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Cognitive and Metalinguistic Abilities Related to Critical Reading in Psychology University Students

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ABSTRACT

Critical reading is one of the fundamental competencies required in higher education, playing a crucial role in student success across diverse academic disciplines. Numerous studies highlight its significance, identifying critical reading as the strongest predictor of academic performance among university students. However, the specific cognitive mechanisms underpinning this competency remain insufficiently understood. This study explores the relationships between critical reading and several cognitive variables—working memory, processing speed, phonemic awareness, and morphological awareness—within a sample of 76 undergraduate psychology students. Employing mediation analysis, the research investigates both direct and indirect effects of these cognitive skills on critical reading performance. Results indicate that working memory demonstrates a significant direct relationship with critical reading. In contrast, processing speed, phonemic awareness, and morphological awareness showed neither direct nor indirect effects on critical reading skills. These findings underscore working memory's unique role as a reliable predictor of critical reading ability and emphasize its importance in fostering academic achievement in higher education contexts. Based on these results, the implementation of targeted cognitive strategies to strengthen working memory may prove beneficial in enhancing reading comprehension.

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Moreover, the potential use of neuromodulation techniques—such as transcranial direct current stimulation (tDCS)—could be explored as complementary approaches to boost cognitive functions linked to reading processes. Future educational interventions might combine these cognitive and neurotechnological tools to support the development of critical reading skills, ultimately contributing to improved learning outcomes in university settings.

Keywords: Critical Reading; Working Memory; Processing Speed; Phonemic Awareness; Morphological Awareness

1. Introduction

When a student enters university, it is generally assumed that they have extensive experience in reading texts and understanding them[1]. However, various studies have shown that, upon entering university, students often demonstrate a lack of reading experience and a low level of comprehension. This situation becomes so severe that it prevents the proper assimilation of knowledge, often leading to frustration and, ultimately, student dropout.

This issue has become increasingly evident due to the expansion of higher education coverage worldwide. Additionally, university enrollment has broadened to include middle-class populations, revealing a contrast with the student demographic of forty years ago[2]. Previously, higher education was primarily accessible to individuals from high-income families, who were well-educated, predominantly white, and from urban communities. Today, higher education has incorporated individuals from more diverse and psychosocially vulnerable backgrounds[3]. Many of these students are the first in their families to attend university and have not been primarily- focused on high academic performance or cultivating fields such as the humanities or social sciences, where reading is widely promoted[4].

Moreover, research conducted in Latin American countries has identified reading comprehension issues among university students. These studies suggest that multiple factors influence the development of this competence. However, although some elements have been identified, there are still few evaluative processes targeting the same student population[5], particularly undergraduate psychology students.

In Colombia, the SABER tests incorporate elements from PISA to define the concept of "critical reading"[6]. In this context, reading ability depends on an individual's capacity to analyze texts critically, which is significantly influenced by their cognitive abilities. The development of this competence progresses from literal comprehension of the text to the ability to construct and interpret its meaning, culminating in the highest level, which involves reading with a critical perspective.

The OECD[7], through its PISA assessments, has found a correlation between reading for pleasure and better reading performance, as well as higher overall evaluation scores. Additionally, reading for pleasure is more prevalent among female students and those from more favorable socioeconomic conditions. On average, students who reported reading for pleasure scored more than a year and a half ahead in schooling. According to the National Administrative Department of Statistics (DANE) in the National Reading Survey of Colombia (ENLEC), 34.9% of respondents stated that they enjoy reading, 38.6% reported feeling neutral, and 26% said they do not enjoy reading. These responses were gathered from municipal centers, where reading enjoyment is higher compared to rural areas. However, when asked about activities related to their reading habits, 33.8% of the national sample reported watching videos, followed by consulting question-and-answer platforms such as Wikipedia, Yahoo Answers, and Google (DANE link).

Based on previous research findings, identifying a significant relationship between working memory, processing speed, and phonological and morphological awareness with students' critical reading performance could facilitate the development of improved assessment strategies. These strategies would allow for a quicker and more precise prediction of critical reading ability. Additionally, evidence suggests that developing reading skills contributes to acquiring abilities such as critical thinking. Therefore, the present study aims to establish the relationship between cognitive abilities, phonological awareness, morphological awareness, and critical reading in undergraduate psychology students.

Theoretical Framework

Critical reading (CR) is a process through which students derive meaning from a text[1]. It involves the ability

to recognize the author's purpose, understand tone and persuasive elements, and ultimately, identify biases[8]. It is a dialectical process in which the reader acquires knowledge about their context and the ability to transform it while simultaneously transforming themselves[9]. Additionally, it is a key precursor to critical thinking. The main characteristics of critical reading include examining the evidence or arguments presented, reviewing influences on the evidence or arguments, assessing the limitations of the study design or topic, analyzing the interpretations made, and determining whether to accept the authors' conclusions. Finally, critical reading requires an interaction between the reader and the text, extending beyond mere word or content recognition[8]. It is a dynamic process that enables extracting meaning from a text beyond the basic information provided, involving questioning, forming hypotheses, seeking evidence, and validating ideas[1].

In this regard, research has found that reading comprehension requires various abilities, such as cognitive processes, reading strategies, and general knowledge of the text being read[10]. These authors conclude that reading comprehension is not merely the ability to recognize isolated words[10]. Similarly, various studies have shown that, among beginners, word decoding ability is an important predictor of reading comprehension skills. However, as individuals develop a solid foundation for word reading, other linguistic comprehension abilities become more relevant in predicting reading comprehension[11].

Thus, adequate reading comprehension requires well-developed cognitive abilities. Daneman and Carpenter developed a test in which participants read or listened to unrelated sentences and were then asked to recall the last word of each sentence presented[12]. When these measures were correlated with reading and listening abilities, the working memory (Gwm) cognitive tests were found to be excellent predictors of comprehension.

Although it is widely accepted that Gwm is involved in reading comprehension[13, 14], there is debate regarding its function. Some researchers propose that this relationship depends on the task's domain specificity—verbal working memory tasks are associated with reading comprehension, whereas visuospatial working memory tasks are less related. Others argue that the contribution of Gwm is general, as it involves attentional and executive control. Reading com-

prehension requires storing and processing semantic and syntactic relationships between words, sentences, and paragraphs while integrating them with prior knowledge stored in memory.

Baddeley conceptualizes working memory as a storage mechanism that simultaneously retains, compares, contrasts, and relates information temporarily[15]. It consists of four components: the central executive, the phonological loop, the episodic buffer, and the visuospatial sketchpad.

Some of these working memory components appear to be closely linked to processing speed. Indeed, Jacobson et al. found that both cognitive abilities significantly predicted oral reading fluency and interacted in reading tasks[16]. Lengenfelder et al. also found a relationship between these abilities[17], suggesting that this interaction emerges in tasks with high working memory demands. They hypothesize that processing speed is primary to working memory based on the Related Consequences Model[18].

Understanding the impact of processing speed on cognitive processing in reading requires recognizing that reading involves not only identifying graphemes and morphemes but also integrating the phonological content of lexical items. As reading proficiency develops, phonological awareness requirements decrease, while morphological recognition becomes more efficient[19]. In this sense, phonological awareness functions as a subdomain of working memory, and processing speed facilitates word recognition, enhancing reading fluency and verbal comprehension.

González et al. emphasize the importance of training processing speed in reading, as it correlates with performance in word identification, reading, and comprehension tasks[19]. Processing speed facilitates information retrieval and contributes to reading fluency. Therefore, children who access their phonological representations more quickly and accurately tend to perform better in reading tasks.

Processing speed development is thus an antecedent to phonological awareness, and its optimal structuring enhances literacy performance. Since phonological awareness operates within working memory, the relationship between processing speed and working memory (which activates phonological awareness) enables the proper integration of cognitive processes essential for verbal comprehension[20]. Consequently, increasing processing speed becomes a protective factor that enhances reading comprehension performance,

provided phonological awareness has been solidly and timely developed.

Phonological awareness is, therefore, an important linguistic predictor of reading[21]. It involves the ability to analyze and segment speech components (words, rhymes, syllables, sounds, and phonemes) and perform complex operations on them[22], which facilitates reading acquisition. For example, in Spanish, pre-reading students find tasks such as isolating syllables and phonemes and counting syllables easier than syllable omission or rhyme tasks, with the latter being the most challenging. Research supports a correlation between reading competence levels and phonological awareness tasks[23].

Similarly, substantial evidence highlights another metalinguistic skill with significant effects on reading ability: morphological awareness[24]. Some authors suggest that morphological skills influence reading in two ways: indirectly through word reading and directly through overall comprehension[25]. This is supported by the study of Levesque et al.[24], although caution is needed when extrapolating these findings to critical reading.

2. Materials and Methods

The research design of the present study is based on a quantitative approach; it is cross-sectional and has a correlational scope[26].

2.1. Participants

Sampling was conducted using the online application http://www.raosoft.com/samplesize.html, considering the total population of psychology students enrolled in the psychology programs at Cooperative University of Colombia [Universidad Cooperativa de Colombia], specifically from the Medellín and Villavicencio campuses in Colombia. Additionally, a 10% margin of error and a 93% confidence level were established, resulting in the following sample distribution (**Table 1**). Participants were required to be actively enrolled in the undergraduate psychology program at the university and not under the influence of psychoactive substances.

2.2. Instruments

2.2.1. Working Memory and Processing Speed

To assess these cognitive abilities, the study utilized the Digit Span, Symbol Search, Coding, and Letter-Number Sequencing subtests from the Wechsler Adult Intelligence Scale—Fourth Edition (WAIS-IV). This is a widely used tool for assessing the intellectual aptitude of adults aged 16 to 90. For instance, the Digit Span subtest requires participants to repeat sequences of numbers that progressively increase in length, in three formats: forward, backward, and in ascending numerical order. In the Symbol Search task, individuals must quickly and accurately scan a series of symbols to identify whether a specific target symbol appears, all within a restricted time limit. The Coding subtest assesses processing speed, and visual-motor integration by having participants rapidly copy symbols that correspond to specific numbers, based on a reference key. Finally, the Letter-Number Sequencing subtest evaluates working memory and cognitive sequencing by asking individuals to mentally reorganize and recall increasingly complex combinations of letters and numbers—placing the numbers in ascending order followed by the letters in alphabetical sequence.

Table 1. Sample Distribution.

Campus	Population	Sample Size
Medellín	450	29
Villlavicencio	578	47
Total	**1,028**	**76**

The WAIS-IV has undergone extensive adaptation and validation for use in the Latin American context. Prior research has reported Cronbach's alpha coefficients ranging from 0.7 to 0.9, indicating high reliability. In the current study, administration procedures adhered strictly to standardized protocols. Additionally, evaluators received targeted training to ensure consistency in test administration and to minimize potential sources of bias or scoring errors.

2.2.2. Morphological Awareness and Phonological Awareness

The Derived Form Morphology (DMORPH) task was employed, adapted into Spanish by the research team based on the work of Tighe[27, 28]. It evaluates morphological structure by assessing the transformation of word roots into derived words within sentence contexts. The adaptation process followed multiple steps to ensure both linguistic and cultural

relevance for Colombian university students. Initially, a bilingual linguistic expert translated the original items. A reconciliation phase then refined the semantic equivalence of the translations. Subsequently, a panel of three linguists—specialized in psycholinguistics—reviewed the adapted items, offering feedback on clarity, linguistic relevance, and cultural appropriateness. Revisions were implemented based on their recommendations.

At the beginning of each item, a root word was presented as a prime for the participant, followed by a short sentence with a missing final word. Participants were asked to complete the sentence using the appropriate derived word, considering the initially provided root word.

For example:

- Root word: *Granja* (*Farm*)
- Sentence: *Mi tío es un* _____. (*My uncle is a* _____.)
- Correct response: *Granjero* (*Farmer*)

A correct response received one point, while an incorrect response received zero points. The task consisted of two practice items and 28 test items. The items were divided into three groups:

1. Morphological derivation without orthographic change
2. Morphological derivation with orthographic change
3. Morphological derivation with phonological change (this last section was administered via oral reading by the evaluator).

The internal consistency (Cronbach's alpha) of the adapted DMORPH task in this study was high, at 0.87, indicating excellent reliability.

2.2.3. Critical Reading

Critical reading was evaluated using the university's existing competency-based assessment system, named SIEC test, which is administered semiannually to track student progress throughout academic terms. This evaluation is structurally aligned with the PISA framework, recognized for its international validity and effectiveness in assessing reading competencies—particularly critical analysis, interpretation, and inferential reasoning in real-world contexts. As an institutional tool, this assessment offered an ecologically valid measure that accurately reflected students' actual academic abilities.

2.2.4. Ethical Considerations

This study adhered to all ethical guidelines for psychological research involving human participants as established by the Colombian College of Psychologists, in accordance with Law 1090 of 2006, particularly Articles 45 to 56, which require obtaining informed consent from each participant and ensuring compliance with ethical standards for psychological research involving human subjects.

2.2.5. Data Collection and Analysis Procedure

All statistical analyses were performed using JASP software, both for descriptive statistics and for Spearman's correlation analyses. To assess the fit of the proposed model, the mediation analysis module in JASP software was employed[29].

3. Results

3.1. Correlations

We found that critical reading was significantly related to working memory, but not to the other variables examined. Among the linguistic and cognitive variables, a relationship was observed between working memory and morphological awareness (**Table 2**).

3.2. Mediation Analysis

A mediation analysis was also conducted, revealing a significant direct effect of working memory on critical reading (Estimated Value = 0.016, 95% CI [0.003, 0.032], p = 0.046). No other significant direct or indirect effects were found (**Figure 1**).
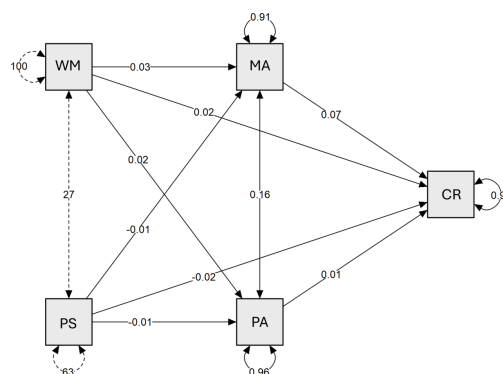

Figure 1. Mediation Analysis.

Source: Authors.
WM = Working Memory, PS = Processing Speed, PA = Phonological Awareness, MA = Morphological Awareness, CR = Critical Reading.

Table 2. Spearman Correlations.

	Critical Reading	Working Memory	Processing Speed	Morphological Awareness	Phonological Awareness
Critical Reading	1.000	0.245*	0.067	0.160	0.063
Working Memory	0.245*	1.000	0.362**	0.253*	0.115
Processing Speed	0.067	0.362**	1.000	0.042	–0.105
Morphological Awareness	0.160	0.253*	0.042	1.000	0.206
Phonological Awareness	0.063	0.115	–0.105	0.206	1.000

*$p < 0.05$, *$p < 0.01$.

4. Discussion

As previously mentioned, the critical reading assessments have been designed based on the PISA instruments. Highlighting this parallel is important for analyzing the results of the present study, as the design of PISA reading tests assumes the evaluation of cognitive and metacognitive processes, such as working memory [7, 30]. In this regard, authors such as Lynn and Mikk have found a significant correlation between PISA reading comprehension scores and participants' intelligence quotient [31], suggesting that in our study, critical reading results would be expected to show a full correlation with WAIS results. Therefore, it is possible that the critical reading assessment does not sufficiently align with the reading comprehension evaluation conducted by PISA. Limitations in the instrument's design or its administration may be generating results that are not consistent with the cognitive abilities assessed by WAIS, making it necessary to evaluate the extent to which our instrument measures the same critical reading construct as tests like PISA.

One aspect to consider in critical reading assessments is that the items correspond to different achievement levels of the competency. This means that the test includes items with varying degrees of difficulty, although they are scored in the same manner. In our study, relationships were established based on an overall critical reading level rather than a scaled assessment of it.

It is possible that some texts in the SIEC test lead students to employ reading comprehension strategies such as identifying key elements, distinguishing relevant data from unnecessary information, and recognizing the main idea—skills that contribute to effective reading [32].

In this study, we found a relationship between reading and working memory (the ability of maintaining information during tasks), which is consistent with González et al. [33].

This suggests that the activation of other cognitive processes not necessarily relevant to the task of reading comprehension may be inhibited, and working memory is relied upon instead. This supports the idea that as reading skills develop, they tend to be executed at a higher operational level, focusing on monitoring the task itself [34], rather than generating a complete metacognitive process that engages other cognitive domains.

Hahnel et al. state that the effect of working memory appears when extracting simple information from texts and fades when reflection and evaluation of the text are required [30]. However, they do not specifically refer to "critical reading." The presence of this relationship in our study suggests that the reading task may not correspond to a true assessment of critical reading.

Working memory enables the coordination of task execution in real time [15]; therefore, in critical reading processes, individuals engage in monitoring their activity. However, the limited capacity of information processing—both in terms of time and volume—does not allow for a more extensive metacognitive process. As a result, relying solely on working memory would not support the optimal execution of a complex critical reading task.

These findings indicate that the critical reading processes observed in this study reflect the use of working memory resources, suggesting that participants engaged in an operational task rather than a fully developed metacognitive process. This aligns with previous discussions, highlighting that working memory allows individuals to monitor activities for short periods and with limited information. Consequently, this suggests an early-stage development of critical reading competencies, emphasizing the need to strengthen and expand the involvement of other cognitive domains to promote higher levels of competency development.

Given that the results of this study indicate that ef-

fective reading does not necessarily involve cognitive and metacognitive processes such as processing speed (quickly performing cognitive tasks), phonological awareness, and morphological awareness, one implication for future research on reading processes is the importance of incorporating measures of various cognitive processes. Additionally, reading assessments should include diverse tasks, such as identifying the main idea, distinguishing essential elements from non-essential ones, inferring a text's conclusions, and identifying the author's purpose, as each task may activate different cognitive processes.

An intriguing observation from the present study is the absence of significant correlations between processing speed and the other cognitive or reading-related variables assessed. This finding contrasts with prior research, which emphasizes processing speed as a crucial component in tasks involving critical reading and efficient cognitive performance. A plausible explanation is that the tasks employed in this study may have required more deliberate, analytical processing—placing less emphasis on rapid responses and more on metacognitive reading strategies. This divergence suggests the need to further investigate whether commonly used measures of processing speed truly capture its role in complex academic settings, particularly in tasks that demand reflective and critical engagement, such as those analyzed in this study.

Training in critical reading should go beyond cognitive training in working memory, as working memory alone is primarily necessary for simple reading. The components of critical reading involve processing sociocultural factors, incorporating lifelong learning experiences. The more knowledge one has about the sociocultural context, the better their critical reading ability. However, this presents a paradox, as acquiring such knowledge requires a basic reading ability. From an applied perspective, these findings carry important implications for educators aiming to foster critical reading skills in psychology students. Beyond traditional training that emphasizes foundational cognitive abilities such as working memory, the results suggest a need to explicitly incorporate activities that cultivate metacognitive and analytical strategies. This includes targeted exercises designed to help students identify underlying assumptions, evaluate the argumentative validity of texts, and make inferences grounded in specific sociocultural contexts. In this regard, implementing pedagogical methods such as group text analysis, guided

debates, and individual reflection tasks may significantly enhance students' critical reading competencies in academic settings.

An innovative approach to enhancing critical reading skills in university students may involve the combined use of transcranial direct current stimulation (tDCS) targeted at brain regions associated with working memory—such as the dorsolateral prefrontal cortex—and areas directly involved in reading and social cognition, such as the temporoparietal junction (TPJ). Focal stimulation of these regions could temporarily enhance neural plasticity, thereby facilitating the adoption of complex cognitive strategies essential for critical reading. Integrating tDCS with structured pedagogical activities—such as text analysis, identification of authorial intent, and metacognitive exercises—may provide a robust framework for educational intervention.

The main limitation of this study lies in the instrument used to assess critical reading ability. Although the test is based on a robust epistemological and methodological framework, it is not possible to guarantee that all administrations of the test were conducted under optimal conditions, which could introduce variance in the results. Another relevant limitation of the study concerns potential biases stemming from the sampling method and test administration conditions. Although clear protocols were established, the administration of the assessment by institutional personnel across different campuses and cities may have introduced variability in environmental conditions, the delivery of instructions, and students' perceived motivation. These factors could compromise the internal validity of the findings. Future research could benefit from implementing stricter control procedures or adopting experimental designs that minimize these potential sources of bias, thereby enabling a more robust interpretation of the results.

Additionally, the instrument was designed to evaluate various levels of critical reading competency as defined by the institution [9]. This means that some test items were intentionally designed to assess lower levels of complexity (unistructural competency level), whereas others required more complex analysis. Consequently, different sections of the test may have demanded different cognitive processes from students.

5. Conclusions

The possible relationship between basic reading ability and critical reading suggests that the effect of working memory on critical reading may occur indirectly through basic reading skills. Therefore, we recommend conducting a study to explore this relationship further.

Since critical reading is a fundamental component in the training and professional practice of psychology, identifying students' working memory ability could enhance the development of skills and the acquisition of psychological knowledge, ultimately improving the practice of psychology.

Author Contributions

Conceptualization, R.Z.-C.; methodology, R.Z.-C.; software, R.Z.-C.; validation, R.Z.-C., H.A.E.-L., M.E.M.-D., D.A.V.-C. and R.D.Z.-G.; formal analysis, R.Z.-C.; investigation, R.Z.-C., H.A.E.-L., M.E.M.-D., D.A.V.-C., and R.D.Z.-G.; resources, R.Z.-C.; data curation, R.Z.-C.; writing—original draft preparation, R.Z.-C.; writing—review and editing, R.Z.-C., H.A.E.-L., M.E.M.-D., D.A.V.-C. and R.D.Z.-G.; visualization, R.Z.-C.; supervision, R.Z.-C.; project administration, R.Z.-C.; funding acquisition, R.Z.-C. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Universidad Cooperativa de Colombia (protocol code 009, 24 October 2016).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data is available under request to the main author.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

[1] Marschall, S., Davis, C., 2012. A Conceptual Framework for Teaching Critical Reading to Adult College Students. Adult Learning. 23(2), 63–68.

[2] Navas, L.P., Montes, F., Abolghasem, S., et al., 2020. Colombian higher education institutions evaluation. Socio-Economic Planning Sciences. 71, 100801. DOI: https://doi.org/10.1016/j.seps.2020.100801

[3] Londoño-Vélez, J., Rodríguez, C., Sánchez, F., 2020. Upstream and Downstream Impacts of College Merit-Based Financial Aid for Low-Income Students: Ser Pilo Paga in Colombia. American Economic Journal: Economic Policy. 12(2), 193–227. DOI: https://doi.org/10.1257/pol.20180131

[4] Pascarella, E.T., Pierson, C.T., Wolniak, G.C., et al., 2004. First-Generation College Students. The Journal of Higher Education. 75(3), 249–284. DOI: https://doi.org/10.1080/00221546.2004.11772256

[5] Guerra-García, J., Guevara-Benítez, C.Y., 2014. Validation of inventory of metacognitive strategies and motivation for reading (IEMML) in college students of psychology [Validación del inventario de estrategias metacognoscitivas y motivación por la lectura (IEMML) en estudiantes de psicología]. Psicogente. 17(31), 17–32. DOI: https://doi.org/10.17081/psico.17.31.1467

[6] OECD, 2006. Assessing Scientific, Reading and Mathematical Literacy. OECD Publishing: Paris, France. DOI: https://doi.org/10.1787/9789264026407-en

[7] OECD, 2019. PISA 2018 Reading Framework. In: OECD (ed.). PISA 2018 Assessment and Analytical Framework. OECD Publishing: Paris, France. pp.

21–71.

[8] Kurland, D.J., 1994. I Know What It Says...What Does It Mean? Critical Skills for Critical Reading. Wadsworth Publishing Company: Belmont, CA, USA.

[9] Unigarro Gutierrez, M.A., Bogoya Maldonado, D., 2018. Theoretical framework on generic competencies: Quantitative reasoning and critical Reading [Marco teórico sobre competencias genéricas: Razonamiento cuantitativo y lectura crítica]. DOI: https://doi.org/10.16925/greylit.2304

[10] Oakhill, J.V., Berenhaus, M.S., Cain, K., 2015. Children's Reading Comprehension and Comprehension Difficulties. In: Pollatsek, A., Treiman, R. (eds.). The Oxford Handbook of Reading. Oxford University Press: Oxford, UK. pp. 344–360. DOI: https://doi.org/10.1093/oxfordhb/9780199324576.013.23

[11] Babayiğit, S., Stainthorp, R., 2011. Modeling the relationships between cognitive–linguistic skills and literacy skills: New insights from a transparent orthography. Journal of Educational Psychology. 103(1), 169–189. DOI: https://doi.org/10.1037/a0021671

[12] Daneman, M., Carpenter, P.A., 1980. Individual differences in working memory and reading. Journal of Verbal Learning and Verbal Behavior. 19(4), 450–466. DOI: https://doi.org/10.1016/S0022-5371(80)90312-6

[13] Peng, P., Barnes, M., Wang, C., et al., 2018. A meta-analysis on the relation between reading and working memory. Psychological Bulletin. 144(1), 48–76. DOI: https://doi.org/10.1037/bul0000124

[14] Peng, P., Zhang, Z., Wang, W., et al., 2022. A meta-analytic review of cognition and reading difficulties: Individual differences, moderation, and language mediation mechanisms. Psychological Bulletin. 148(3–4), 227–272. DOI: https://doi.org/10.1037/bul0000361

[15] Baddeley, A., 2012. Working Memory: Theories, Models, and Controversies. Annual Review of Psychology. 63(1), 1–29. DOI: https://doi.org/10.1146/annurev-psych-120710-100422

[16] Jacobson, L.A., Ryan, M., Martin, R.B., et al., 2011. Working memory influences processing speed and reading fluency in ADHD. Child Neuropsychology. 17(3), 209–224. DOI: https://doi.org/10.1080/09297049.2010.532204

[17] Lengenfelder, J., Dahlman, K.L., Ashman, T.A., Mohs, R.C., 2019. Psychological assessment of the elderly. In: Goldstein, G., Allen, D.N., DeLuca, J. (eds.). Handbook of Psychological Assessment. Elsevier: Amsterdam, Netherlands. pp. 505–532. DOI: https://doi.org/10.1016/B978-0-12-802203-0.00016-X

[18] DeLuca, J., Chelune, G.J., Tulsky, D.S., Lengenfelder, J., Chiaravalloti, N.D., 2004. Is Speed of Processing or Working Memory the Primary Information Processing Deficit in Multiple Sclerosis? Journal of Clinical and Experimental Neuropsychology. 26(4), 550–562. DOI:

https://doi.org/10.1080/13803390490496641

[19] González Seijas, R.M., Cuetos Vega, F., López Larrosa, S., Vilar Fernández, J., 2017. Effects of phonological awareness and naming speed training on reading: A longitudinal studyl [Efectos del entrenamiento en conciencia fonológica y velocidad de denominación sobre la lectura. Un estudio longitudina]. Estudios Sobre Educación. 32, 155–177. DOI: https://doi.org/10.15581/004.32.155-177

[20] Labin, A., Brenlla, M.E., Taborda, A., 2015. Preliminary study on the relationship between the educational level of the mother and the Verbal Comprehension and Processing Speed Indexes of the WISC-IV [Estudio preliminar sobre la relación entre el nivel educativo de la madre y los índices comprensión verbal y velocidad de procesamiento del WISC-IV]. Revista de Psicología. 11(21), 35–45.

[21] Landerl, K., Freudenthaler, H.H., Heene, M., et al., 2019. Phonological Awareness and Rapid Automatized Naming as Longitudinal Predictors of Reading in Five Alphabetic Orthographies with Varying Degrees of Consistency. Scientific Studies of Reading. 23(3), 220–234. DOI: https://doi.org/10.1080/10888438.2018.1510936

[22] Gómez-Villalba, E., Núñez-Delgado, M.P., 2007. Teaching of Reading in the classroom [La enseñanza de la lectura en el aula]. Textos de Didáctica de La Lengua y La Literatura. 44, 19–33.

[23] De la Calle, A.M., Aguilar, M., Navarro, J.I., 2016. Developmental Progression of Phonological Awareness: How Is It Related to Subsequent Reading Competence [Desarrollo evolutivo de la conciencia fonológica: ¿Cómo se relaciona con la competencia lectora posterior]? Revista de Investigación En Logopedia. 6(1), 22–41. DOI: https://doi.org/10.5209/rlog.58553

[24] Levesque, K.C., Kieffer, M.J., Deacon, S.H., 2017. Morphological awareness and reading comprehension: Examining mediating factors. Journal of Experimental Child Psychology. 160, 1–20. DOI: https://doi.org/10.1016/j.jecp.2017.02.015

[25] Perfetti, C., Stafura, J., 2014. Word Knowledge in a Theory of Reading Comprehension. Scientific Studies of Reading. 18(1), 22–37. DOI: https://doi.org/10.1080/10888438.2013.827687

[26] Ato, M., López-García, J.J., Benavente, A., 2013. A classification system for research designs in psychology [in Spanish]. Anales de Psicología. 29(3), 1038–1059. DOI: https://doi.org/10.6018/analesps.29.3.178511

[27] Tighe, E.L., 2015. Assessing the Importance of Metalinguistic Skills to the Word Reading and Reading Comprehension Abilities of Adult Basic Education Students [PhD Thesis]. Florida State University: Tallahassee, FL, USA.

[28] Tighe, E.L., Little, C.W., Arrastia-Chisholm, M.C., et

al., 2019. Assessing the direct and indirect effects of metalinguistic awareness to the reading comprehension skills of struggling adult readers. Reading and Writing. 32(3), 787–818. DOI: https://doi.org/10.1007/s11145-018-9881-2

[29] Biesanz, J.C., Falk, C.F., Savalei, V., 2010. Assessing Mediational Models: Testing and Interval Estimation for Indirect Effects. Multivariate Behavioral Research. 45(4), 661–701. DOI: https://doi.org/10.1080/00273171.2010.498292

[30] Hahnel, C., Goldhammer, F., Kröhne, U., Naumann, J., 2017. Reading digital text involves working memory updating based on task characteristics and reader behavior. Learning and Individual Differences. 59, 149–157. DOI: https://doi.org/10.1016/j.lindif.2017.09.001

[31] Lynn, R., Mikk, J., 2009. National IQs predict educational attainment in math, reading and science across 56 nations. Intelligence. 37(3), 305–310. DOI: https://doi.org/10.1016/j.intell.2009.01.002

[32] Cogmen, S., Saracaloglu, A.S., 2009. Students' usage of reading strategies in the faculty of education. Procedia - Social and Behavioral Sciences. 1(1), 248–251. DOI: https://doi.org/10.1016/j.sbspro.2009.01.045

[33] González Pérez, P.A., Hernández Expósito, S., Pérez Hidalgo-Gato, J., et al., 2018. Electrophysiological correlates of reading in children with attention deficit hyperactivity disorder [in Spanish]. Revista de Neurología. 66(06), 175. DOI: https://doi.org/10.33588/rn.6606.2017521

[34] Esquivel Gámez, I., Martínez Olvera, W., Córdoba del Valle, R., Reyes Gutiérrez, C., 2016. Working memory and reading comprehension: Measurement through reading span test and cloze type test for high school and university levels. Apertura. 8(2), 38–53. DOI: https://doi.org/10.32870/Ap.v8n2.919