

LITERATURE REVIEW

THE USE OF THE CLOZE TEST IN READING COMPREHENSION ASSESSMENT IN BRAZIL: POST- PANDEMIC CHALLENGES



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ABSTRACT

The cloze test is a pedagogical tool used by teachers and psychologists for 70 years to assess proficiency in understanding texts in different languages, both L1 and L2, including Brazil. The test was based on the systematic gapping of a text, and hit scores were associated with the participants' degree of comprehension of the task. This procedure allows for distinguishing reader profiles—frustrated, instructional, and independent—by checking the participants' performance when filling in the gaps. Almeida's survey (2023) showed that 75 of the 345 studies on reading assessment over the last 20 years adopted this procedure. In the current COVID-19 post-pandemic context, where reading asymmetries have become even more pronounced, relying solely on the criterion of exact word matching proves inadequate for accurate diagnosis. The post-pandemic assessments conducted at the Colégio de Aplicação of the Federal University of Sergipe indicated that several students exhibited insufficient reading comprehension (Santos and Machado, 2022, Cardoso *et al.*, 2024). This information underscores the need to encourage the use of consolidated tools such as the cloze test, which

can assist educators in enhancing both their teaching practices and students' reading proficiency. This article systematically reviews studies published across three databases that have applied the traditional cloze test to assess reading comprehension. The analysis criteria are based on Taylor's (1953) original exact answers proposal (Brown, 1980, 2013) and are supplemented by additional assessment tools from the psychology field. This systematic review focuses on empirical studies that examined reading assessment through the cloze test, specifically those published between 2009 and 2022, and applied it to elementary school students to investigate the measures used to assess the test responses. Our research suggests that most studies have employed the exact word completion criterion (Joly and Istome, 2008), similar to computerized tests (Joly; Piovezan, 2012; Brito; Ribeiro; Seabra, 2022), instead of incorporating alternative approaches, such as word familiarity (Oliveira *et al.*, 2007) or grammatical class (Abreu *et al.*, 2017). We highlight the need to integrate natural language processing techniques, including lexical distance measurements, to offer a more refined comprehension analysis in the context of low reading proficiency. These lexical distances are calculated based on the "minimum number of insertions, deletions, or substitutions of a single character needed to transform one word into the other" (Petroni and Serva, 2010), while maintaining consistency in grammatical class or semantic field with the expected word.

RESUMO

O Teste cloze é uma ferramenta pedagógica utilizada por professores e psicólogos há 70 anos para avaliar a proficiência na compreensão de textos em diferentes idiomas, tanto L1 quanto L2, incluindo o Brasil. A base do teste consiste na omissão sistemática de palavras em um texto, e as pontuações de acerto são associadas ao grau de compreensão da tarefa pelo participante. Esse procedimento permite distinguir perfis de leitores – frustrado, instrucional e independente – com base no desempenho do participante quanto ao preenchimento das lacunas. A pesquisa de Almeida (2023) aponta que 75 dos 345 estudos sobre avaliação de leitura, nos últimos 20 anos, adotaram esse procedimento. No atual contexto pós-pandemia de COVID-19, em que as assimetrias na leitura tornaram-se ainda maiores, a adoção exclusiva do critério de correspondência exata de palavras mostra-se insuficiente para um diagnóstico preciso. As avaliações pós-pandemia realizadas no Colégio de Aplicação da Universidade Federal de Sergipe indicaram que vários estudantes apresentam compreensão leitora insuficiente (Santos; Machado, 2022, Cardoso *et*

al., 2024). Esses dados reforçam a necessidade de incentivar o uso de ferramentas consolidadas, tais como o teste cloze, que podem auxiliar os educadores na melhoria tanto das práticas de ensino quanto da proficiência leitora dos estudantes. Esse artigo revisa, sistematicamente, estudos que aplicaram o teste cloze para avaliar a compreensão leitora e que foram publicados em três bases de dados escolhidas para esta pesquisa. Os critérios de análise baseiam-se na proposta original de respostas exatas de Taylor (1953) e (Brown, 1980; 2013) e são complementadas por instrumentos adicionais de avaliação provenientes do campo da psicologia. A revisão sistemática enfoca estudos empíricos publicados entre 2009 e 2022 que analisaram a avaliação de leitura por meio do teste cloze, especificamente aqueles aplicados a estudantes do ensino fundamental, com o objetivo de investigar as medidas utilizadas na correção das respostas ao teste. Esta pesquisa indica que a maioria dos estudos empregou o critério de completamento exato da palavra (Joly; Istome, 2008), assim como os testes computadorizados (Joly; Piovezan, 2012; Brito; Ribeiro; Seabra, 2022), em vez de considerar abordagens alternativas, como a familiaridade lexical (Oliveira *et al.*, 2007) ou classe gramatical (Abreu *et al.*, 2017). Destacamos a necessidade de integrar técnicas de processamento de linguagem natural, incluindo medidas de distância lexical, para oferecer um entendimento mais preciso da compreensão em contextos de baixa proficiência leitora. Essas distâncias lexicais são calculadas com base no “número mínimo de inserções, deleções ou substituições de um simples caractere necessário para transformar uma palavra em outra” (Petroni; Serva, 2010), mantendo a consistência quanto à classe gramatical ou ao campo semântico da palavra esperada.

KEYWORDS

Cloze Test; Exact Answers; Systematic Review.

PALAVRAS-CHAVE

Teste Cloze; Respostas Exatas; Revisão Sistemática.

INTRODUCTION

The cloze test, also known as the cloze procedure, has been widely used to assess reading proficiency in first- and second-language contexts. Initially developed by Taylor in 1953, the cloze test was designed to evaluate the readability of texts for native English speakers. Researchers have expanded its use by adopting the cloze test as an instrument to measure proficiency in English as a foreign language (Brown 1980, 2002). Since then, it has been integrated into exams such as the Test of English as a Second Language (TOEFL) and Teaching English to Speakers of Other Languages (TESOL) assessments.

The cloze test is currently used to evaluate how well a subject comprehends the meaning of a given text. In this procedure, the subject is required to read a text and then fill in blanks with a single word, which could be functional (e.g., prepositions, articles, conjunctions), lexical (e.g., nouns, adverbs, adjectives), or even a random term (Abreu *et al.*, 2017; Cardoso, Menezes Freitas and Freitag, 2024; Colombo and Cárnio, 2017). The primary goal of this test is to allow participants to complete a passage by supplying omitted words, thereby obtaining meaning. The foundation of the cloze test lies in the systematic omission of words from a passage of prose (Bickley *et al.* 1970), with participants' scores reflecting their level of comprehension. In Brazil, the cloze procedure has been effectively utilized as a key tool for assessing L1 reading comprehension.

The cloze test can be a valuable tool for teachers and researchers to identify and distinguish three readers' profiles – frustrated, instructional, and independent (Bormuth, 1968) –based on their performance. The frustrated level refers to participants who achieved up to 44% of correct literal answers, the instructional level applies when participants scored between 45% and 57% of correct answers, and the independent level was reached by individuals who scored more than 57% of correct answers according to the original passage of the text.

These results are useful for calculating the individual performance of cloze test-takers. Once a participant has completed the test within the stipulated time, the total number of correct responses must be counted, multiplied by 100%, and divided by the total number of deleted spaces (Cardoso *et al.* in press).

This study investigates methods to evaluate gap-filling through exact answers (EX) (Brown, 1980), which are considered the most appropriate to the context, thereby demonstrating students' comprehension of the text. The criteria for analyzing these responses were based on Taylor's initial proposal (1953), which prioritizes the exact answer. Despite alternative methods, such as multiple-choice and Clozentropy (Brown, 1980; Darnell, 1968), this study focuses on the exact-answer method, within the Brazilian context, where teachers must manually check their students' responses, making the process less time-consuming.

The primary objective of this systematic review was to identify the most validated cloze test assessment measures through empirical studies and published research, with a particular focus on Elementary School students. Almeida (2023) reported that the cloze procedure appeared in 75 of 345 studies on reading assessment over the past 29 years, highlighting the significance of

investigating this procedure and its scoring methods. Three virtual databases – Scielo, Scopus, and Web of Science – were consulted for this study.

In the post-pandemic period, reading asymmetries have widened compared to the pre-pandemic era, yet the exact word criterion does not provide a fully adequate reading diagnostic; it remains the most appropriate available method. Post-pandemic applications conducted at Colégio de Aplicação of Universidade Federal de Sergipe revealed that some students were classified as having insufficient comprehension or frustration (Santos and Machado, 2022, Cardoso *et al.*, 2024). These findings underscore the importance of encouraging the use of well-established tools such as the cloze test, which can aid education professionals in refining their practices and enhancing students' reading proficiency levels.

The remainder of this paper is organized as follows. It begins with a brief introduction to the cloze procedure and the stages used to create this test. The second section provides a review of the relevant literature. Subsequently, this article outlines the methodology. The subsequent sections present the results, including the analysis of the papers selected for this study and a discussion supported by additional data. In the final section, the authors emphasize the applications of cloze tests, advocate for the broader dissemination of this practice across other regions of Brazil, and suggest the adoption of semantic similarity responses.

1. BACKGROUND

In 1953, journalist Wilson Taylor developed the cloze test or cloze procedure to assess children's reading comprehension and evaluate communication effectiveness in English (Brown, 2002; Bickley; Ellington; Bickley, 1970). Since then, different science fields, including psychology, phonology, and language teaching, have adopted it as a research method either independently or in conjunction with other assessment measurements.

The cloze procedure is grounded in the Gestalt Psychology principle of "closure", which highlights the natural human inclination to complete patterns by filling in gaps (Taylor, 1957; Oller; Conrad, 1971). In language field studies, this principle explains students' tendency to fill in the blanks of written text, drawing on their ability to understand the materials. This process involves various cognitive and linguistic factors including comprehension, general language proficiency, vocabulary, learning ability, attention, motivation, and memory (Taylor, 1957; Morais and Kolinsky, 2015).

The cloze test typically uses a prose passage of 200 to 250 words (Bickley, Ellington and Bickley, 1970; Cardoso *et al.*, 2024). The selected text may be informational, and the test designer can adapt the content from a school textbook or news report. The construction of the text can be tailored to the social and economic background, age, and educational level of the target students depending on the researcher's objective. The passage may be taken from any test section (Bormuth, 1968), preserving its title and initial 15–17 words. This allowed participants to read the introductory segment and contextualize the subject matter of the text. Beginning from the sixteenth word, every fifth word was omitted, requiring the participant to complete the text by filling in the blank spaces. This method

aids students in understanding the task and restoring disrupted patterns (Oller and Conrad, 1971), thereby facilitating comprehension of the text.

A blank of uniform length was placed after every fourth word (Trassi *et al.*, 2019), ensuring that all blanks were of the same size (Darnell, 1968; Brown, 1980). This standardization is crucial in preventing the participant from inferring the correct word based on the blank space, which could lead to skewed responses such as selecting longer or shorter answers. The consistent length of the blanks minimizes the potential for misleading cues, ensuring that the blank size does not influence the participant's judgment of the most appropriate word.

Taylor's scoring criterion adheres to a binary correct/incorrect system, where participants must fill in the blanks with exact words from the original text (Bormuth, 1968). A variation of this approach offered two answer options per blank, with only one being correct. Any responses that deviated from the original wording were considered incorrect.

Brown (1980) identified four prominent cloze test scoring methods: (1) the exact word method (EX), which only accepts the original word from the text to be correct; (2) the acceptable answer (AC), which allows any contextually appropriate word as the correct answer; (3) Clozentropy (CLNTZ-Darnell, 1968), a method that considers the frequency of native speaker responses in a pre-test and logarithmically weights acceptable answers; and (4) multiple-choice (MC), in which students are provided with alternative answers and must select the correct word for each blank. The following section outlines the methodology employed in this study.

2. METHOD

The primary goal of this study was to identify the measurement procedures most commonly employed in Brazilian studies to assess gap-filling responses in cloze tests. The methodological approach to this study adheres to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), as Galvão and Ricarte (2019) recommend.

The descriptors utilized for the database search included "test cloze" and "reading assessment combined with the Boolean operator AND. To validate these descriptors, the bibliometric tool, Bibioshiny, was used to generate a word cloud illustrating the frequency of terms in various cloze test studies. The search was conducted simultaneously and independently using the CAPES Journal Portal, which provides access to several databases. Based on the availability of articles related to the topic, the SciELO, Web of Science, and SCOPUS databases were selected as the primary databases for the literature search. The search criteria focused on the title, abstract, and keywords, and only the studies published in the paper were considered.

The next step involved establishing inclusion and exclusion criteria. While the inclusion criterion focused on selecting empirical studies that used the cloze test to assess reading ability and involved studies with basic education in Brazil, the exclusion criterion, on the other hand, led to the removal of studies conducted on adults, graduate and undergraduate students, or those focusing on atypical populations, such as children with dyslexia or Attention Deficit Hyperactivity Disorder (ADHD).

Two researchers independently reviewed all relevant papers on the topic, organizing the information in an Excel table to consolidate the data and facilitate content analysis. The *corpus construction process was divided into three stages: 1) study identification, 2) screening, and 3) eligibility assessment*. During the initial identification stage, 42 papers were retrieved: 27 from SciELO, three from Web of Science, and 12 from SCOPUS. The papers were screened for further evaluation.

The second stage of this review was the screening process that explained the articles selected for this study. The exclusion criteria, based on paper titles, keywords, and abstracts, resulted in the removal of 15 texts, and one additional screening identified eight duplicated entries. Ultimately, 19 articles met our inclusion criteria.

The eligibility stage involved full-text review of the remaining papers. The final selection of this review comprised 19 empirical studies that applied the cloze test to assess the reading abilities of basic-education students in Brazil. These studies are presented in a table containing detailed information on published papers across the selected databases.

3. RESULTS

This systematic review *corpus* comprises 18 papers published over thirteen years, from 2009 to 2022. The table 1 offers an overview of this information, including the authors' names, fields of study, number of participants, and the specific measures used in the cloze test assessments.

After analyzing the papers, it was possible to realize that the participants' preponderance was boys and girls, ranging from 6 to 14 years of age. In two studies, the participants were up to 17 years old. One paper does not specify the students' school level, but addresses differences in textual genre issues (Brito *et al.*, 2022). In addition, one study mentioned students' social conditions, noting that the participants lived in socially at-risk conditions (Santos *et al.*, 2009).

Ten studies were conducted in public schools, five in private schools, and two in industrial institutions (Cunha and Santos, 2009; 2010). Two studies did not specify the setting of the studies (Brito *et al.*, 2016; Brito *et al.*, 2022).

In two separate studies, Cunha and Santos (2009, 2010) investigated the validity of evidence based on the traditional cloze test, which focuses on literal or *verbatim* answers. Their first study (Cunha and Santos, 2009) examined the errors in students' responses to a cloze test to identify the validity evidence in the response process. They compared the results obtained from students' responses with their school averages and academic performance, observing that students with higher grades made more lexical errors, and those with lower grades showed more semantic errors. The authors noted evidence of validity in the response process by assessing the error-type distribution homogeneity.

In the same study, the reliability of the cloze test measure was analyzed by conducting a pilot study with 314 children, both boys and girls, from 2nd to 4th grade. The study demonstrated satisfactory precision indices through internal consistency analysis (following the recommendations of CFP (2003), which prescribes an index above 0,70), indicating that the gap-filling text used in

the research was suitable for the sample. Cronbach's alpha was 0.83 for the participants. Internal consistency was also analyzed by grade level, with rates of 0.85 for the 2nd year, 0,70 for the 3rd year, and 0,72 for the 4th year (Cunha; Santos, 2009). There were no correlation tests between the cloze test and other instruments.

Study	Field of knowledge	State	Number of participants	Cloze assessment measures
• Santos, Suehiro and Vendemiato, 2009	Psychology	São Paulo	63 teenagers between 13 and 17 years old, but the study does not inform their education level.	EX
• Mota <i>et al.</i> , 2009	Psychology	Minas Gerais	42 elementary school children from private institutions.	EX
• Mota and Santos, 2009	Psychology	Juiz de Fora, Minas Gerais	42 students from elementary private schools.	EX
• Cunha and Santos, 2009	Psychology	São Paulo	266 students from three different environments: 66 students (24.8%) from elementary private school; 189 (71.1%) from elementary public school, 4 (1.7%) from industrial school, and 7 (2.6%) did not mention	EX
• Santos and Oliveira, 2010	Psychology	Campinas, São Paulo and Jundiá, São Paulo state.	314 students from elementary public school. This number was divided into two groups.	EX
• Cunha and Santos, 2010	Psychology	São Paulo	266 students from three different environments: 66 students (24.8%) from elementary private school; 189 (71.1%) from elementary public school, 4 (1.7%) from industrial school, and 7 (2.6%) did not mention.	EX
• Mota <i>et al.</i> , 2012	Psychology	Minas Gerais	The collection data took two stages: 1st: 42 students from Elementary School; 2nd stage: a year later, 38 students participated in this part.	EX
• Joly and Piovezan, 2012	Humanities and Philosophy	The article does not mention it	58 students from elementary public school.	Cloze Test Basic-MAR (computerized) and EX
• Mota and Santos, 2014	Psychology	Minas Gerais	42 students from elementary private school.	EX
• Suehiro and Magalhães, 2014	Psychology	Bahia	519 students from elementary public schools.	EX
• Suehiro and Santos 2015	Psychology	São Paulo	112 students from elementary public schools.	EX
• Santos and Fernandes, 2016	Psychology	The five main Brazilian regions, from the one with the most participants to the one with less	458 students from elementary schools: 36.3%: Southeast; 23.9% from Northeast; 15.7% from North; 15.5% from Midwest and 8.6% from South.	EX
• Colombo and Carnio, 2018	Phonology	the article does not mention it	69 students from elementary public school.	Structural cloze.
• Santos, Moraes and Lima, 2018	Psychology	São Paulo	169 elementary school students from public schools.	EX
• Trassi, Oliveira and Inácio, 2019	Psychology	Paraná	470 students from elementary public school.	EX
• Cunha <i>et al.</i> , 2020	Psychology	São Paulo	593 participants from elementary public school	EX
• Cunha, Ferraz and Santos, 2021	Psychology	Minas Gerais	618 students from elementary public schools.	EX
• Fabri <i>et al.</i> , 2022	Education	Paraná	259 students from elementary public school.	EX

Table 1. Selected papers.

In their second study, Cunha and Santos (2010) examined the same group of 266 students from a previous study to investigate the evidence of convergent validity. By relating writing acquisition to reading comprehension, they identified evidence of convergent validity in the assessment of

difficulties in learning writing scales, word recognition scales, and cloze test instruments. Responses were measured by considering the exact words. However, they did not specify how the reliability of the cloze test was assessed. The correlation between the averages of this test and the other instruments indicated statistically significant differences according to the analysis of variance results. These results were as follows: $[F(3,262) = 105,942; p < 0,001]$, $[F(3,262) = 49,734; p < 0,001]$ (Cunha and Santos, 2010).

Mota and Santos (2009, 2014) also explored the cloze test as a reading-assessment tool. Their first paper (Mota and Santos, 2009) focused on the relationship between phonological awareness and reading comprehension. The scores obtained in the phonological awareness tasks correlated with those of the cloze test, which were corrected using *verbatim* criteria, excluding synonyms or misspelled words. They argued that this correction method reduces the influence of the experimenter's subjective judgment.

The cloze tests used by Mota and Santos (2009) demonstrated satisfactory internal consistency rates ($\alpha > 0,70$) and were effective in assessing 1st-grade students in elementary education. There was a positive and significant correlation between reading comprehension and phonological awareness: $[r = 0,37; p < 0,05]$ for alliteration and cloze test scores 1, $[r = 0,37; p < 0,05]$ for alliteration and cloze test scores 2, $[r = 0,40; p < 0,01]$ for rhyme and cloze test 1, and $[r = 0,51; p < 0,01]$ for rhyme and cloze test 2 (Mota and Santos, 2009). To control for the influence of cognitive development on reading and writing acquisition, researchers also employed the vocabulary and digit subtest of the Weschler Intelligence Scale for Children WISC-III (Weschler 1991) in their study. The digit memory measure showed a positive and significant correlation with the cloze test (cloze 1 $p < 0,05$; cloze 2 $p < 0,01$), whereas the vocabulary task did not correlate with the reading comprehension scores.

In their second study, in which the same cloze tests from the study mentioned above were employed, thus maintaining the same psychometric properties, Mota and Santos (2014) applied the cloze test as a measure of reading ability in two primary school grades, and compared the results with those of the School Achievement Test (TDE), whose focus is specifically on academic performance in reading and writing, used as a standard measure. The authors found that higher performance on the School Achievement Test correlated better with cloze test performance across grades and categories, with positive and significantly moderate results $[r = 0,47; p < 0,001]$.

Using reading comprehension tests identical to those used by Mota and Santos (2009; 2014), Mota *et al.* (2009) conducted a study on 42 children from a private school and investigated the relationship between morphological awareness and text comprehension measured by the cloze test. The association between morphological awareness tasks and text comprehension measures showed that morphological awareness is related to contextual reading in Portuguese. There were positive and significant associations between the two cloze tests and the morphological awareness tasks (analogy task and morpheme-semantic association task): $[r = 0,47, p < 0,01]$ for cloze 1 and

analogy task, and [$r = 0,52, p < 0,01$] for cloze 2 and analogy task; and [$r = 0,25, p < 0,01$] for cloze 1 and morpheme-semantic association task, and [$r = 0,58, p < 0,01$] for cloze 2 and morpheme-semantic association task (Mota *et al.*, 2009). Mota *et al.* (2012) found similar results using an identical methodology.

A study conducted by Santos *et al.* (2009) applied the cloze test to measure reading comprehension and relate it to intelligence, as assessed by the R1-Test- Form B (Sisto, Santos and Noronha, 2004). The criterion for evaluating the participants' responses to the cloze test was literal accuracy. The authors found a significant positive correlation between the results of the intelligence and reading tests [$r=0,39; p=0,002$], indicating that higher scores on R1 -Test Form B were associated with greater accuracy in completing cloze test gaps. However, it does not address the test reliability.

Santos and Oliveira (2010) sought to identify the appropriateness of cloze techniques for assessing and developing text comprehension skills through an intervention program. In this study, they employed the traditional cloze method, considering only words that matched the original text, similar to the approach used by Joly and Piovezan (2012) and other researchers. They used the Computerized Basic-MAR Cloze test as both pre-and post-measures. This test was developed by Joy and Piovezan as a reading comprehension test using the cloze technique with psychometric characteristics (Joly and Istome, 2008). Reliability was evaluated through test-retest (pre- and post-assessment). The results of both studies demonstrated a significant positive effect on students' reading comprehension levels.

Suehiro and Magalhães (2014) and Suehiro and Santos (2015) show the results from studies conducted in different Brazilian states, such as Bahia and São Paulo. The first study aimed to examine the relationship between reading and writing among public elementary school students and search for evidence of convergent discriminant validity and concurrent criteria between the instruments used. The second paper also sought validity evidence, but this time through measures that assess related constructs such as reading comprehension and phonological awareness. Both studies demonstrated criterion validity through contrasting group methods, and the cloze test proved to be sensitive in capturing the relationship between learning to write and reading comprehension.

Santos and Fernandes (2016) conducted a comprehensive study of five Brazilian regions. They aimed to explore the relationships between instruments assessing writing and reading comprehension, and to examine the predictive value of these instruments for school performance. They also investigated potential differences in children's test performance based on gender and school grade. This study presented the reliability of the test by calculating the alpha coefficient (0,96). The measures of the instruments used – cloze, Writing Evaluation Scale (Sisto, 2005), and School Performance Test (Stein, 1994) – were correlated, indicating that cloze and writing evaluation scales predicted school performance in reading, as controlled by the school performance test in this study. The correlation coefficient between the cloze test and school performance

($R=0,73$, with an adjusted R^2 of $0,53$) demonstrates the predictive value of the cloze test for academic performance.

Although the study did not specify where data collection took place, Colombo and Cárnio (2018) aimed to develop an instrument to assess reading comprehension and examine the influence of receptive vocabulary on the reading comprehension of typical elementary school students. Although some students were impacted by their low socioeconomic status, the results indicated that most scored above average in receptive lexicons. The students also performed better on explicit and implicit questions. Furthermore, cloze tests revealed more homogeneous and similar performance across different school years. The authors did not explain how the reliability of the cloze instrument was assessed, and they suggested strong significant and positive associations between the results of the cloze procedure and the question-and-answer method [$p < 0,001$].

Santos et al. (2018) sought to identify the relationship between reading comprehension and learning motivation among elementary-school students. Two measurement instruments were applied: the exact-answer cloze test and Motivation Assessment Scale for Learning. This scale is based on three goals that represent students' efforts, their concern about standing out to their peers, and their concern about not showing weakness in front of their peers (Santos et al., 2018).

The results revealed a positive correlation between cloze test and learning goal scores, with significant negative effects on performance, approach, and avoidance goals. According to the statistical data, the higher the reading comprehension score, the lower the score for a student's interest in excelling in the classroom (performance/approach) and avoiding appearances in front of their classmates and teachers (performance avoidance). The results of the significance levels were as follows: [$r = 0,167$; $p = 0,041$] for cloze and goal to learn; [$r = -0,234$; $p = 0,003$] for cloze and goal performance approach; and [$r = -0,224$; $p = 0,004$] for cloze and goal performance avoidance. However, the authors did not explicitly determine the reliability of the cloze test.

Trassi, Oliveira, and Inácio (2019) applied three measurement tools at different stages to achieve four objectives: to analyze the reading level of public elementary school students; compare their performance on the cloze test; investigate possible relationships between reading comprehension, learning strategies, and verbal reasoning; and determine whether verbal reasoning can predict other variables. A total of 470 students completed the test and assessment scales for learning strategies. Of these, only 45 were selected to complete the Wechsler Abbreviated Scales of Intelligence (WASI). This scale "briefly assesses the abilities in general, verbal and execution intelligence in 4 subtests: similarities, vocabulary, cubes, and matrix reasoning, the first two referring to the verbal area" (Trassi, Oliveira and Inácio, 2019, p. 618).

The results indicated that the sample exhibited an independent reading comprehension level, particularly among students in the 2nd, 3rd, and 4th years compared to students in other grades. Based on the WASI results, the students in this sample demonstrated good verbal reasoning performance as expected. Regarding the cloze test used, there were no specific details regarding

the instrument reliability. The research data indicated statistically significant correlations between the cloze test and metacognitive strategies [$r = 0,217$; $p = 0,001$], and between the cloze test and verbal IQ [$r = 0,528$; $p = 0,001$].

Cunha *et al.* (2020) applied the cloze test as evidence of validity through response processes and analyzed the types of semantic and syntactic errors. The highest and lowest scores on the cloze test were used to construct a scale to analyze the complexity of terms through morphosyntactic analysis. This study is similar to that of Cunha and Santos (2009), who identified five types of errors: blank space, phonological, lexical, syntactic, and semantic. Students with higher averages tended to make more syntactic and linguistic errors, whereas those with lower averages tended to make more semantic errors. Cunha and Santos (2009) demonstrated good test reliability, and an internal consistency analysis revealed a Cronbach's alpha of 0,83.

Cunha *et al.* (2021) conducted a psychometric study using a questionnaire and two cloze tests to investigate the psychometric properties of the Metatextual Awareness Assessment Questionnaire, based on the "Theory of Human Information Processing and the precepts of cognitive psychology" (Cunha *et al.*, 2021). The questionnaire responses revealed differences in performance according to the school year. The cloze tests were evaluated using traditional or literal correction methods and provided valid evidence. For this study, the internal consistency of the cloze tests indicated ($\alpha = 0,82$) (cloze 1) and ($\alpha = 0,77$) (cloze 2).

Fabri *et al.* (2022) applied the traditional cloze to verify the internal structure of the *Inventory of Learning Self-regulation Processes* (Polydor *et al.*, 2011) and to assess self-regulation, learning strategies, and reading comprehension of students in early elementary school. This inventory, developed in Portugal, was designed to investigate self-regulatory processes in their different dimensions, consisting of a 9-item questionnaire, using a Likert scale, with responses ranging from "never" to "always" (Fabri *et al.*, 2022). The authors reported significant use of self-regulatory strategies, demonstrating relationships between this construct, metacognitive strategies, and instructional reading comprehension levels. They also identified a dependent relationship between self-regulation and cognitive skill.

4. DISCUSSION

The results of this systematic review reinforce the cloze test's sensitivity in capturing reading and writing skills, making it a valuable indicator of overall academic performance. The cloze test is a well-established instrument that can be used independently or with other measurement tools.

Most of the analyzed studies adopted the exact word as the criterion for scoring cloze test responses (Cunha, Ferraz and Santos, 2021; Cunha *et al.*, 2020; Cunha and Santos, 2009; Cunha and Santos, 2010; Fabri *et al.*, 2022; Joly; Piovezan, 2012; Mota *et al.*; 2012; Mota *et al.*, 2009; Mota and

Santos, 2009; Mota and Santos, 2014; Santos and Fernandes, 2016; Santos, Moraes and Lima, 2018; Santos and Oliveira, 2010; Santos, Suehiro and Vendemiatto, 2009; Suehiro and Magalhães, 2014; Suehiro and Santos, 2015; Trassi, Oliveira and Inácio, 2019).

There is a tendency to adopt the exact word criterion for scoring; however, a recent study by Brito et al. (2022) differs from others in that it does not specify the criterion used to score the responses. Instead, the researchers adopted a computerized correction made by the Coh-Metrix-Port 2.0. This study aimed to analyze the characteristics of words, syntactic structure, and cohesion elements in the Cloze Reading Comprehension Test (TCCL), comparing its two parts: narrative text (TCCL-N) and expository text (TCCL-E), using the Coh-Metrix software. This program allows for the analysis of cohesion, coherence, and difficulty in understanding a text (Brito, Ribeiro and Seabra, 2022) using Natural Language Processing resources and tools. The results showed that TCCL-E is slightly more complex than TCC-N, as supported by the literature, and the authors emphasized the importance of considering reader characteristics when determining text difficulty.

Although Santos and Fernandes's research in 2016 was the only study conducted across all five Brazilian regions, most participants were from the southeast region, particularly São Paulo, the most populous state (IBGE, 2010). Of the 19 papers analyzed, eight were from São Paulo (Santos *et al.*; 2009; Cunha and Santos, 2009; Santos and Oliveira, 2010; Cunha and Santos, 2010; Suehiro and Santos, 2015; Santos *et al.*, 2018; Cunha *et al.*, 2020), Minas Gerais (Mota *et al.*, 2009; Mota and Santos, 2009; Mota *et al.*, 2012; Mota and Santos, 2014; Cunha *et al.*, 2021), and Paraná (Trassi *et al.*, 2019; Fabri *et al.*, 2022). Only one study was from Bahia (Suehiro and Magalhães, 2014), in the northeast region, and none were from the North or Midwest regions. Three papers did not specify the location of their study (Joly and Piovezan, 2012; Colombo and Cárnio, 2018; Brito *et al.*, 2022).

The field that produced the most studies on the cloze test was psychology with 16 papers. One study was published in speech-language pathology (Colombo and Cárnio, 2018), one in education (Fabri *et al.*, 2022), and one in the humanities (Joly and Piovezan, 2012).

Despite their specific objectives, each study used the cloze test as a reading assessment, applying it to examine the relationship between reading comprehension and other linguistic abilities such as morphological and phonological awareness (Suehiro; Santos, 2015; Mota; Santos, 2009; Mota *et al.*, 2009; Mota *et al.*, 2012) and metatextual awareness (Cunha *et al.*, 2021).

The cloze test has also been used to assess writing ability (Cunha and Santos, 2010; Santos and Fernandes, 2016; Suehiro and Magalhães, 2014) as well as other factors related to education, such as learning motivation (Santos *et al.*, 2018), learning strategies, verbal reasoning (Trassi *et al.*, 2019), and school development (Colombo and Cárnio, 2018). Furthermore, the latter study aimed to create a tool for assessing textual reading comprehension. It was the only study to consult linguists to validate the cloze tests before applying them.

A few studies have used the cloze test exclusively to analyze reading without relating it to other skills, such as Joly and Piovezan's (2012) study, which aimed to evaluate their Computerized Reading Program Strategy (Programa Informatizado de Leitura Estratégica-PILE) (Joly, 2008).

This systematic review revealed that the analyzed studies consistently adopted exact answer scoring criteria, including those using computerized tests. Clozentropy or multiple-choice scoring methods have not been mentioned in previous papers.

5. CONCLUSION

The findings of this systematic review reinforce the consolidation of the cloze test in Brazil as a tool for assessing reading proficiency particularly in research that focuses on primary and elementary school students. It also underscores that the psychology and phonology areas have produced more research on the cloze procedure than the language studies field. Teachers, linguists, psychologists, and other professionals can work together to examine the development of these tests, ensuring that they are appropriately aligned with the participants' age, educational level, and knowledge base.

Currently, such research is concentrated in southeastern Brazil. Expanding these studies to other Brazilian states could provide a broader understanding of reading difficulties across the country, particularly in the Covid-19 post-pandemic context, where reading asymmetries have widened. Furthermore, the "exact word" criterion used in many cloze tests limits the accuracy of reading diagnosis as it narrows the range of acceptable responses and excludes answers with semantic similarity, such as synonyms. Despite these limitations, one piece of information should be highlighted. The research results assume that it is a reliable measure to assess reading comprehension and predicts students' performance in other skills related to reading activity.

Natural language processing techniques could be employed, utilizing measures of lexical distance, to better assess comprehension in contexts with low reading proficiency. Lexical distances, defined as the "minimum number of insertions, deletions or substitutions of a single character needed to transform one word into the other",¹ could be used to measure responses that follow the same grammatical class or semantic field as the expected word, revealing alternative responses possibilities (Gois *et al.*, 2025).

Previous studies reinforce the validity of the cloze test as an instrument for measuring reading comprehension. Due to its low cost and ease of application, it is a highly practical tool for diagnosing reading proficiency, especially in the post-pandemic context, where performance rates have

1 These distances can be found through a "simply the minimum number of insertions, deletions, or substitutions of a single character needed to transform one word into the other" (Petroni and Serva, 2010, p. 2281).

declined, raising concerns among education networks and challenging teachers to address this issue. Mapping how the cloze technique has been applied in Brazil contributes to the development of new analytical approaches, particularly those based on natural language processing (Gois *et al.*, 2025) and novel gap types, such as verbal aspect (Santos, 2025), ultimately aiding in the reduction of reading asymmetries.

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ADDITIONAL INFORMATION

CONFLICT OF INTEREST

The authors declare no competing interests.

STATEMENT OF DATA AVAILABILITY

Data sharing does not apply to this article, as no new data was created or analyzed in this study.

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