

Preschool performance in vocabulary and predictive skills in blended learning

Desempenho de pré-escolares em vocabulário e habilidades preditivas no ensino híbrido

Desempeño de preescolares en vocabulario y habilidades predictivas en aprendizaje combinado

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Abstract

Introduction: Remote teaching limited the experience of concrete experiences in collective spaces for the formation of knowledge and intensified children's vulnerability in terms of formal education, especially children in the initial phase of literacy. From this panorama, it became essential to investigate the performance of students in search of information about the impact caused by the pandemic of COVID-19 on child development. **Objective:** To verify the performance of preschoolers in vocabulary and predictive skills in hybrid teaching, given the impacts of the COVID-19 pandemic. **Method:** Participated in this study 12 schoolchildren, aged between 5 and 6 years, belonging to the third period of early childhood education. For the evaluation were selected the Protocol for Early Identification of Reading Problems, and the Auditory Vocabulary and Expressive Vocabulary Tests. **Results:** The data obtained showed statistical significance for the tests of Receptive Vocabulary in relation to Expressive, Rapid Automatic Naming and Alphabet Knowledge, Syllabic Segmentation and Rhyme Production, correct answers for Expressive Vocabulary and Alphabet Knowledge, as well as for the number of errors in Expressive Vocabulary and for the Automatic Rapid Naming. **Conclusion:** The desired success for entering the 1st year of Elementary

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Authors' contributions:

LMR: The researcher responsible for structuring the study, contributed to data collection and analysis, bibliographical survey, and manuscript writing.

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School will depend on the individual variations of each student regarding the performance of the aspects evaluated in this work and the quality of the stimuli received.

Keywords: Pandemics; Vocabulary; Literacy; Child; Reading

Resumo

Introdução: O ensino remoto limitou a vivência de experiências concretas em espaços coletivos de formação de conhecimentos e intensificou a vulnerabilidade infantil quanto à educação formal, em especial as crianças em fase inicial de alfabetização. A partir deste panorama, tornou-se fundamental investigar o desempenho de escolares em busca de informações sobre a repercussão ocasionada pela pandemia de COVID-19 ao desenvolvimento infantil. **Objetivo:** Verificar o desempenho de pré-escolares em vocabulário e habilidades preditivas no ensino híbrido, frente aos impactos da pandemia de COVID-19. **Método:** Participaram deste estudo 12 escolares, com idade entre 5 a 6 anos, pertencentes ao terceiro período da educação infantil. Para a avaliação foram selecionados o Protocolo de Identificação Precoce dos Problemas de Leitura, e os Testes de Vocabulário Auditivo e de Vocabulário Expressivo. **Resultados:** Os dados obtidos demonstraram significância estatística para as provas de Vocabulário Receptivo em relação ao Expressivo, Nomeação Automática Rápida e Conhecimento do Alfabeto, Segmentação Silábica e Produção de Rima, acertos para Vocabulário Expressivo e Conhecimento do Alfabeto, assim como para a quantidade de erros em Vocabulário Expressivo e para a Nomeação Automática Rápida. **Conclusão:** O sucesso almejado para o ingresso no 1º ano do Ensino Fundamental dependerá das variações individuais de cada aluno quanto ao desempenho dos aspectos avaliados neste trabalho e à qualidade dos estímulos recebidos.

Palavras-chave: Pandemias; Vocabulário; Alfabetização; Criança; Leitura

Resumen

Introducción: La enseñanza a distancia limitó la vivencia de experiencias concretas en espacios colectivos de formación de saberes e intensificó la vulnerabilidad de los niños frente a la educación formal, especialmente de los niños en fase inicial de alfabetización. A partir de este panorama, se hizo imprescindible investigar el desempeño de los escolares en busca de información sobre el impacto que la pandemia de la COVID-19 provocó en el desarrollo infantil. **Objetivo:** Verificar el desempeño de preescolares en vocabulario y habilidades predictivas en aprendizaje semipresencial, ante los impactos de la pandemia del COVID-19. **Método:** Participaron en este estudio 12 escolares, con edades comprendidas entre los 5 y 6 años, pertenecientes al tercer ciclo de educación infantil. Para la evaluación se seleccionaron el Protocolo para la Identificación Temprana de Problemas de Lectura, y las Pruebas de Vocabulario Auditivo y Vocabulario Expresivo. **Resultados:** Los datos obtenidos mostraron significancia estadística para las pruebas de Vocabulario Receptivo en relación con Expresivo, Denominación Automática Rápida y Conocimiento del Alfabeto, Segmentación Silábica y Producción de Rimas, aciertos para Vocabulario Expresivo y Conocimiento del Alfabeto, así como para el número de errores en Vocabulario Expresivo y para Nomenclatura Automática Rápida. **Conclusión:** El éxito deseado para el ingreso al 1º año de la Enseñanza Fundamental dependerá de las variaciones individuales de cada estudiante en cuanto al desempeño de los aspectos evaluados en este trabajo y la calidad de los estímulos recibidos.

Palabras clave: Pandemias; Vocabulario; Alfabetización; Niño; Lectura

Introduction

Child language is approached in two lines of study, named oral language and written language, which at the same time have striking differences and a strong feedback relationship. It is a correct analysis that oral language boosts children's learning to read and write. However, for them to learn so, it is not enough for them to be in contact with other children who can read and write; formal teaching is indispensable^{1,2}.

Acquiring oral language depends on a strong biological predisposition, whereas written language has a more social origin – i.e., its invention involved sociocultural demands, leading to conventional systems in various communities³. Moreover, the time taken to acquire and develop speech and writing varies from child to child, as social, emotional, environmental, and hereditary factors affect each one's pace as they grow⁴.

Among such factors, attention is called to vocabulary acquisition, which is the appropriation of open-class and closed-class words, which make up together the mental lexicon used in verbal communication. Open-class words have a lexical meaning, as they refer to names, qualities, states, actions, or conditions such as mode, time, and place; these are identified as nouns, adjectives, verbs, and adverbs. In their turn, closed class words represent categories associated with language syntax – i.e., they determine how lexical items are ordered in sentences; these are identified as pronouns, articles, conjunctions, prepositions, and numerals⁵.

In agreement with semantic-lexical and morphosyntactic progress, linguistic performance is also outlined by areas such as phonology and pragmatics, which are characterized by the recognition and use of the language in its sound segments (mainly represented by phonemes) and functional use in various contexts¹. Hence, when skills related to all these areas are consolidated as expected (typically developing children), they are more likely to develop a grammatically well-structured and intelligible discourse. This scenario provides a crucial basis for future school learning².

Brazilian Portuguese has an alphabetical writing system, which is characterized by a code with univocal correspondence between phonemes and graphemes – i.e., a grapheme is represented by a single phoneme. However, there are ambiguities as well because some graphemes may be represented

by more than one phoneme. This makes such a system almost transparent or regular, as complete regularity and transparency require that all graphemes have a single phonemic correspondence¹¹.

Thus, the key to acquiring an alphabetic writing system is discovering its phonemes, which in turn requires the acquisition of phonological awareness. This skill gives individuals mental awareness as they hear and use speech sounds and can be acquired and stimulated in preschool, during oral language development^{6,7}.

In this approach, using and improving phonological awareness, mental lexicon access (via rapid automatized naming), and phonological working memory are directly associated with vocabulary. Rapid automatized naming verifies how quickly children access the lexicon and name a word or image, while phonological working memory stores and processes information they read or hear in a phonological code. Hence, an expanded and organized vocabulary articulated with an efficient mechanism to access and retrieve material learned during preschool is essential to boost learning when children enter first grade³.

February 2020 was characterized by the confirmation of the first CODIV-19 case in Brazil, as a 61-year-old man traveled back from Italy to São Paulo and tested positive for SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). In March 2020, contagion already had significant consequences, eventually reaching a worrying mark of thousands of deaths. Given these events, it was necessary to take preventive measures such as social isolation and distancing, wearing masks, and sanitizing hands and personal belongings⁸⁻¹⁰.

Such alarming circumstances forced a large portion of the population to redirect their occupational and academic activities to remote mode. Consequently, in-person classes at school were canceled, and students began a challenging process of learning via systematized online format, receiving content on digital platforms or blended learning, depending on each town's hospital occupancy rate¹¹⁻¹³.

In this scenario, children who were being prepared to begin learning to read and write (as all basic and higher education students) had to adjust to an atypical and non-conventional learning reality. Regardless of the model each institution uses, children need a satisfactory balance between neurobiological and environmental conditions (which

characterize them as people) to construct a strong basis of knowledge to guide them as they learn to read and write^{11,14}.

However, the scenario associated with the development of such skills, which was almost fully outlined by the educational setting, had now changed. When such settings were closed, it interfered with interpersonal relationships and ruptured practical learning experiences in groups, which involved the interaction between teachers and students^{10,15}.

It is also important to point out possible organic consequences triggered by sequelae of coronavirus contagion (which are still being studied for scientific confirmation), psychological changes (emotional factors triggered by social isolation and distancing), and increased screen time (mobiles, TV, computer, and electronic devices in general), which may interfere with global child development. Furthermore, school learning content may have been lost, as parents had to dedicate their time to work, and most children in the age range in question are not autonomous to handle these digital platforms, do not have access to such resources, or are not autonomous to acquire new school content^{9,12}.

On the other hand, besides the impairments, the new situation may have provided certain gains – for instance, maturing routine construction, gaining autonomy to do tasks, refining attention and the visual and auditory perception needed to watch video lessons, developing creativity, imagination, and memory to play (which used to be done together with other children, but now had to be experienced alone). Parents also had a greater contact as mediators of the many activities that used to be carried out in school but now were done at home¹⁶.

Hence, the issue at hand is to identify how children responded to the stimuli they received in terms of language development and how parents and/or caregivers worked as mediators providing and dosing these resources, as children received content from different approaches. Depending on the media used, communication exchanges may have been unilateral (in the case of videos and games) or bilateral (in the case of interactive didactic games and online classes, in which teachers encourage conversations). Nuances like these can impact the quantity and quality of linguistic stimuli they internalized and the aspects of speech and writing they acquired¹⁴.

Remote learning limited concrete experiences in collective knowledge construction spaces and revealed a vulnerability in child education. Hence, such a scenario makes it essential to investigate preschoolers' performance in vocabulary and educational predictive skills to identify suggestive consequences of the COVID-19 pandemic on child development. Despite the lack of comparative data previous to the pandemic, understanding the current scenario makes it possible to outline more directed intervention strategies^{9,12,17}.

The hypothesis of this study is based on the possibility of analyzing school and vocabulary performance during social isolation and blended learning to gather information indicating possible aspects to be stimulated to maximize child educational development. Given the above, this study aimed to verify preschoolers' performance in predictive skills to learning to read and write and acquiring vocabulary as they returned to blended learning, considering the possible impacts of the COVID-19 pandemic.

Method

Ethical Procedures

This cross-sectional, experimental, quantitative analysis research was approved by the Research Ethics Committee under evaluation report number 5.073.456 (CAAE: 52646921.5.0000.5626). The participating institution signed an authorization form for the research, and the parents/guardians and participants received and signed informed consent and assent forms, respectively.

Participants

The study comprised 12 kindergarteners of both sexes, aged 5 to 6 years, attending a private school in Nova Friburgo, Rio de Janeiro, Brazil. During the COVID-19 pandemic, the institution initially had remote classes and later returned to blended learning, in which parents were free to choose whether their children should attend school in person, with the possibility of gradually returning to full in-person classes in the future. Thus, in agreement with the school principal, teachers, and the students' parents/guardians, data were collected at the school, as classes were returning to blended learning.

Research participants were selected according to the following inclusion criteria: students with

normal vision and hearing acuity and cognitive performance; typical motor development; absence of oral language changes or diagnoses; and who had returned to blended learning. The exclusion criteria were students who had undergone or were undergoing speech-language-hearing or psycho-pedagogical follow-up, with a diagnosis indicative of neurodevelopmental changes; and students who remained in remote learning. This information was obtained from their school records.

Instruments

The following three tests were used to identify and analyze the children's vocabulary and performance in predictive skills to learning to read and write: Reading Problems Early Identification Protocol (IPPL, in Portuguese)¹⁸ and the Auditory Vocabulary (TVFusp)¹⁹ and Expressive Vocabulary Tests (TVEp)¹⁹. These instruments are described below.

IPPL¹⁸ is an instrument indicated for students aged 6 years to 7 years and 11 months. It has subtests that aim to investigate seven cognitive-linguistic skills, as follows: alphabet knowledge; phonological awareness (rhyme production, rhyme identification, syllable segmentation, word production from a phoneme given, phonemic synthesis, phonemic analysis, initial sound identification); working memory; phonological information access speed; visual attention; word and nonword reading; and sentence comprehension based on figures given.

Given the participants' age range, the teaching method of the school where the study was conducted, and the unprecedented context of protection measures taken against COVID-19, it was necessary to adapt the instrument's structure and form of presentation before applying it. Hence, it used electronic devices such as computers, instead of printed paper, and 10 IPPL items and subitems that suited the assessment approach were selected – i.e., adapted to be used on the screen, as the stimuli were scanned and digitalized to favor the sanitation of the material. Moreover, a careful analysis was performed to survey the skills acquired in preschool, previously addressed in the school setting, making it possible to assess them in this age range. Thus, the visual attention test was adapted – since these students had not yet acquired the reading level, the test was presented with figures, and students were

instructed to identify which item corresponded to the word they heard, focusing on its length.

The other selected tests were as follows: alphabet knowledge (letter name identification), phonological awareness (rhyme production, rhyme identification, syllable segmentation, and word production based on a phoneme given), working memory, phonological information access speed, visual attention, and sentence comprehension based on figures given.

The vocabulary was assessed with two instruments to analyze receptive and expressive vocabulary. The receptive vocabulary was assessed with TVFusp¹⁹, which has 107 items in its original version, validated and standardized to be individually applied to children aged 18 months to 6 years and 11 months. The instrument early assessed the children's development of auditory speech comprehension and information processing. It was applied by presenting a digital page with images, and students were instructed to point to a single image that represented the word spoken by the researcher.

The expressive vocabulary was assessed with TVEp¹⁹, which has 100 items in its original version, validated and standardized to be individually applied to children aged 3 years to 6 years and 11 months. The instrument assessed information processing via visual input, lexical access, and word retrieval for motor production. It was applied by presenting a digital page with isolated images, which students were instructed to name.

The vocabulary tests were adapted by presenting them on digital pages, maintaining the number of stimuli and the application form proposed in the original version of the test.

Data Collection Procedure

All students in this study were submitted to the same assessment instruments. When they were invited to participate in the research, they were informed about its objective, the test application form, and the secrecy of the answers. Data were collected during regular school hours, with the teacher's consent and without missing classroom content. The tests were individually applied in two sessions, which lasted an average of 20 to 30 minutes each.

Data Analysis

Data analysis was described with their means, standard deviations (SD), minimum and maximum

values, and quartile distribution represented by the median and quartiles 1 (Q_1) and 3 (Q_3). The normality distribution was verified with the Kolmogorov-Smirnov test. The relationship between the variables was analyzed with the Spearman correlation test and the percentage of variance of the dependent variable, explained by the variation of the independent variable. The level of significance was set at 5% ($p \leq 0.05$), and the data were analyzed in Minitab software, version 19.2.

The correlation coefficient values used in the study range from 0 to 1 and can be positive (positive correlation) or negative (negative correlation). The values were interpreted as follows: 0 to 0.25 – inexistent to weak correlation; 0.25 to 0.50 – weak

to moderate correlation; 0.50 to 0.75 – moderate to strong correlation; ≥ 0.75 – strong correlation²⁰.

Results

The results are shown in tables that describe the analyses of variables of the instruments used in the study. Table 1 shows the students' performance distribution in the IPPL subtests and Expressive and Receptive Vocabulary Tests, according to the quantitative analysis of correct and wrong answers. The results are shown in mean, SD, minimum and maximum values, and quartile distribution (median, Q_1 , and Q_3).

Table 1. Students' performance distribution in the subtests of the Reading Problems Early Identification Protocol (IPPL) and Expressive and Receptive Vocabulary Tests

Variables	Mean	Standard deviation	Minimum	Q1	Median	Q3	Maximum
Alphabet knowledge	19.8	5.4	6	17	23	23	23
Rhyme production	1.5	3.8	0	0	0	1	13
Rhyme identification	6.6	7.4	0	1	3	15	20
Syllable segmentation	19.2	2.1	14	18	20	21	21
Word production	9.3	7.0	1	2	9	16	18
Phonological WM	20.5	2.8	13	20	22	22	23
RAN	47.8	14.1	33	42	45	48	88
Word read/perception	10.0	1.5	7	10	11	11	11
Hearing sent. compr.	17.6	1.5	15	16	18	19	20
Expr. vocab. correct	86.9	7.25	72	82	88	93	95
Expr. vocab. errors	13.1	7.25	5	7	12	18	28
Recept. vocab. correct	106.18	1.08	104	105	107	107	107
Recept. vocab. errors	0.818	1.079	0	0	0	2	3

Caption: Word production = Word production from a phoneme given; WM = working memory; RAN = rapid automatized naming; Word read/perception = word reading/perception; Hearing sent. compr. = hearing sentence comprehension; Expr. vocab. = expressive vocabulary; Recept. vocab. = receptive vocabulary; correct = correct answers.

The correlation analysis between the IPPL tests is shown in Table 2. The results show a statistical significance ($p\text{-value} \leq 0.05$) in the rapid automatized naming and alphabet knowledge subtests,

indicating a moderate to strong negative correlation, and in the syllable segmentation and rhyme production subtests, both with a strong positive correlation.

Table 2. Correlation analysis between IPPL tests

IPPL		Correlation (r)	95% CI	p-value
Rhyme product.	Alphabet knowl.	-0.014	(-0.609; 0.591)	0.968
Ident Rima	Alphabet knowl.	0.399	(-0.289; 0.815)	0.225
Syllable segment.	Alphabet knowl.	-0.131	(-0.679; 0.511)	0.7
Word production	Alphabet knowl.	0.202	(-0.459; 0.718)	0.552
Phonological WM	Alphabet knowl.	-0.044	(-0.628; 0.571)	0.897
Ran	Alphabet knowl.	-0.675	(-0.920; -0.052)	0.023*
Word read/perc.	Alphabet knowl.	0.529	(-0.150; 0.869)	0.095
Hear. sent. comp.	Alphabet knowl.	0.408	(-0.280; 0.819)	0.213
Rhyme identific.	Rhyme product.	0.516	(-0.166; 0.864)	0.105
Syllable segment.	Rhyme product.	0.756	(0.198; 0.944)	0.007*
Word production	Rhyme product.	-0.128	(-0.678; 0.513)	0.708
Phonological WM	Rhyme product.	-0.188	(-0.711; 0.469)	0.581
RAN	Rhyme product.	-0.077	(-0.647; 0.549)	0.822
Word read/perc.	Rhyme product.	-0.386	(-0.809; 0.301)	0.241
Hear. sent. comp.	Rhyme product.	0.092	(-0.539; 0.656)	0.789
Syllable segment.	Rhyme identific.	0.448	(-0.240; 0.836)	0.167
Word production	Rhyme identific.	0.176	(-0.478; 0.704)	0.606
Hear. sent. comp.	Rhyme identific.	0.334	(-0.350; 0.785)	0.316
RAN	Rhyme identific.	-0.506	(-0.860; 0.177)	0.112
Word read/perc.	Rhyme identific.	0.222	(-0.442; 0.729)	0.511
Hear. sent. comp.	Rhyme identific.	0.404	(-0.284; 0.818)	0.217
Word production	Syllable segment.	0.256	(-0.415; 0.747)	0.447
Phonological WM	Syllable segment.	0.041	(-0.573; 0.625)	0.906
RAN	Syllable segment.	-0.024	(-0.615; 0.584)	0.944
Word read/perc.	Syllable segment.	-0.292	(-0.765; 0.386)	0.384
Hear. sent. comp.	Syllable segment.	0.054	(-0.564; 0.634)	0.874
Phonological WM	Word production	0.329	(-0.354; 0.783)	0.323
RAN	Word production	0.142	(-0.503; 0.686)	0.677
Word read/perc.	Word production	0.567	(-0.103; 0.883)	0.069
Hear. sent. comp.	Word production	0.486	(-0.199; 0.852)	0.13
RAN	Phonological WM	0.089	(-0.541; 0.655)	0.795
Word read/perc.	Phonological WM	0.017	(-0.589; 0.610)	0.961
Hear. sent. comp.	Phonological WM	-0.027	(-0.617; 0.582)	0.937
Word read/perc.	RAN	-0.12	(-0.673; 0.519)	0.726
Hear. sent. comp.	RAN	-0.294	(-0.766; 0.384)	0.381
Hear. sent. comp.	Word read/perc.	0.286	(-0.391; 0.762)	0.394

* Spearman correlation coefficient test; 95% CI for p-value;

* p-value ≤ 0.05 indicates a significant correlation

Caption: Alphabet knowl. = alphabet knowledge; Rhyme product. = rhyme production; Rhyme identific. = rhyme identification; Syllable segment. = syllable segmentation; WM = working memory; RAN = rapid automatized naming; Word read/perc. = word reading/perception; Hear. sent. comp. = hearing sentence comprehension

The correlation analysis between IPPL and the Expressive Vocabulary Test is shown in Table 3. There was a statistically significant ($p\text{-value} \leq 0.05$) strong positive correlation between the number of correct answers in the Expressive Vocabulary Test and the alphabet knowledge subtest and between the number of wrong answers in the Expressive Vocabulary Test and the rapid automatized Naming subtest.

Strong negative correlations were found between the number of correct answers in the Expressive Vocabulary Test and rapid automatized naming subtest and between the alphabet knowledge subtest and the number of wrong answers in the Expressive Vocabulary Test.

Table 3. Correlation analysis between IPPL tests and Expressive Vocabulary

IPPL	Expres Voc	Correlation (r)	95% CI	p-value
Alphabet knowl	Correct	0.825	(0.353; 0.962)	0.002*
Rhyme product.	Correct	0.089	(-0.540; 0.655)	0.794
Rhyme identificat.	Correct	0.558	(-0.115; 0.880)	0.075
Syllable segment.	Correct	0.005	(-0.597; 0.603)	0.989
Word production	Correct	0.094	(-0.537; 0.658)	0.784
Phonological WM	Correct	0.069	(-0.554; 0.643)	0.839
RAN	Correct	-0.767	(-0.947; -0.220)	0.006*
Word read/perc.	Correct	0.467	(-0.220; 0.844)	0.147
Hear. sent. comp.	Correct	0.129	(-0.513; 0.678)	0.706
Alphabet knowl	Wrong	-0.825	(-0.962; -0.353)	0.002*
Rhyme product.	Wrong	-0.089	(-0.655; 0.540)	0.794
Rhyme identificat.	Wrong	-0.558	(-0.880; 0.115)	0.075
Syllable segment.	Wrong	-0.005	(-0.603; 0.597)	0.989
Word production	Wrong	-0.094	(-0.658; 0.537)	0.784
Phonological WM	Wrong	-0.069	(-0.643; 0.554)	0.839
RAN	Wrong	0.767	(0.220; 0.947)	0.006*
Word read/perc.	Wrong	-0.467	(-0.844; 0.220)	0.147
Hear. sent. comp.	Wrong	-0.129	(-0.678; 0.513)	0.706

* Spearman correlation coefficient test; 95% CI for p-value;
 * p-value ≤ 0.05 indicates a significant correlation with the Spearman test

Caption: Alphabet knowl. = alphabet knowledge; Rhyme product. = rhyme production; Rhyme identific. = rhyme identification; Syllable segment. = syllable segmentation; WM = working memory; RAN = rapid automatized naming; Word read/perc. = word reading/perception; Hear. sent. comp. = hearing sentence comprehension

The correlation analysis between IPPL and the Receptive Vocabulary Test is presented in Table 4. There was a statistical significance ($p\text{-value} \leq 0.05$) in the number of correct and wrong answers in the

Receptive Vocabulary test and the hearing sentence comprehension subtest, which were respectively a moderate to strong positive correlation and a moderate to strong negative correlation.

Table 4. Correlation analysis between IPPL tests and Receptive Vocabulary

IPPL	Recep Voc	Correlation (r)	95% CI	p-value
Alphabet knowl.	Correct	0.014	(-0.591; 0.609)	0.968
Rhyme product.	Correct	0.545	(-0.131; 0.875)	0.083
Rhyme identificat.	Correct	0.272	(-0.402; 0.755)	0.418
Syllable segment.	Correct	0.586	(-0.078; 0.890)	0.058
Word production	Correct	0.368	(-0.318; 0.801)	0.266
Phonological WM	Correct	-0.27	(-0.754; 0.404)	0.422
RAN	Correct	-0.128	(-0.677; 0.513)	0.708
Word read/perc.	Correct	-0.128	(-0.677; 0.513)	0.708
Hear. sent. comp.	Correct	0.63	(-0.017; 0.905)	0.038*
Alphabet knowl	Wrong	-0.014	(-0.609; 0.591)	0.968
Rhyme product.	Wrong	-0.545	(-0.875; 0.131)	0.083
Rhyme identificat.	Wrong	-0.272	(-0.755; 0.402)	0.418
Syllable segment.	Wrong	-0.586	(-0.890; 0.078)	0.058
Word production	Wrong	-0.368	(-0.801; 0.318)	0.266
Phonological WM	Wrong	0.27	(-0.404; 0.754)	0.422
RAN	Wrong	0.128	(-0.513; 0.677)	0.708
Word read/perc.	Wrong	0.128	(-0.513; 0.677)	0.708
Hear. sent. comp.	Wrong	-0.63	(-0.905; 0.017)	0.038*

* Spearman correlation coefficient test; 95% CI for p-value;
 * p-value ≤ 0.05 indicates a significant correlation with the Spearman test

Caption: Alphabet knowl. = alphabet knowledge; Rhyme product. = rhyme production; Rhyme identific. = rhyme identification; Syllable segment. = syllable segmentation; WM = working memory; RAN = rapid automatized naming; Word read/perc. = word reading/perception; Hear. sent. comp. = hearing sentence comprehension

Discussion

The COVID-19 pandemic caused many educational demands and highlighted issues that were previously already requiring careful attention to stimulate students. Hence, the results to be discussed in this study could not compare data before the social isolation and when activities were resumed. Rather, based on the specialized literature, hypotheses were raised regarding factors associated with the performance in vocabulary and predictors of learning to read and write.

The receptive vocabulary test data show a higher mean number of correct answers than the expressive one. The auditory stimulus information in the Receptive Vocabulary Test is already mingled with other ones. Hence, children need to identify which is better associated with the preestablished image in their mental lexicon. They have to relate the meaning to its corresponding item, which is not an easy task – although this test has an auditory cue in association with the image shown on the page^{6,16}.

On the other hand, the Expressive Vocabulary Test provides only a visual cue. Thus, children must have previous contact with the words given, often enough to have them fixed in their semantic field with the possibility of retrieving them as needed²¹.

The greater and better the quality of the mediation for received linguistic stimuli, the greater the number of words stored and the quality with which the vocabulary tends to be stored. The pandemic limited the exposure of children to such stimuli, as social exchanges were limited to the family, which is suggestive of attenuated interactive verbal communication (involving the notorious use of expressive vocabulary). On the other hand, it is believed that it may have intensified the retention of auditory and visual information, directly associated with the use of receptive vocabulary, due to screen exposure during educational or leisure activities, for instance^{4,10,17,22}.

The results between the rapid automatized naming and alphabet knowledge tests show a statistically significant moderate to strong negative correlation. Hence, the analysis shows that the more correct answers in alphabet letter naming, the less time needed to name figures in the rapid automatized naming test. This is associated with the relationship of the time taken to access the lexicon when doing activities. As an example, in both activities, children verbalize sequentially a list

of symbols – letters in one and a variety of images in the other^{3,16}.

The literature presupposes that children with difficulties accessing precisely their mental inventory of images, words, or sounds have negative consequences in deeper decoding, reading comprehension, and fluency skills. This finding can be corroborated by this study, as students that took longer in rapid and automatized naming images also had few correct answers when trying to recognize letters of the alphabet. Likewise, those who took less time in the first task also had a greater capacity to visualize letters and associated them with the respective sounds. Processing speed depends, among other factors, on the development of cognitive skills such as attention and memory^{22,23}.

Considering that up to 6 years old brain connections are still being established, it can be questioned whether children had to explore their neuroplasticity during social distancing to gain autonomy in school activities. Hence, the occipital-temporal region, which is importantly relevant to learn to read and write, played a crucial role in this process. Therefore, through neuronal plasticity, the competence to recognize stimuli quickly and correctly may have enabled the creation of greater cognitive resources available to the alphabet code recognition task^{2,7,24}.

Mastering rhymes is an important phonological awareness skill for preschoolers, as it allows children to recognize words with the same sound ending. From another perspective, word segmentation requires a notion of the concept of syllables (i.e., that words can be fragmented into parts). This process depends on the knowledge of word length, as the longer the structure, the greater the number of syllables it has⁷.

Rhyme production and syllable segmentation require the perception of time and rhythm and the comprehension of word structure to recognize its elements (beginning, middle, and end). The target public in question had more correct answers in the syllable segmentation test than in the rhyme production one².

This shows the sensitivity to the notion of the word structure as a whole and its subdivision into parts – i.e., the overall number of syllables. However, a more specific analysis of final word segment recognition (which is focused on the sound combination and is a more abstract perception) showed an increase in the difficulty level^{1,25}.

This performance profile allows for some hypotheses that explain the performance with a higher mean of correct answers in the syllable segmentation task than in the rhyme production one. Children usually learn syllable families in preschool and therefore explicitly develop syllable awareness as they combine consonants with their pairs, thus forming syllables^{2,16,26}.

Students assimilate and reinforce this knowledge as they practice daily school exercises. Then, in the following year, they continue learning and practicing more in-depth syllable connections to form words and sentences – which is one of the educational processes to successfully learn to read and write. Even during remote teaching, this skill was systematized in online classes and with activities to be done asynchronously. On the other hand, rhyme production tasks are usually not taught explicitly, but implicitly, using music and plays, which minimizes its remote teaching or makes it unfeasible^{3,10}.

Even though it is not formally taught, unlike syllables, the school setting is appropriate to develop fun strategies to help children internalize the awareness and notion of rhymes. Given that teaching phonological awareness skills in-person is a challenging mission, teaching and acquiring it remotely can be even more laborious^{8,15,27}.

It is interesting to point out that Brazilian preschool teaching systems in general are not usually based on methods that involve the letter-sound relationship. If such learning were explicit, the results might be recognized by facilitated and improved expressive and receptive vocabulary, which would lead to students' significant academic gains and middle- and long-term consequences in curricular activities in elementary, middle, and high school, for instance^{8,26}.

To recognize the letters of the alphabet, children must have a visual representation of each letter in their mental lexicon and correctly identify the corresponding sounds. Hence, when asked to name vowels and consonants, students access their visual lexicon to recognize the written stimulus and then transform this information into a verbal answer, after their speech production lexicon. Thus, alphabet knowledge involves expressive skills to name each letter, which is crucial to the whole word decoding process^{2,16}.

Expressive Vocabulary Test performance likewise depends on previously stored images as-

sociated with their verbal correspondence – i.e., children must have received adequate linguistic stimulation throughout their development. Therefore, the higher mean performance in expressive vocabulary tests demonstrates a greater use of this lexicon access route in both the visual input system and speech production system. Constantly using expressive vocabulary tends to lead to better completion of later more complex tasks, such as recognizing the letter-sound relationship associated with words^{6,8,22}.

The results of this research point to a statistically significant strong positive correlation between expressive vocabulary and alphabet recognition, considering the correct answers in the Expressive Vocabulary Test. The previous discussion in this study regarding the better performance in receptive than expressive vocabulary does not change the fact that during the months of social distancing children also had communication exchanges in the context to which they belonged, even though it was more limited. Hence, the lexical structure of word storage continued to grow because, despite being heterogeneous and ruptured, this process is continuous and progresses to a greater or lesser degree depending on the quality and quantity of stimuli the person receives in the various settings they attend^{8,28}.

Hence, based on the previous outline, the ability to relate a letter to its respective sound and associate it with word production can proportionally benefit a greater number of correct answers in tasks involving expressive vocabulary. Moreover, it must be reinforced that the last preschool year provides a solid learning basis supported by the transmission of knowledge of the Brazilian Portuguese alphabet code, as the consolidation of such understanding is predictive of the child's process of learning to read and write. Hence, online classes aimed to ensure such learning, as alphabet letters were progressively and sequentially presented – which also explains the satisfactory number of correct answers in the alphabet knowledge task^{9,13,27}.

The rapid automatized naming task verifies how quickly children can access the lexicon to name certain stimuli – in this case, images. Students must first have an expressive vocabulary that encompasses such stimuli – i.e., they must be able to name the stimuli they see. Also, their information processing must be quick and precise to discriminate rapidly the items presented to them. Hence,



children with difficulties transposing verbally the words stored alone may have performed below the expected in tasks that require such skill associated with more stimuli and adequate processing speed²⁹.

The results point to statistical significance between the Expressive Vocabulary Test and rapid automatized naming – a strong negative correlation for correct answers and a strong positive correlation for wrong answers. Thus, students who took longer in rapid automatized naming of images also had fewer correct answers regarding the words that represented figures in the Expressive Vocabulary Test. Likewise, those who took less time in the first task had greater capacity in the second one^{3,16}.

Given the above, considering the context of the COVID-19 pandemic, it is necessary to return to a point previously discussed in this study concerning the evident attenuation of verbal communication involving expressive vocabulary – but in this analysis relating it to processing speed. The profile of children who took long to name images in the rapid automatized naming test may be associated with the lack of and/or difficulty automatizing the use of elements present in their mental lexicon³⁰.

Cognitive, affective, and psychomotor domains and family and social relationship skills can be affected as their exchange experiences are limited^{9,12}. Each one of these domains may have had consequences on both mental lexicon structure for word production and information processing maturation. It must be considered that if these bases are not previously reinforced, later school learning stages may be compromised²³.

Word comprehension requires the phonological identification of its structure and knowledge and development of its meaning. It can be stated that the greater the capacity to mentally translate a verbal stimulus into an adequate mental representation, the greater the receptive vocabulary basis. It is also essential to have adequately functioning central auditory processing in combination with the integrity of the peripheral hearing system to perceive and discriminate hearing stimuli¹⁶.

Hence, when children do not perform as expected for auditory perception and discrimination, in combination with an inadequately structured lexicon and/or delayed central auditory processing skills, they are likely to have difficulties in more complex tasks, going beyond words to involve sentences – which also requires greater morphosyntactic knowledge. On the other hand, a reinforced

receptive vocabulary basis is likely to facilitate more complex cognitive and linguistic tasks^{3,6}.

According to the literature, the age range addressed in the study is expected to manifest an intense development of narrative and comprehension aspects, along with greater applicability of closed-class elements in their sentence constructions. Thus, it can be hypothesized that the many correct answers in the Receptive Vocabulary noun task favored the hearing comprehension of syntactically more complex sentences. This also requires the recognition of closed class elements, such as articles and conjunctions, while processing the sentences^{5,7}.

The same reasoning previously used in this study can also be used concerning the consequences of social isolation on children's receptive vocabulary organization, but this time associating it with hearing sentence comprehension. Thus, the notorious constant physical contact experienced before the pandemic was possibly compensated by more passive activities in terms of expressive language. Hence, absorbing content from television programs, computer and mobile games, and even from interacting with the family may have helped develop information processing and word correspondence. Furthermore, the receptive lexicon is identified as the first one to be structured and progress in early child development as a basis for the expressive lexicon to progress toward refined morphosyntactic linguistic aspects in later ages^{10,12-14,28}.

The data obtained and discussed in this study refer to a focus, convenience sample of a private school. Thus, there is an evident need for further research with larger samples in different public and private educational settings to identify preschool performance as in-person classes resumed. Another point to address with this study is the reassessment of students after being back in contact with the classroom to measure the gains in such skills from being in the educational context.

Final Considerations

This study could not identify which limitations in vocabulary and educational predictive skills were due to the social distancing caused by the COVID-19 pandemic regarding preschoolers' performance. It is believed that the pandemic limited the exposure of children to communication



exchanges, cognitive challenges, and new learning in the school setting, as such experiences were limited to the home.

Nevertheless, the data on the group's performance led to the conclusion that they absorbed hearing and visual information, given their receptive vocabulary performance. Concerning educational predictive skills, the mean answers were within the expected from developing performances – although some skills did not follow this pattern, either for teaching method issues or possible effects of online classes. However, this performance cannot be linked specifically to remote learning.

Therefore, the aimed success to enter first grade depends on each student's variations concerning their performance in aspects assessed in this study. The higher the quality of the skill development in question, the more likely they are to conduct and complete satisfactorily their process of learning to read and write, though preceded by an atypical and challenging remote learning scenario.

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