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Invented spelling activities in kindergarten: the role of instructional scaffolding and collaborative learning

Ana Albuquerque and Margarida Alves Martins

Centro de Investigação em Educação, ISPA – Instituto Universitário, Lisboa, Portugal

ABSTRACT

There is considerable evidence on the connections between emergent literacy-related skills in preschool-age and successful reading and writing. The purpose of this double-designed experimental/descriptive study was to analyse the impact of invented spelling activities on kindergarten children's spelling performance and to explore adult mediation and peer collaboration processes that occurred within a sample of intervention sessions. Data was collected with 52 participants divided into an experimental group and a control group who were submitted to a pre/post-test assessment. The global quantitative analysis revealed the strong impact of the intervention on children's word spelling progress scores. The descriptive qualitative data of 2304 verbal interventions of a small-scale sample suggested that significant and diverse mediation scaffolding strategies were incorporated by the children in a shared dialogical learning approach. Our findings point to the need for delivering group interaction activities combining early literacy contents in kindergarten contexts as a vehicle for responding to the challenge of reading and writing acquisition at the beginning of schooling.

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Theoretical background

Preschool age represents a critical developmental period in childhood education where emergent literacy skills arise in diverse forms and children's learning throughout these early years play a significant role in their later academic achievement. Thus, the emergent literacy approach perceives the operation of literacy learning as a process where the early literacy skillset acts as a foundation for later reading and writing ability. These key components include mainly cognitive skills and knowledge, such as oral language, letter knowledge, and phonological awareness (Adams 1990; Mann 1993; Melby-Lervåg, Lyster, and Hulme 2012; Treiman 2017; Tunmer, Chapman, and Prochnow 2006). Moreover, there is growing evidence that children's invented spellings – i.e. their early attempts to represent spoken language into print before receiving formal literacy instruction – also play a crucial role as they promote the understanding of the alphabetic principle and provide a rich opportunity to shift into conventional literacy (Caravolas, Hulme, and

CONTACT Ana Albuquerque aalbuquerque@ispa.pt Centro de Investigação em Educação, ISPA – Instituto Universitário, R. Jardim do Tabaco, 34, 1149-04 Lisboa, Portugal
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Snowling 2001; Gerde, Bingham, and Wasik 2012; Ouellette and Sénéchal 2008; Piasta 2016; Puranik and Lonigan 2011; Puranik et al. 2017; Shatil, Share, and Levin 2000; Zhang and Bingham 2019).

Encouraging young children to read and write, and to think and talk about sound and print seems to provide a positive 'kick-start' for literacy acquisition. Therefore, several researchers have addressed this subject in order to facilitate kindergarteners' metalinguistic thinking (e.g. Ouellette and Sénéchal 2008; Rieben et al. 2005). Furthermore, recent studies have explored the ways in which preschool teachers support children's early literacy development in kindergarten classrooms, particularly in deep/opaque orthographic language systems (Bingham, Quinn, and Gerde 2017; Copp, Cabell, and Invernizzi 2019).

However, in invented spelling-based interventions, the role of mediation strategies and interactive processes is not yet clear, since researchers have been focusing predominantly on the effectiveness of training on children's literacy outcomes. Thus, limited attention has been drawn to scaffolding strategies and collaborative processes that occur in the context of invented spelling activities, which constitutes the starting point to the design of the present research.

Because adult mediation and child collaboration seem to be critical elements of literacy acquisition, it is important to understand how external support can boost children's learning. This study represents an effort to implement an exploratory intervention focusing on early spelling skills through social interactions with adults and peers. These findings could provide insight regarding the links between verbal mediation strategies and preschoolers' spelling development in a linguistic system with moderately shallow/transparent orthographic depth.

Emergent literacy in early childhood – the role of invented spelling

In literate cultures, it is common for children to develop writing skills from scribbling to writing letters, from inventing written words to writing conventionally, before they are submitted to formal literacy instruction (Chomsky 1970; Read 1971). These early written productions – invented spellings – are perceived as a relevant means for exploring the written code since they have a beneficial imprint on decoding and metalinguistics (Aram 2005; Puranik and Lonigan 2014). Children play a participative role in this process as they actively use their cognitive resources to represent the sounds in print, involving analytic procedures in a problem-solving reasoning activity (Ferreiro and Teberosky 1979; Tolchinsky 2005).

These findings have been thoroughly researched in recent studies, engaging kindergarten children in metalinguistic thinking activities designed to promote learning experiences through invented spelling guidance, in language systems with diverse orthographic depth, such as English, French, Hebrew, Norwegian, and Portuguese (e.g. Alves Martins et al. 2016; Hofslundsengen, Hagtvet, and Gustafsson 2016; Levin and Aram 2013; Ouellette and Sénéchal 2008; Pulido and Morin 2017). In these activities, children's written productions are the basis for intervention, from which situations of cognitive conflict are generated to promote reasoning on the connections between oral and written language. This approach operates within the Zone of Proximal Development (Vygotsky 1962), i.e. the distance between the actual developmental level (independent problem solving) and the level of potential development (problem-solving under adult guidance or in collaboration with

more competent peers). Using dialogue as a privileged instrument for teaching-learning practices, these contexts lead to a positive disruption of children's knowledge through adult support interventions (e.g. immediate feedback, inferential cues, facilitating interventions, and mediation strategies), establishing an interactive dynamics that allows them to think about the logic of the alphabetic principle.

Social interaction in learning contexts – the role of adults and peers

Collaborative learning's approach lies its theoretical roots in Vygotsky (1962) and has been intensely researched throughout psychological, educational, and cognitive scientific studies. This perspective suggests that learning is built in interaction with others within specific social and cultural contexts, so the developmental process is depicted as a social activity, since knowledge learning is the result of a permanent link between the learner and the environment. Our skills first emerge at an inter-psychological level and then social mediation boosts the way we structure, guide, and carry our actions. Therefore, mediation is considered a crucial concept in sociocultural studies of development, learning, and literacy as the mediational means that people use in the process of speaking, reading, and writing shape the unit of analysis for literacy research. Accordingly, the study of literacy relies on the foundational theory that learning and development are mediated by psychological tools that produce culturally determined social features.

When transposing this model to classroom contexts, the teacher acts as facilitator of students' knowledge appropriation processes, thus assuming a role of orientation and group guidance. Social interactions and interventions in verbal discourse represent a means of access to learning mechanisms, acknowledging oral language as a tool of mediation in knowledge building (Vegas 2004). By fostering communication, discussion, and sharing of points of view, and simultaneously promoting autonomy in thinking, the role of the adult is strongly integrated into this support dynamics.

Generally, this framework encompasses a cooperative team-based approach to develop mastery skills, deepen understanding, and build knowledge. Several studies have made clear that when collaborative strategies are structured effectively, its impact on learning and expertise is consistently positive. Thus, communication and social interactions between peers are largely beneficial in a way that they activate cognitive functions and metacognitive skills (Cole 2006; Coll, Onrubia, and Mauri 2008).

In literacy acquisition, researchers have aimed attention at the social aspects of learning, exploring the concepts of mediation and scaffolding, in order to understand the strategies used by the adult in educational situations (Pentimonti and Justice 2010; van de Pol, Volman, and Beishuizen 2010). The process of scaffolding – related to the role of adults in problem solving – emerges as a way of boosting children's cognitive strategies for autonomous and efficient task execution (Wood, Bruner, and Ross 1976). The adult modifies and adapts his mediation strategies to encourage the progressive withdrawal of support and to enhance the internalisation and consolidation of procedures, taking into account the individual characteristics of the learner, the type of task, and the context in which the activity takes place. This view strengthens the relevance of cognitively challenging talk for children's development in a way that the use of questions encourages their participation in conversation at a more advanced, complex, and inferential level (Zucker et al. 2010). Also, more diverse scaffolding strategies seem to be linked to a more sophisticated

support action. Pontecorvo, Alejo, and Zucchermaglio (2005) stated that social interaction and peer support is also crucial to facilitate this learning process, particularly the development of metacognitive skills, which may occur in preschool children through conversational movements, such as the development of a common discourse argument, or communicative acts, such as explanations.

Accordingly, in classroom contexts, the adult may assume an active role and incorporate a meaningful and instructional teaching approach, engaging in different practices, in order to embed academic learning in children's activities by delivering comments or asking questions (Pyle, Poliszczuk, and Danniels 2018). Through instruction and/or intervention, the adult is granted to scaffold a skill into classroom practices, especially concerning literacy abilities, for instance, the understanding of the alphabetic principle (Botts et al. 2014). Observation studies have shown that teacher-directed activities are an appropriate literacy behaviour for preschool children (Wayne et al. 2007) and this engagement can be applied as an effective procedure to boost literacy skills and deepen metalinguistic knowledge, by providing the opportunity to participate in literacy purposeful experiences.

The present study

The first goal of this study was to analyse the impact of invented spelling activities on kindergarten children's spelling performance. We stated the hypothesis that children who participated in these activities would reach higher spelling progress scores as compared to control group children. Considering the central role of adult mediation and peer interactions on knowledge learning, our second goal was to explore the instructional scaffolding strategies and collaborative learning practices that occurred in these invented spelling group activities. The following research questions were outlined: What are the strategies used by the adult in the invented spelling activities and how do they progress throughout the sessions? What are the strategies used by the children in the invented spelling activities and how do they progress throughout the sessions?

Materials and methods

Research design

This study was based on a double design: experimental and descriptive. To determine the impact of invented spelling activities on children's spelling progress, two groups were created: experimental and control. A pre/post-test assessment was applied with both groups to evaluate word spelling skills before and after the intervention. To examine adult mediation and peer collaboration processes, a detailed descriptive analysis of social interactions and verbal discourse was then conducted with a sample of groups randomly selected from the experimental condition.

Participants

Participants included a sample of 52 five-year-old Portuguese children enrolled in three kindergarten classes from two schools in Lisbon where no formal literacy activities were

carried out as they followed the national curriculum guidelines for preschool education. Their socioeconomic status was diverse and measured by parental education level – mothers reported 7–16 years of schooling (M=14.38; SD=2.41) and fathers reported 6–18 years of schooling (M=13.83; SD=3.36).

Children from each classroom were randomly assigned into two groups: there were 11 girls and 17 boys in the experimental group (n=28; age in months: M=62.68; SD=3.95) and 9 girls and 15 boys in the control group (n=24; age in months: M=61.21; SD=3.05) – multiples of four children were then included in each small intervention group.

This study was licensed by the General Directorate of Education (Direção-Geral da Educação) and adequate provisions were kept protecting privacy and preserving data confidentiality – legal guardian permission and consent was previously required for all participants.

Measures

Cognitive ability

In order to foresee potential developmental difficulties, children's cognitive abilities were tested with the Raven's Progressive Matrices Test (Raven, Raven, and Court 1998), a non-verbal test used in measuring abstract reasoning. In this test, 60 multiple-choice items (visual geometric designs with a missing piece listed in order of difficulty) are presented and the test taker is asked to pick and fill in the missing piece from six to eight possible choices (max. score: 36 points; one point per correct item).

Letter knowledge

The experimenter randomly presented a set of flashcards with 23 letters of the alphabet printed in uppercase and asked the children to name each one (excluding K, W, and Y as they are rarely represented in Portuguese) (max. score: 23 points; one point per correct letter).

Syllable/phoneme awareness

Syllabic/phonemic skills were tested with an initial-syllable and initial-phoneme classification test (Silva 2002), two standard tests designed to analyse the ability to identify small linguistic units in Portuguese. Each test is composed of 14 items preceded by two examples. In each item, four pictures are presented – each one representing an oral word – where two of the words begin with the same sound, and the children are asked to identify them. Using Cronbach's alpha for evaluation, the internal consistency was 0.89 for the syllable test and 0.82 for the phoneme test (max. score in each test: 14 points).

Word dictation task – spelling pre/post-test

The spelling test consisted of an 18-word dictation task administered individually. The words were withdrawn from a children's frequent vocabulary knowledge list with common syllabic structures in Portuguese. The frequency of correct grapheme-phoneme correspondences was counted in both assessments.

Intervention description

Experimental group condition: invented spelling activities

The sessions were conducted in heterogeneous counterbalanced groups according to gender, letter knowledge, syllable awareness, and phoneme awareness. There were four participants per group, which is considered favourable in early literacy activities since young children seem to be more interactive in small-group settings as opposed to large-group environments (Wasik 2008). This diversity also allows children to expand the opportunities of discussion within each group.

Ten invented spelling sessions of approximately 20 minutes were carried out twice a week. In the first sessions, the priority was to code the initial consonants of words. From the fifth session onwards, the focus moved to a more complex level, to intermediate and final phonemes. In each session, children were encouraged to think about four words, one at a time, and decide which letters would be more appropriate to represent them. The researcher would write them down until the group had reached the final spelling.

The purpose was to promote the understanding of the alphabetic principle, guiding children to use the correct graphemes for different phonemes through a dialogical approach. The sessions were monitored by the researcher who played an important role in this process, acting as facilitator of the children's thinking course and interactions, by asking questions about their written productions and encouraging their active participation. The adult would generate positive interactions that triggered productive discussions about the written code and the oral speech, as well as the letters and sounds in each word. This supportive action was managed through diverse interventions: for instance, asking children to share and justify their points of view; challenging participants with more advanced thinking processes; highlighting different sounds of words; demonstrating example modelling procedures; providing adequate hints for task-solving operations; or asking direct and indirect questions.

Control group condition

Children were engaged in typical preschool classroom activities, such as storytelling.

Interactive processes and discourse analysis

The training sessions of three groups of children randomly selected from the seven groups of the experimental condition were audio recorded with the previous consent of the respondents' legal guardian. In order to access relevant qualitative data, the digital sound files of the first, fifth, and tenth sessions were then transcribed to clarify the analysis of interactive processes at the beginning, middle, and end of the intervention, based on significant discourse units. This analysis would provide valuable insight on the significant changes and trends over time in interactive approaches regarding children's interactions and adult mediation strategies. All transcripts were coded according to a classification system of interactive dynamics, presented in Table 1 with definitions for each category and illustrative examples – based on previous related studies (Alves Martins et al. 2017; Pentimonti and Justice 2010; van de Pol, Volman, and Beishuizen 2010; Vegas 2004).

Table 1. Classification system of adult-children/children-adult/peer interactions.

	Discourse	Definition	Examples
Adult	1. Direct question	Short inquiry.	*Teresa, which letter comes first?*
	2. Inferential question	Facilitating inquiry with a hint for the correct answer.	*Do you think the first letter is P or O?*
	3. Confirmation request	Question asked to approve a previous proposition.	*Do you all agree it is an O?*
	4. Explanation request	Question asked to justify the presented proposition.	*Why do you think the first letter is P?*
	5. Focus/management	Request to aim attention after hesitation/ disagreement.	*Think it over and tell me the letter.*
	6. Synthesis/mirroring	Recap of the previous proposition.	*Ana thinks it's P and José thinks it's H.*
	7. Explanation	Justification of a previous proposition.	*Like your name: it sounds like /u/ but it's O.*
	8. Procedure modelling	Example of a strategy to support task solving.	*PE-NA.*
	9. Feedback	Evaluation of an answer or previous proposition.	*Right! The letter A may have an /ɑ/ sound.*
	10. Visual representation	Written record of the group's final spelling.	*[Spelling: PT]*
Children	1. Direct answer	Short response.	*It's T.*
	2. Answer confirmation	Repetition of previous answer.	*It's P, I know it's P.*
	3. Agreement	Approve someone's proposition.	*Yes, P.*
	4. Disagreement	Disapprove someone's proposition.	*No! It's an A.*
	5. Argumentation attempt	Effort to answer a question or to justify an opinion.	*I think it's … I don't know.*
	6. Explanation	Justification of a previous proposition.	*The word is PE-NA so it's P.*
	7. Question/Affirmation	Inquiry/clarification addressed to the adult or a peer.	*What sound does it make?*
	8. Procedure modelling	Example of a strategy to support task solving.	*PE-NA.*

Assessment procedure

Children were assessed individually by two psychologists. The initial assessment (cognitive ability, letter knowledge, phonological awareness) took place in January and the pre-test was carried out in February. The intervention sessions began one week after the pre-test and lasted for 5 weeks. The post-test was conducted one week after this period. In order to monitor the fidelity of the experiment, all intervention sessions were issued by a psychologist expert in the scientific field of invented spelling who received training and supervision within our research team.

Data analysis

The results were examined using *IBM SPSS Statistics* – a widely applied software for conducting statistical analysis in social sciences – and descriptive statistics were used primarily to provide a summary about the sample and the initial observations; a repeated measures ANOVA was performed to test the differences in the spelling progress of both groups; chi-square independence tests were executed to test the changes in the participants' strategies throughout the sessions.

Results

Initial measures

Table 2 presents the means and standard deviations for preliminary measures.

Table 2. Descriptive statistics for preliminary measures.

	Cognitive ability (max.=36)		Syllable awareness (max.=14)		Phoneme awareness (max.=14)		Letter knowledge (max.=23)	
	M	SD	M	SD	M	SD	M	SD
EG	16.82	4.76	4.96	3.52	2.71	1.82	16.07	4.17
CG	15.21	4.33	4.33	3.49	2.96	1.85	16.46	3.90

As reported in Table 2, both groups were equivalent on cognitive ability, syllable awareness, phoneme awareness, and letter knowledge. T-tests including these four initial measures as dependent variables and the group as independent variable, revealed no statistically significant differences between the experimental group and the control group at the beginning of the experiment (p>.21 in all cases).

Experimental analysis – word spelling progress

In the pre-test, both groups displayed low equivalent spelling scores (EG: M=8.96, SD=6.20; CG: M=7.46, SD=8.58) whereas in the post-test, the experimental group scored significantly higher than the control group (EG: M=47.61, SD=15.82; CG: M=5.96, SD=6.47). A repeated-measures ANOVA using the group as independent variable and the pre/post-test scores (frequency of correct grapheme-phoneme correspondences) as dependent variable, revealed statistically significant differences between the two groups ($F_{(1,150)}$=165.9; p<.000; hp^2=0.77).

Descriptive analysis – social interaction process

From the initial pool of 52 participants, three groups of four children were randomly selected from the experimental condition and submitted to an exploratory qualitative analysis. This small-scale sample of twelve children was balanced in gender (6 girls and 6 boys) and age (months: *min.* = 62; *max.* = 72; M=65.75; SD=3.08).

Individual assessment: metalinguistic, literacy, and interactive measures

Table 3 presents the children's profiles in individual measures.

As demonstrated in Table 3, the groups were organised according to heterogeneous criteria regarding gender and initial literacy measures, so that each one was comprised of 2 girls and 2 boys, and at least one participant with a higher score and another one with a lower score on metalinguistic measures (letter knowledge, syllable awareness or phoneme awareness) and spelling pre-test scores.

Instructional scaffolding strategies and peer interactions: discourse analysis

A total of 2304 verbal interactions were audio-recorded and transcribed to be coded and examined: 731 in Group 1, 805 in Group 2, and 768 in Group 3. The preliminary analysis of participation revealed a highly dialogical interaction process portrayed by a balanced and shared dialogue between the adult and the children. From the first to the last session, a relatively stable proportion of interventions was identified. The global percentage of turns per interlocutor is displayed in Figure 1.

Table 3. Individual scores regarding metalinguistic, literacy, and interaction measures.

	Group_1				Group_2				Group_3			
	Clara	Henrique	Isabel	Tomás	António	Guilherme	Madalena	Maria	Catarina	Gonçalo	Mariana	Vicente
Letter knowledge (max.=26)	22	18	9	21	19	16	20	20	16	23	18	22
Syllable awareness (max.=14)	13	2	11	2	2	13	0	5	12	10	3	4
Phoneme awareness (max.=14)	5	1	2	2	1	4	0	3	4	9	3	2
Spelling pre-test (max.=68)	14	10	4	36	5	16	6	27	30	26	3	17
Spelling post-test (max.=68)	57	67	39	66	67	46	42	67	67	64	39	68
Spelling progress	43	57	35	30	62	30	36	40	37	38	36	51
Interaction frequency_S1	44	11	11	23	44	59	19	34	30	49	21	32
Interaction frequency_S5	29	24	4	20	6	8	6	8	19	16	19	13
Interaction frequency_S10	39	46	38	16	40	0	12	32	28	31	13	31
Interaction frequency_Total	112	81	53	59	90	67	37	74	77	96	53	76

Note: Spelling progress: difference between post-test and pre-test scores; Interaction frequency: number of occurrences of verbal discourse units per participant.

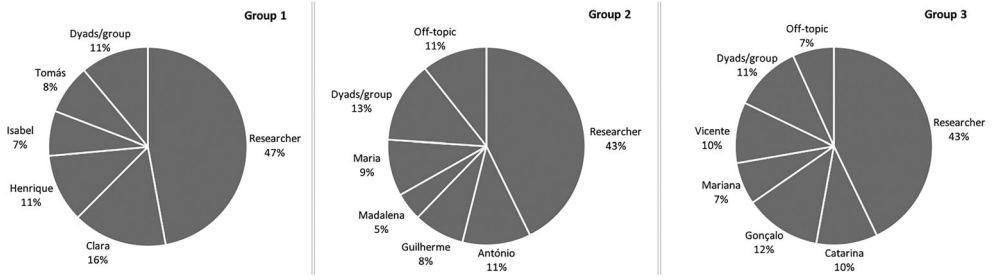

Figure 1. Percentage distribution of interactions per group.

These charts indicate a solid intervention of the experimenter throughout the sessions, who owned approximately 44% of the total percentage of turns (M=44.33) regardless of group or session number. This stability points to the significant role of the adult as a facilitator within the group of children while mediating social interactions and learning dynamics. Despite the children's degree of participation (who may increase or decrease frequency of intervention from session to session), the adult consistently preserved an active presence in nearly half the session. Children also shared verbal interventions in a balanced way, owning an individual score that ranged between 5% and 12% of turns. To describe the frequency and percentage score of each interactive category, a subsequent qualitative analysis was conducted. These scores are reported in Table 4.

As displayed in Table 4, there seemed to be an evident discrepancy in the prevalence of different categories depending on group and session number. Questioning was the most frequently used strategy by the adult, with particular emphasis on direct and inferential questions, followed by confirmation requests, procedure modelling, and synthesis/mirroring interventions. Concerning children's discourse, the most used strategies were direct

Table 4. Frequency and percentage scores of adult and children interactive categories in each session.

		Session_1		Session_5		Session_10	
		N	%	*N*	%	*N*	%
Adult	Direct question	96	24.49	64	23.70	86	20.53
	Inferential question	28	7.14	21	7.78	57	13.60
	Confirmation request	66	16.84	45	16.67	72	17.18
	Explanation request	14	3.57	24	8.89	29	6.92
	Focus/management	28	7.14	12	4.44	19	4.53
	Synthesis/mirroring	53	13.52	12	4.44	12	2.86
	Explanation	17	4.34	25	9.26	31	7.40
	Procedure modelling	37	9.44	22	8.15	62	14.80
	Feedback	11	2.81	5	1.85	6	1.43
	Visual representation	42	10.71	40	14.81	45	10.74
	Total	392	100	270	100	419	100
Children	Direct answer	139	29.70	95	36.26	115	28.12
	Answer confirmation	87	18.59	19	7.25	32	7.82
	Agreement	86	18.38	38	14.50	80	19.56
	Disagreement	48	10.26	12	4.58	20	4.89
	Argumentation attempt	3	0.64	7	2.67	13	3.18
	Explanation	36	7.69	24	9.16	38	9.29
	Question/Affirmation	8	1.71	8	3.05	21	5.13
	Procedure modelling	61	13.03	59	22.52	90	22.00
	Total	468	100	262	100	409	100

answers, answer confirmations, agreements, and especially procedure modelling which tended to increase throughout the sessions.

On the level of adult discourse, a chi-square independence test suggested a statistically significant association between categories and sessions ($\chi2(18) = 77.84$, $p<.001$). A substantial increase was found for procedure modelling and inferential questions from the first to the last session where high scores were reached. Explanations and explanation requests also increased from the first to the fifth session whilst synthesis/mirroring lost frequency from the first to the following sessions.

On the level of child discourse, a chi-square independence test also suggested a statistically significant association ($\chi2(14) = 74.40$, $p<.001$). On the one hand, an increase was found from the first to the following sessions for questions/affirmations. Similarly, argumentation attempts and procedure modelling highly increased their predominance, thus showing that children incorporated adequate task-solving procedures and became more aware of metalinguistic analysis operations. On the other hand, the frequency of answer confirmations and disagreements decreased from the first to the following sessions. Generally, the children internalised procedure modelling strategies and adopted a more active behaviour throughout the sessions – they exposed a larger frequency of questions/affirmations and revealed an effort to justify their suggestions, thus showing the impact of the intervention on learning. Two session transcripts are presented below to illustrate these results.

Example 1 – Group: Clara, Henrique, Isabel, Tomás | Session: 1 | Word: PATO (*duck*) | Letter: P

Researcher	Let's think about the word PATO. What is the first letter?
Tomás	A! A!
Clara	I know! It's P! P!
Tomás	A! A!
Clara	P! P!
Researcher	Clara thinks it's P and Tomás thinks it's A.
Clara	It's P, that's true! Because look: **P**A! It's similar to A but in fact it's P.
Researcher	What do you think, Isabel?
Isabel	P.
Researcher	Why do you think it's P first?
Isabel	Because it's PA, PA …
Researcher	What about you, Tomás? Is it A or P?
Tomás	It's an A.
Clara	No! PA, PA … PA-TO! PA! It's P.
Researcher	So what letter should I write down first? **P**A.
Clara	It's P! PA, PA!
Researcher	Do you all agree?
Tomás	Yes, it's P.
Children	P!
Clara	P, please!
Researcher	Letter P then. [Writes down P].

In this session, after a direct question that begins the activity, Clara and Tomás share different points of view, so the researcher endorses a synthesis/mirroring strategy in order to recapture the previous propositions and focus their attention (*Clara thinks it's P and Tomás thinks it's A.*). Clara – who gives the correct answer – actively repeats her suggestion providing an appropriate statement (*It's P, that's true! Because look: **P**A! It's similar to A but in fact it's P.*). To promote everyone's active participation in the discussion, the adult asks for Isabel's response and explanation (*What do you think, Isabel? / Why do you think*

it's P first?). When asking for Tomás' proposition, the researcher provides an inferential question including a hint in order to facilitate the answer (*What about you, Tomás? Is it A or P?*). After Tomás' response, Clara shows a disagreement towards her peer and illustrates her reasoning argument with a procedure modelling strategy (*No! PA, PA … PA-TO! PA! It's P.*). The adult then reinforces this procedure modelling to highlight the sound of *P* and asks for a general consensus with a confirmation request (*So what letter should I write down first? **P**A.*) before writing down the group's final answer (visual representation).

Example 2 – Group: Catarina, Gonçalo, Mariana, Vicente | Session: 10 | Word: DATA (*date*) | Letter: D

Researcher	Let's think about the word DATA. How should we spell it?
Vicente	D!
Gonçalo	**D**ATA … D!
Researcher	Girls, do you agree with Vicente and Gonçalo?
Children	Yes!
Researcher	Why is it D, Gonçalo?
Gonçalo	Because it sounds like D. It's **D**A!
Researcher	So should I write down the letter D, Mariana?
Children	Yes!
Researcher	Ok, letter D. [Writes down D].
Vicente	And now it's an A!
Researcher	Vicente thinks it's an A now. What do you think, Catarina?
Catarina	An A!
Researcher	Why?
Catarina	It makes the sound of A.
Researcher	D**A**. So should I write an A?
Children	Yes!
Researcher	Ok, letter A. [Writes down A]. And now? DA-**TA**!
Vicente	T! T!
Catarina	T!
Children	T!
Researcher	Does it make the sound of the letter T now?
Children	T!!
Vicente	DA**TA**!
Mariana	I can hear the sound of the letter T!
Researcher	So should I write T now?
Children	Yes!
Researcher	T then! [Writes down T].
Catarina	And an A!
Gonçalo	Yes, A!
Children	A!
Researcher	Why do you all think it's an A now?
Mariana	Because I can hear the sound of A.
Vicente	It makes an /ɑ/ sound!
Researcher	Ok, good, let's write an A then! [Writes down A]

In this session, after the adult's direct question that begins the activity, while Vicente gives a direct answer disclosing the correct solution (*D!*), Gonçalo starts by expressing a procedure modelling strategy to illustrate his understanding (***D**ATA … D!*). The girls' proposition is then asked with an inferential question calling attention to the boys' suggestion (*Girls, do you agree with Vicente and Gonçalo?*) and they all show an agreement. The adult recaptures Gonçalo's intervention, who had showed a more advanced thinking process, and asks him for an explanation (*Why is it D, Gonçalo?*) – he is able to give an appropriate answer with a procedure modelling strategy (*Because it sounds like D. It's **D**A!*). When requesting this answer confirmation, the researcher encourages Mariana's active participation (*So should I write down the letter D, Mariana?*) and then writes down the group's final decision (visual

representation). The children spontaneously proceed with the activity – Vicente actively provides the next response showing an adequate understanding of the metalinguistic operations involved in this task (*And now it's an A!*). The adult captures his suggestion with a synthesis/mirroring strategy and directly asks for Catarina's opinion (*Vicente thinks it's an A now. What do you think, Catarina?*). After her direct answer, an explanation is requested in order to stimulate her thinking process. Catarina is able to give a reason pointing to the sound of the letter (*It makes the sound of A.*). The researcher requests the group confirmation starting with a procedure modelling strategy to focus the children's attention on the phonological aspects of spelling (*D**A**. So should I write an A?*). After the group consensus, the letter is written down by the adult (visual representation) who immediately continues the activity with a direct question and a procedure modelling intervention (*And now? DA-**TA**!*). At this point all participants give the correct answer so the researcher asks an inferential question to promote their reasoning process (*Does it make the sound of the letter T now?*). The children provide several suitable responses from a procedure modelling answer (*DA**TA***!) to a more advanced explanation (*I can hear the sound of the letter T!*) and a general agreement is reached after a confirmation request. At the end of the session, after the visual representation of the third letter, the children become more active and participative and spontaneously continue the activity (*And an A!*), so the adult asks for an explanation request to challenge their thinking process (*Why do you all think it's an A now?*). The children demonstrate an increase in metalinguistic awareness by providing appropriate clarifications and relevant arguments (*Because I can hear the sound of A. / It makes an /α/ sound!*).

Discussion

The purpose of this study was to analyse the impact of invented spelling activities on kindergarten children's spelling performance and to explore adult mediation and peer collaborative processes that occurred within a sample of three intervention groups. Our hypothesis that children who participated in these activities would reach higher spelling progress scores as compared to control group children was confirmed. The results of this experiment, based on a moderately shallow/transparent orthographic language, are consistent with what has been found in previous studies conducted in diverse linguistic contexts, indicating that children who were engaged in invented spelling experiences with adult guidance improved their understanding of the alphabetic coding system. This intervention impacted their literacy acquisition to uphold the emergence of metalinguistic abilities, supporting the perception that interaction with written stimuli is a valuable element in kindergarten environments.

Following these findings, our second goal was to explore the instructional scaffolding strategies and collaborative learning practices that occurred in three sessions of three random intervention groups. As far as the first research question is concerned, the results demonstrated that the adult kept an active role throughout the sessions and gradually adapted mediation strategies to facilitate the learning progress and interactive dynamics. In this process, questioning seems to be used as a tool for challenging children's thinking course, especially considering that the adult reinforces the use of inferential questions and procedure modelling strategies along time.

Thus, regarding the experimenter's discourse, data showed that when considering procedure modelling and explanations simultaneously, the adult's endeavour to show or teach, either in a direct or indirect way, tended to increase. Also, procedure modelling growth seemed to reach higher scores than explanations. Inferential questions tended to escalate from the first to the following sessions and there was some propensity to decrease direct questions and synthesis/mirroring interventions, which reflects an indirect strategy to enhance thinking. When using procedure modelling and explanation requests, the adult showed a more challenging strategy seeking to broaden thinking mechanisms. This strategy suggests a progressive transfer of support and task control, developing children's autonomy associated with the consolidation of spelling (Cole 2006).

The adult adapted mediation strategies to the children's zone of proximal development, which indicates an active role in conducting interaction and communication, promoting discussion around graphemes, and guiding verbal discourse, to facilitate inferences about oral-written connections. According to Pontecorvo, Alejo, and Zucchermaglio (2005), exposure to confrontational situations involving argumentation and collective decision-making for problem-solving is essential in mediation. This strategy was evident in the adult's discourse, constantly asking for justification of the children's proposals and inciting discussion to achieve a group solution. Exploring these mediation processes helps to understand the individual approach used by the adult in each specific educational context and it seems that a more diverse set of scaffolding strategies is linked with a more sophisticated support action.

As far as the second research question is concerned, the results suggested a shared dialogical participation of the children in the invented spelling activities. They improved the quality of interventions as the frequency of questions/affirmations, argumentation attempts, and procedure modelling strategies increased throughout the sessions. In fact, when considering argumentation attempts and explanations simultaneously, the children showed an effort to understand the process of problem-solving in learning the alphabetic principle. They demonstrated an appropriation of thinking processes along time either by using explanations, argumentation attempts or even procedure modelling, which seemed to experience a great increase in all groups.

An interesting insight that should be focused is that children began to adopt behaviours of explicitness and procedure verbalisation, giving inferential cues to peers trying to simulate the role of the adult in the teaching-learning process. Procedure modelling interventions should, therefore, be highlighted, since children mirrored the researcher's behaviour by providing more advanced responses. This observation points to the significance of cognitively challenging questions as a beneficial means to encourage active participation in conversations at a more sophisticated, complex, and inferential degree (Zucker et al. 2010).

This study emphasises the importance of mediation and scaffolding for the advancement of cognitive and metalinguistic skills (Coll, Onrubia, and Mauri 2008). These findings recall previous research suggesting that in educational contexts, the adult is empowered to scaffold a certain skill, especially concerning literacy (Botts et al. 2014). In order to boost the progressive withdrawal of support and to encourage children to incorporate specific procedures, the adult adapts his mediation strategies by paying attention to the individual characteristics of the learner, the type of task and the context of the activity (Cole 2006; van de Pol, Volman, and Beishuizen 2010). In learning situations that lead to a knowledge disruption through active thinking about the alphabetic principle, the

adult applies dialogue as a plausible tool for teaching operations, using immediate feedback, inferential cues, and mediation strategies. By providing comments or asking questions, they may engage in a range of methods to enclose or scaffold several academic skills within children's activities, providing them the opportunity to take part in significant literacy practices (Pyle, Poliszczuk, and Danniels 2018).

Furthermore, the key seems to be to take conversational turns as a major component of interaction and the adult supports this process of children's turn-taking. These findings are in compliance with Pontecorvo, Alejo, and Zucchermaglio's (2005) perspective, disclosing that peer interaction is important to facilitate the self-learning route, particularly the maturity of metacognitive skills, which is expressed in preschool children through conversational movements (e.g. common discourse arguments) or communicative acts (e.g. explanations). In fact, the global analysis of social dynamics in this study described these invented spelling activities as a dialogical interaction process. Therefore, these results depict a shared management teaching-learning process where the adult acted as a facilitator within the group of children whilst simultaneously mediating social interactions and learning dynamics. The researcher surpassed an instructive and regulatory function in these group sessions – marked by a differentiated educational action, adopting strategies to promote participation and cooperation, and to boost a reflexive process of mental elaboration for task solving.

In summary, the adult played a vital role in these invented spelling-based activities when considering children's verbal and written inputs and trying to bolster their literacy skills and knowledge towards the understanding of the alphabetic principle. In fact, children were able to develop their word spelling abilities although having demonstrated low average phoneme awareness scores at the beginning of the experiment, which strengthens the metalinguistic nature of the intervention and the high-level degree of dialogue and interaction. It seems that children's letter knowledge and the adult's focus on sound units of words positively impacted this process. In this small-group model, the adult undertakes the process of word spelling to its conventional form through personalised feedback and direct facilitation in a context where explicit awareness of oral language is activated. Children are led to think about their own written production and to discuss about sounds and letters, as well as letter order within the word and other relevant aspects. Throughout this process, the activity is adapted to each session specific dynamics, especially at the level of reasoning demonstrated by the children in constant learning. Thus, it is important that this task considers adult mediation and dialogue among group members, so that all children actively participate and feel part of the learning process.

From an educational perspective, the intervention model applied in these sessions may be adapted to classroom contexts. The major assumption is to promote cognitive and metalinguistic processes, encouraging children to think about word spelling, to establish a collaborative dialogue and to justify their proposals, enhancing literacy development. When transposing this approach to an ecological setting, the facilitator is crucial for orientation and group guidance.

Concluding remarks and directions for future research

Instructional scaffolding and collaborative learning seem to be central aspects of learning processes, particularly in literacy development. Given the importance of children's content

learning in preschool years for their later academic achievement and since a great number of students still struggle when learning to read and write, invented spelling activities may be addressed in kindergarten curricula as a priority in the educational agenda. Research-based recommendations on how to put these elements into practice could integrate a positive strategy to support invented spelling activities. Thus, delivering early literacy contents and know-how in classroom contexts and routines may be a promising way to respond to these challenges.

However, in this study, only three groups of children were examined, which represents a great limitation for generalisation and restricts an accurate transfer towards broader patterns. Therefore, a greater dimension of groups and participants is recommended for future research. After discussing the significance of this study – developed in Portuguese, a moderately shallow/transparent linguistic system – there is now a necessity to examine the existing framework for the effectiveness of addressing invented spelling development and to explore the use of scaffolds in diverse orthographic structures and more deep/opaque languages. Moreover, this study points to the need for including a naturalistic framework of classroom environment in early literacy research involving kindergarten practitioners as trainers and group facilitators. This perspective would converge scientific experimental settings and naturalistic academic contexts bringing diverse insight for innovative kindergarten curriculum standards and guidelines.

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ORCID

Ana Albuquerque http://orcid.org/0000-0001-6370-7677
Margarida Alves Martins http://orcid.org/0000-0002-2773-1634

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