cycles of 2 weeks each (**Figure 1**), spread over 12 sessions lasting approximately 60 min each. To engage the teachers in the intervention, they were each given the opportunity to choose between two options and start with their preferred strategy. Given the uniformly low use of definitions and inferential questions, all participants had the choice of starting with one of these two strategies. All chose to start with definitions.

The intervention targeted story-reading activities in the program developed by Hreich et al. (2022). This target is a common preschool activity that provides training in everyday life conditions and offers natural opportunities for discussion beyond here-and-now topics (Burke Hadley et al., 2022). However, reading books is currently underutilized

in preschools to support language development. In fact, book reading activities without adult-child interaction result in limited language outcomes (Wasik et al., 2016). Therefore, it is not the story-reading activity alone that positively influences children’s language levels, but rather the quality of interactions that it provides. To reflect real classroom conditions as closely as possible, the activity was offered to the whole class group.

The books studied were chosen to offer stories that followed repeated narrative patterns so that the children could think about what might happen next. They were suitable for 4-year-olds (the target population for the study). All teachers worked on the strategies based on the same books.

Each first-cycle meeting consisted of three main modalities, known as active ingredients of the successful intervention (Biel et al., 2020): sharing information, modelling, and feedback. During the sharing information session (about 20 min), the same procedure was followed throughout. Information was provided about what was going to be proposed with the targeted strategy and why it was important for language development. In addition, it was explained how this strategy could be implemented in book reading as well as in other daily activities. Finally, a summary sheet with all this information was given.

The modelling session (about 20 min) consisted of demonstrating the use of the strategy in book reading. To do this, the speech-language pathologist researcher read the story using the strategy while the teacher observed. The intervention ended with a feedback session (about 20 min) to obtain the teacher’s first general impression of the strategy and to hear the strategy knowledge the teacher had learned. This session also provided an opportunity to train with an example and to identify the teacher’s remaining needs so that they could implement the strategy themselves.

Figure 1

Baseline phase			Intervention															Baseline phase					
BL1	BL2	BL3	Cycle 1		M1	Cycle 2		M2	Cycle 3		M3	Cycle 4		M4	Cycle 5		M5	Cycle 6		M6	BL1	BL2	BL3
Rec	Rec	Rec	SI	+	Rec	SI	+	Rec	SI	+	Rec	SI	+	Rec	SI	+	Rec	SI	+	Rec	Rec	Rec	Rec
A1	A1	A1	MO	SP	A1	MO	SP	A1	MO	SP	A1	MO	SP	A1	MO	SP	A1	MO	SP	A1	A1	A1	A1
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
A2	A2	A2	FB	FB	A2	FB	FB	A2	FB	FB	A2	FB	FB	A2	FB	FB	A2	FB	FB	A2	A2	A2	A2

Description of the Intervention

Note. BL = baseline; M = measure session; Rec = video recording; A1 = targeted activity (i.e., book reading); A2 = nontargeted activity; SI = sharing information; MO = modelling; FB = feedback; SP = supervised practice

For the second meeting of each cycle, which took place 1 week later, the same sessions were proposed except for the modelling time, which was replaced by supervised practice. During this session, the teacher read the same book as the speech-language pathologist researcher and practised the strategy.

After each intervention cycle (every 2 weeks), a measurement was taken. This measurement was a count of the number of occurrences of all strategies used when reading a book that the teacher had never read. The strategy was considered acquired and another strategy was practised in the next cycle if the teacher achieved at least nine occurrences of the targeted strategy. If not, the strategy was pursued until the nine occurrences were reached in the measurement session. Therefore, the number of strategies learned during the intervention differed for each participant. The threshold of nine occurrences was the same as in the study by Hreich et al. (2022). Hreich et al. chose this number because it is considered the minimum number of exposures to a word needed for children with developmental language disorders to learn it (Storkel et al., 2019). However, if the teacher used the strategy nine times while reading, this did not mean that they used it nine times for the same word. However, this threshold was still used in the present study because, as illustrated in **Table 2**, the number nine was slightly higher than the highest number of strategies used (all combined) observed before the intervention. We felt this threshold gave sufficient room for improvement without making it impossible to reach it in a single story-reading session.

Each time two strategies were acquired, a cycle was proposed in which the two acquired strategies were combined, because it was possible that use of the first strategy could decrease significantly during the acquisition phase of the second (Hreich et al., 2022). This combination cycle therefore allowed the acquired strategies to be consolidated. The way in which these cycles were carried out was identical to the way in which the strategies were learned alone. The aim for these sessions was to achieve a total of nine occurrences of the strategies.

Data Collection

The number of occurrences of the strategies used by the teachers was counted in three phases: (a) preintervention baseline phase (a total of three measures), (b) repeated measures phase during intervention (a total of six measures), and (c) postintervention baseline phase (a total of three measures). All phases were video recorded. The number of occurrences of all four strategies (trained and

Table 2**Number of Occurrences of Strategies Used per Book Reading Prior to Intervention**

Teacher	DEF		IQ		REL		SC		TOTAL	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
P1	1.00	1.73	1.00	1.00	1.00	1.00	0.00	0.00	3.00	1.00
P2	0.67	1.15	1.00	1.00	5.67	4.51	0.67	1.15	8.00	6.24
P3	1.67	0.58	2.00	2.00	1.33	0.58	1.33	1.53	6.33	3.51
P4	0.67	0.58	0.00	0.00	1.67	1.53	1.00	1.00	3.33	1.15
P5	0.33	0.58	0.33	0.58	3.67	3.51	0.00	0.00	4.33	2.52

Note. P = participant; DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion.

not trained) was evaluated during two different activities: an activity targeted by the intervention and another activity not targeted by the intervention.

For the targeted activity, book reading, the teacher had to read an unknown book provided by the researcher. This procedure was the same for each measure except for the first session of baselines where the teacher chose their book. This method allowed us to verify that there was no difference in the use of strategies between familiar and unfamiliar books and that the teacher was able to use strategies spontaneously with any book, not just imitate what was learned with a trained book. The teachers did not have time to preview the unknown books. Giving the teacher time to prepare could lead to better quality questions or strategies. However, as this was already a long intervention, we decided to give more time for practice rather than preparation and to observe what could be generalized regardless of the book used.

For the nontargeted activity, the 15 min period immediately following the book reading measure was video recorded. That this did not include switching between activities: It could include independent workshops where the teacher interacted with the children, routines, arts and crafts, themed activities, cooking activities, and so on. The teacher chose the activity and no instructions were given for this measure. As a result, the activity varied from time to time and from teacher to teacher. The process allowed us to place each teacher under the same conditions of a possible priming effect of the strategies used just before the book reading. By assessing this in both targeted and nontargeted activities, it was possible to measure the use of strategies in targeted activities and the generalization of these strategies to other activities.

Data Coding

The video recordings were coded by three speech-language pathologists who were blind to the experimental conditions of each participant. They had to count the number of occurrences for each vocabulary strategy. In this way, they were unknowingly coding both trained and untrained strategies.

Prior to the study, training sessions were organized to ensure a degree of reliability between coders. They were given guidelines to precisely determine what behaviours were considered as vocabulary strategies. During these training sessions, the guidelines were corrected at points where the coders did not agree 100% in order to reach consensus. Once each coder was able to observe each behaviour accurately, the reliability between coders was checked through a sample of 20% of the recordings. They obtained at least 80% agreement for the sum of the strategies, ensuring fidelity between coders.

Once consensus was reached, if a strategy did not meet all the quality criteria set out in these guidelines, it was not counted. This process ensured that the strategies used were of a certain quality and that each teacher had the same degree of mastery.

Data Analysis

First, descriptive analyses were conducted to report on the use of different strategies prior to the intervention for each teacher. Then, visual analyses were performed to consider how often each strategy occurred in each phase, as recommended for multiple case studies (Kazdin, 2020).

Finally, statistical analyses were conducted to assess the outcomes of the intervention on strategy use in a

targeted activity and a nontargeted activity. To do this, the nonoverlap rates of the data between the baseline and intervention phases were calculated with statistical Tau, a test known for its robustness (Tarlow, 2017) that allows the effect size of an intervention to be characterized. Specifically, Tau-U is a nonoverlap statistic computed by analyzing all possible pairwise comparisons between baseline and intervention phases which allows for correction of baseline trends. Tau statistic values above .90 indicate a large effect size, values between .60 and .90 indicate a moderate effect, and values below .60 indicate a small effect (Kazdin, 2020).

Results

Use of Vocabulary Strategies in Book Reading Before Intervention

Table 2 shows the average scores for the use of vocabulary strategies per book reading over the three baseline phase sessions. Definition, inferential questions, and sentence completion were rarely used by any of the teachers during book reading (on average, no more than two uses per book reading). Some strategies were never used by some teachers, such as inferential questions for P4, and sentence completion for P1 and P5.

Sequence Completed by Each Participant

As explained above, based on the results of the use of each strategy before the intervention, each teacher was given the option of starting with definitions or inferential questions. Each of them began by working on the definitions (see **Table 3**). Nevertheless, the time needed to acquire a strategy differed from one teacher to another. P1 needed only one learning cycle per strategy. Once these two strategies were mastered in isolation, Cycle 3 was used to work on them in combination. P1 then learned relating and sentence completion in Cycles 4 and 5. Cycle 6 was designed to work on all the strategies in combination. As a result, teacher P1 learned all of the targeted strategies.

Teacher P2 also needed only one learning cycle to master the first two strategies taught (definitions and inferential questions). For the third strategy, sentence completion, P2 needed two learning cycles. Cycle 6 was also designed to work on all the strategies taught in combination. Therefore, at the end of the intervention, P2 had learned three different strategies.

In contrast, P3 needed at least two learning cycles to master each strategy. The first two cycles focused on training in definitions. After that, this teacher chose training in sentence completion. The latter was particularly difficult

to master and was pursued for two cycles in isolation. Because P3 used definitions to try to set up sentence completions, we decided to show her how to combine the two strategies in Cycle 5 during modelling sessions. As she still had not acquired sentence completion, we continued this combined work in the last cycle. Consequently, teacher P3 learned two targeted strategies.

Given that teachers P4 and P5 work together in the same classroom, the intervention had to be adapted; however, each step of the protocol was scrupulously respected. Given the homogenously low use of each strategy for these teachers, identifying similar strategies for these teachers to practice was not a problem. In concrete terms, we targeted similar strategies to be practiced by both of these teachers. Together, they chose one strategy out of the two proposals to work on. Then, during the modelling session, they observed the same book reading by the speech-language pathologist. The following week, they took turns practising. When measurements were taken, each teacher was alone with the class while her colleague was in another room. Hence, the way one teacher read could not influence the way the other one read.

Each of them required two cycles to master definitions. At the end of the third cycle, P5 needed an additional cycle to master the new strategy, inferential questions. Cycle 4 was therefore dedicated to additional practice on inferential questions. Once the two strategies were mastered in isolation by the two teachers (i.e., at the end of Cycle 4), they were trained in a combined manner during Cycle 5. In the last cycle, a new strategy was worked on, namely sentence completion. Thus, P4 and P5 practised three strategies during the intervention.

First Objective: Analysis of the Effectiveness of the PD Program in Book Reading

First, the effectiveness of the intervention was evaluated. Effectiveness was evidenced by an increase in the teachers' use of learned vocabulary strategies between the baseline phases before and after the intervention during book reading. Visual analyses (see **Figure 2**) and Tau statistical analyses (see **Table 4**) were conducted to verify this increase between baseline phases pre- and postintervention.

Figure 2 illustrates the number of strategies used during each story-reading session at different intervention times. It shows an increase in each strategy targeted by the intervention for each teacher. This increase is confirmed by the statistical analyses reported in **Table 4**, which show a statistically significant increase for each targeted strategy, with mostly large effect sizes (range: .67–1.00). Thus,

Table 3**Illustration of Sequences Completed by Each Participant**

Teacher	Intervention											
	Cycle 1	M1	Cycle 2	M2	Cycle 3	M3	Cycle 4	M4	Cycle 5	M5	Cycle 6	M6
P1	DEF	✓	IQ	✓	Comb	✓	REL	✓	SC	✓	Comb	✓
P2	DEF	✓	IQ	✓	Comb	✓	SC	X	SC	✓	Comb	✓
P3	DEF	X	DEF	✓	SC	X	SC	X	Comb	X	Comb	✓
P4	DEF	X	DEF	✓	IQ	✓	IQ	✓	Comb	✓	SC	✓
P5	DEF	X	DEF	✓	IQ	X	IQ	✓	Comb	✓	SC	✓

Note. P = participant; M = measure; DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion; Comb = combination; ✓ = mastered strategy; X = not mastered strategy.

regardless of the teacher's profile or the strategy taught, at the end of the intervention, each teacher mastered each strategy targeted by the intervention. **Figure 2** also demonstrates the significant increase in the total number of strategies used at the end of the intervention.

Figure 2 and **Table 4** demonstrate that the acquisition of a strategy overrode the use of previously acquired strategies, as reflected by a drop in the frequency of use (e.g., P1, IQ goes from 16 to 1, 2 weeks later). This observation was the same for every teacher each time a new strategy was proposed, except for the definition strategy when implementing the sentence completion strategy. Teachers tended to use the previously learned definition strategy when learning to implement sentence completion.

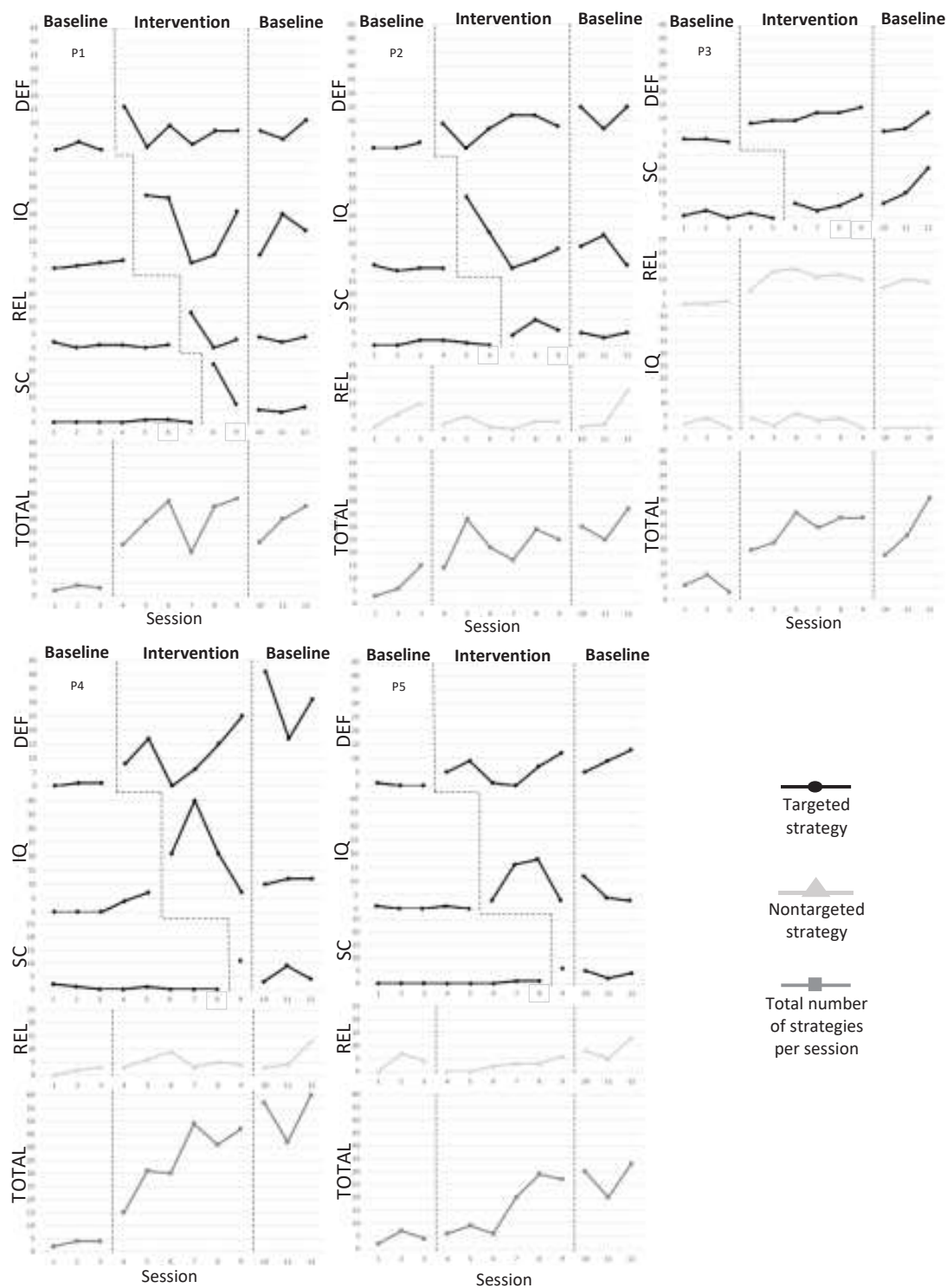
This effect suggests that, in general, it is difficult to combine two strategies that are being worked on separately. Incidentally, the strategy least used by teachers P4 and P5 in the posttest baselines (sentence completion) was the one that was not combined with the other two. The ones that were combined seemed to be more established in practice.

These Tau and visual analyses (**Figure 2** and **Table 4**) allowed us to verify the transfer effects between strategies, that is, whether training in one strategy led to a significant increase in the use of another nontargeted strategy. **Table 4** displays a statistically significant increase in the use of the relating strategy for teachers P3 and P4, a nontargeted strategy for all teachers except P1. Teacher P3 spontaneously used examples related to the children's experiences to define words. Teacher P4 also used examples related to children's experience to define words, but she used this strategy more to help children find answers to her inferential questions.

On the other hand, teachers P2 and P5 did not increase their use of the relating strategy despite the fact that, as with teachers P3 and P4, the intervention targeted definitional and inferential question strategies for P2 and P5. Therefore, the acquisition of inferential questions and definition strategies may lead to an increase in the use of the relating strategy, but it is not systematic. Moreover, it is possible that the relating strategy is inherently more variable than the others. Indeed, during baselines, the frequency of use of definitions varied from 0 to 3, but for relating, it varied from 0 to 10. P3's use of inferential questions, a nontargeted strategy for her, did not increase.

Finally, the specificity of the intervention was verified to ensure that the increase in the use of strategies was due to the intervention. Visual analyses (**Figure 2**) show a clear increase in the use of each strategy once targeted training had been provided. This specificity was confirmed by Tau statistics analyses (**Table 5**), which compared measures collected before the implementation of specific training on a strategy (baseline measures and measures during the intervention) to measures collected after this specific training on a strategy (measures after the specific intervention and baseline measures). Thus, if a strategy was taught in the intervention measure 3, the three measures collected in the preintervention baseline sessions and the two collected in intervention measures 1 and 2 were compared with measures collected in the intervention sessions following the implementation of the specific strategy (i.e., intervention measure 3, 4, 5, 6) and the three measures collected in the postintervention baseline sessions. With statistically significant *p* values for all comparisons, the data in **Table 5** show that the significant increase in the use of targeted strategies was due to the intervention.

Figure 2



Visual Analyses of the Number of Occurrences of Strategy by Time of Intervention

Note. DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion.

Table 4**Frequency of Use of Vocabulary Strategies by Time of Intervention and Comparison of the Number of Occurrences of Each Strategy Before and After Intervention**

Teacher & T/NT	Strategy	BL1	BL 2	BL3	I1	I2	I3	I4	I5	I6	BL1	BL2	BL3	BL Pre M	BL Post M	p	Tau	Effect size
P1																		
T	DEF	0	3	0	16	1	9	2	7	7	7	4	11	1.00	7.33	0.025*	1.00	large
T	IQ	0	1	2	3	27	26	2	5	21	5	20	14	1.00	13.00	0.025*	1.00	large
T	REL	2	0	1	1	0	1	13	0	3	4	2	4	1.00	3.33	0.04*	.89	mod
T	SC	0	0	0	0	1	1	0	23	7	5	4	6	0.00	5.00	0.025*	1.00	large
Total		2	4	3	20	29	37	17	35	38	21	30	35	3.00	28.67	0.025*	1.00	large
P2																		
T	DEF	0	0	2	9	0	7	12	12	8	15	7	15	0.67	12.33	0.025*	1.00	large
T	IQ	2	0	1	1	27	14	1	4	8	9	13	2	1.00	8.00	0.04*	.89	mod
T	SC	0	0	2	2	1	0	4	10	6	5	3	5	0.67	4.33	0.025*	1.00	large
NT	REL	1	6	10	2	5	1	0	3	3	1	2	15	5.67	6.00	0.5	0.00	no
Total		3	6	15	14	33	22	17	29	25	30	25	37	8.00	30.67	0.025*	1.00	large
P3																		
T	DEF	2	2	1	8	9	9	12	12	14	5	6	12	1.67	7.67	0.025*	1.00	large
T	SC	1	3	0	2	0	6	3	5	9	6	10	20	1.33	12.00	0.025*	1.00	large
NT	IQ	2	4	0	4	1	6	3	4	0	0	0	0	2.00	0.00	0.91	.67	no
NT	REL	1	1	2	6	13	14	11	12	10	7	10	9	1.33	8.67	0.025*	1.00	large
Total		6	10	3	20	23	35	29	33	33	18	26	41	6.33	28.33	0.025*	1.00	large
P4																		
T	DEF	0	1	1	8	17	0	6	15	25	41	17	31	0.67	29.67	0.025*	1.00	large
T	IQ	0	0	0	4	7	21	40	21	7	10	12	12	0.00	11.33	0.025*	1.00	large
T	SC	2	1	0	0	1	0	0	0	11	3	9	4	1.00	5.33	0.025*	1.00	large
NT	REL	0	2	3	3	6	9	3	5	4	3	4	13	1.67	6.67	0.04*	.89	mod
Total		2	4	4	15	31	30	49	41	47	57	42	60	3.33	53.00	0.025*	1.00	large

Table 4 (continued)**Frequency of Use of Vocabulary Strategies by Time of Intervention and Comparison of the Number of Occurrences of Each Strategy Before and After Intervention**

P5																		
T	DEF	1	0	0	5	9	1	0	7	12	5	9	13	0.33	9.00	0.025*	1.00	large
T	IQ	1	0	0	1	0	3	16	18	3	12	4	3	0.33	6.33	0.025*	1.00	large
T	SC	0	0	0	0	0	0	1	1	6	5	2	4	0.00	3.67	0.025*	1.00	large
NT	REL	0	7	4	0	0	2	3	3	6	8	5	13	3.67	8.67	0.063	0.78	no
Total		2	7	4	6	9	6	20	29	27	30	20	33	4.33	27.67	0.025*	1.00	large

Note. P = participant; BL = baseline; BL Pre M = baseline mean before intervention; BL Post M = baseline mean after intervention; I = intervention; mod = moderate; T = targeted strategy; NT = nontargeted strategy; DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion. Underlined values indicate the time of strategy implementation. Boxed values indicate sessions with a combination of strategies.

* $p \leq .05$

Second Objective: Generalization of the Use of Vocabulary Strategies in Activities Not Targeted by the Intervention

The frequency of strategy use was assessed in activities not targeted by the intervention to assess the extent to which learning of a strategy may be generalized. This was done by comparing the frequency of strategy use before the intervention (3 preintervention baselines) with the frequency of strategy use after the intervention (3 postintervention baselines; see [Table 6](#)). Some data were missing for nontargeted activities, because it was not always possible to collect them immediately after the book reading. For example, teachers did not have enough time to offer a new activity before the children went home. Sometimes teachers had other activities planned immediately after the book reading, such as rehearsing choreography for the end-of-year show, going to a theatre performance, etc., without informing the researcher in advance. As teacher P3 was missing data from the last measurement time of the baseline phase, the data collected during measurement 6 of the intervention were used for the analyses.

The comparison between the three preintervention baselines and the three postintervention baselines ([Table 6](#)) shows that none of the teachers increased the use of the strategies they had mastered in the targeted activity in nontargeted activities. Thus, generalizing learning from one specific activity to a different activity appeared to be complicated. It should be noted that the frequency of use of vocabulary strategies observed in the baseline phase measures was low, as was that observed in the preintervention book reading activities.

Discussion

The first objective of this study was to evaluate the effects of a collaborative PD program between teachers and a speech-language pathologist researcher on the number of vocabulary strategies used in a targeted activity at the end of the intervention. The second was to assess the teachers' ability to generalize the use of the strategies in any activity other than that targeted by the program. The results allow us to identify three findings around which the discussion is structured: (a) the limited use of language support strategies in preschool, (b) the outcomes of the program in book reading, and (c) the difficulty in generalizing the use of mastered strategies in book reading to other nontargeted activities.

Limited Use of Language Support Strategies in Preschool Before Intervention

The first finding was that, prior to the intervention, few vocabulary strategies emerged spontaneously in book reading, a situation that is known to be conducive to the emergence of rich conversations between children and teachers (Burke Hadley et al., 2022). This finding is consistent with other studies showing that only 5 min per day are specifically dedicated to supporting oral language skills in preschools (Dwyer & Harbaugh, 2020). This result highlights the importance of supporting preschool teachers to increase language support for all children. To support them efficiently, a sustained accompaniment seems required to help them recognize the importance of oral language in early

Table 5

Comparison of the Number of Occurrences of Each Strategy Before and After Specific Implementation of Each Strategy

Teacher	Strategy	BL1	BL 2	BL3	I1	I2	I3	I4	I5	I6	BL1	BL2	BL3	Pre <i>M</i>	Post <i>M</i>	Tau	<i>p</i>
P1																	
	DEF	0	3	0	16	1	9	2	7	7	7	4	11	1.00	7.11	.85*	.020
	IQ	0	1	2	3	27	26	2	5	21	5	20	14	1.50	15.00	.91*	.010
	REL	2	0	1	1	0	1	13	0	3	4	2	4	0.83	4.33	.69*	.020
	SC	0	0	0	0	1	1	0	23	7	5	4	6	0.29	5.00	1.00*	.002
P2																	
	DEF	0	0	2	9	0	7	12	12	8	15	7	15	0.67	9.44	.85*	.020
	IQ	2	0	1	1	27	14	1	4	8	9	13	2	1.00	9.75	.84*	.010
	SC	0	0	2	2	1	0	4	10	6	5	3	5	0.83	5.50	1.00*	.002
P3																	
	DEF	2	2	1	8	9	9	12	12	14	5	6	12	0.83	9.67	1.00*	.006
	SC	1	3	0	2	0	6	3	5	9	6	10	20	1.20	8.43	.97*	.003
P4																	
	DEF	0	1	1	8	17	0	6	15	25	41	17	31	0.67	17.78	.82*	.020
	IQ	0	0	0	4	7	21	40	21	7	10	12	12	2.20	17.57	.97*	.003
	SC	2	1	0	0	1	0	0	0	11	3	9	4	0.50	6.75	1.00*	.003
P5																	
	DEF	1	0	0	5	9	1	0	7	12	5	9	13	0.33	6.78	.82*	.020
	IQ	1	0	0	1	0	3	16	18	3	12	4	3	0.40	8.43	1.00*	.002
	SC	0	0	0	0	0	0	1	1	6	5	2	4	0.25	4.25	1.00*	.003

Note. P = participant; BL = baseline; Pre *M* = mean before intervention; Post *M* = baseline mean after intervention; I = intervention; DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion. Bold vertical bars indicate time of strategy implementation.

**p* ≤ .05

childhood, to learn how to promote it through vocabulary strategies, and to use these strategies by reconsidering their role as a communication partner with children.

Significant Increase in the Use of all Trained Strategies for the Targeted Activity

The second finding concerns the effectiveness of the PD program. The use of each strategy targeted by the intervention was significantly increased for each teacher, with the effect sizes ranging from moderate to high. Therefore, the PD program proved to be effective for each teacher and increased the use of vocabulary strategies in book reading.

However, not every teacher learned the same number of strategies, due to the learning time required by individual teachers to master strategies, which differed among participants. This variation emphasizes the extreme importance of individualizing PD programs according to participants' learning needs and of determining clear acquisition thresholds to identify when a strategy is acquired and when to move to a new strategy. It is not surprising that one-size-fits-all programs demonstrate limited effectiveness (Markussen-Brown et al., 2017).

These findings are also consistent with the fact that there is no consensus on the optimal duration of a PD program (Desimone, 2009). It is generally acknowledged that practice change takes time and that there is a need for intensive, ongoing, and long-term PD programs (Markussen-Brown et al., 2017; Schachter et al., 2019) that account for the variation in individual learning. Therefore, it would be complicated to determine the universal duration of PD programs. As each teacher mastered each strategy targeted by her individualized PD program, it was hypothesized that each teacher could have mastered all the strategies with additional learning cycles.

Beyond individualization, another key to effectiveness could lie in the active ingredients of the PD program recommended by Biel and colleagues (2020): information sharing, modelling, supervised practice, and feedback. We attribute the significant increase in each strategy for each teacher to these 4 key parameters that were respected in this program. More specifically, sharing information on strategies provides new knowledge about the benefits of each strategy for children's oral language. This allows teachers to buy into the program and want to use strategies. Information on how to implement each strategy in practice also allows teachers to observe target behaviours during the modelling phase. Modelling is necessary to precisely show what behaviour is expected to implement the strategy (Brock & Carter, 2013, 2017). Teachers need to be allowed to practice the strategies.

This active participation simplifies the establishment of links between the theoretical concepts presented and their concrete application in the classroom (Zaslow et al., 2010). Finally, feedback on practice is imperative to engage in a process of reflection on practice, an essential step in changing one's practice. These feedback sessions are recognized as a fundamental parameter for the success of programs (Brock & Carter, 2016; Fallon et al., 2015; Peleman et al., 2018).

Inability to Generalize the Use of Mastered Strategies in Book Reading to Nontargeted Activities

This study showed that without coaching in all activities, teachers did not generalize the learning of a mastered strategy in book reading to another activity. It should be noted that while sharing information about each strategy, some examples were given of the application of the targeted strategy in activities other than book reading. This again highlights that traditional training that only provides knowledge is insufficient for a change in practice (Markussen-Brown et al., 2017). The finding also stresses that practice change is a process that takes time and practice, and requires long, continuous, intensive, and individualized PD programs.

It is likely that teachers would be able to quickly apply these learned strategies to other activities. It can be assumed that they would not need as much time as the first time to master them in new activities. One could imagine a program in which, once the strategy is mastered in book reading, a video of strategy use in another activity is shown, thus reducing the modelling phase. Nevertheless, this study shows that the generalization of practices from one activity to another does not happen naturally and that it is necessary to encourage teachers to engage in a process of reflection about strategies used in all activities. In any case, the process of practice change takes time and requires close support.

Together, these three findings have societal implications and must be considered by policymakers. Individualized, sustained, and ongoing PD programs are costly in terms of time, effort, and economics, but they are one of the most effective ways to support teachers in using more frequent language support strategies for all children (Peleman et al., 2018), and especially those who are socioeconomically disadvantaged. Early support for language development is indeed very important because early language level is notably predictive of future social and academic success (Chow & Wehby, 2018). Policymakers should consider how best to allocate the budget for PD.

Table 6

Tau Comparison of Occurrences of Trained Strategies During Nontargeted Activities Between Pre- and Postintervention Baselines

Teacher	Strategy	BL1	BL2	BL3	I1	I2	I3	I4	I5	I6	BL1	BL2	BL3	Pre M	Post M	Tau	P	Effect size
P1																		
	DEF	0	0	0	<u>0</u>	0	<u>0</u>	-	0	<u>0</u>	0	0	0	0.00	0.00	.00	.50	None
	IQ	6	7	0	0	1	<u>2</u>	-	0	<u>0</u>	0	3	4	4.33	2.33	.44	.81	None
	REL	1	2	0	2	0	1	-	0	<u>0</u>	1	0	0	1.00	0.33	.44	.81	None
	SC	1	5	0	0	0	0	-	<u>2</u>	<u>0</u>	1	0	0	2.00	0.33	.44	.81	None
P2																		
	DEF	2	0	0	<u>0</u>	0	<u>1</u>	0	0	<u>1</u>	0	7	0	0.67	2.33	.11	.41	None
	IQ	0	0	1	0	<u>30</u>	<u>8</u>	0	1	<u>0</u>	1	3	1	0.33	1.67	.78	.06	None
	SC	6	0	0	0	0	0	<u>0</u>	<u>0</u>	<u>0</u>	0	9	9	2.00	6.00	.56	.14	None
P3																		
	DEF	0	1	0	<u>0</u>	<u>2</u>	0	0	-	<u>1</u>	2	0	-	0.33	1.00	.44	.19	None
	SC	0	0	0	0	0	<u>0</u>	<u>0</u>	-	<u>0</u>	0	0	-	0.00	0.00	.00	.50	None
P4																		
	DEF	0	0	0	<u>0</u>	<u>0</u>	2	-	<u>0</u>	-	0	0	1	0.00	0.33	.33	.26	None
P5																		
	IQ	2	6	1	0	0	<u>2</u>	-	<u>0</u>	-	6	4	14	3.00	8.00	.67	.09	None
	SC	0	0	0	0	0	0	-	<u>0</u>	-	0	0	0	0.00	0.00	.00	.50	None

Note. P = participant; BL = baseline BL Pre M = baseline mean before intervention; BL Post M = baseline mean after intervention; I = intervention; DEF = definitions; IQ = inferential questions; REL = relating; SC = sentence completion. Underlined values indicate time of strategy implementation. Boxed values indicate time of combined use of several strategies.

Several limitations, inherent in all research, must be considered when reading these results. First, a threshold of nine occurrences of the same strategy per measure had to be reached in order to consider that the strategy had been mastered by the teacher, allowing training in a new strategy. This threshold remains arbitrary and could be debated. Other means of determining strategy acquisition could have been proposed as a criterion for use in other activities. However, the results show that setting this threshold as a target for each strategy in the training phases resulted in a significant increase in each strategy taught for each teacher after the intervention. Therefore, setting a threshold of nine

occurrences to be reached during the intervention phase seems to be effective in increasing the use of language support practices.

A second limitation could be advanced concerning the choice of activities to measure the ability to generalize the strategies mastered in book reading. Our methodological choice was to observe the activities planned immediately after the story-reading measures. That way, it was possible to check for a priming effect, but it involved considering activities of a very diverse nature from one teacher to another and from one measurement time to another. However, the target activities for

measurement were activities conducive to interaction, and the taught strategies are known to support word learning in any context (Wasik & Hindman, 2015). Therefore, regardless of the activity chosen, it should have been possible for teachers to use the strategies.

Finally, this study examined the number of strategies used, not their quality. Although the very specific counting criteria followed by the coders ensured a certain threshold of quality for each strategy counted, this study did not measure the improvement in the quality of the strategies used by the teachers during the intervention. For example, during the preintervention baselines, the recorded definitions tended to be rudimentary. In contrast, during the postintervention baselines, the recorded definitions were more elaborate and the information given about the words was more varied, such as the use of gestures and multiple synonyms. Counting occurrences does not highlight this improvement in the quality of strategies. It would be interesting to consider this improvement in strategy quality in future research protocols.

Conclusion

Oral language support is regarded as a key focus in preschool education. This is particularly important for the most disadvantaged children who are known to have generally lower levels of language skills than their peers. To this end, much research has examined the effectiveness of several PD programs. However, further individualization could increase the impact of these programs. The purpose of this study was to implement a PD program, individualized in terms of content and learning time with preschool teachers, and to evaluate its effectiveness in a targeted activity and nontargeted activities. The results show a significant increase in the use of strategies taught, with a majority of large effect sizes regardless of the teacher or strategy taught. However, these increases were only observed in book reading, the activity targeted by the program.

Despite theoretical information on how to generalize strategies mastered in the targeted activity to other activities, without modelling, it remains complicated to apply these strategies to other activities. This lack of generalization raises questions, as supporting language in one-time activities cannot guarantee a positive influence on children's language. Further research is needed to develop interventions that would allow teachers to easily use language support strategies throughout the day regardless of the activity offered in order to maximize the influence on children's language development.

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Data Availability Statement

All data obtained and/or analyzed are available from the authors upon reasonable request.