ARTICLE

INSTRUCTION IN READING COMPREHENSION IN THE CLASSROOM: WHAT CAN WE LEARN FROM A META-ANALYSIS?

HELENA VELLINHO CORSO[1]
ORCID: https://orcid.org/0000-0002-2476-0923
<hvcorso@gmail.com>
DÉBORA MAYER NUNES[1]
ORCID: https://orcid.org/0000-0002-6756-0390
<deboramayernunes@gmail.com>
ÉVELIN FULGINITI DE ASSIS[1]
ORCID: https://orcid.org/0000-0002-8542-0607
<evelin_assis@hotmail.com>

[1] Universidade Federal do Rio Grande do Sul (UFRGS). Porto Alegre, RS, Brazil.

INSTRUCTION IN READING COMPREHENSION IN THE CLASSROOM:WHAT CAN WE LEARN FROM A META-ANALYSIS?

ABSTRACT: The theory and research in reading comprehension (RC) make it clear that this ability fails to result automatically from the capacity to decode a text because it involves linguistic and cognitive components that need to operate together with decoding fluency. Therefore, we must face the ability to understand as an object of teaching that school instruction must pursue. Intervention studies — and meta-analyses on them — indicate effective interventions to foster this ability. However, applying scientific evidence to teachers' classroom practice is neither simple nor immediate, requiring new elaboration. This integrative review examines a group of meta-analyses on RC-intervention studies to verify the types of instruction analyzed, their effectiveness, and the main aspects which impacted this effect. Highlights among the findings include: teaching strategies favor all student profiles (with or without difficulties or at risk); some strategies are more recommended than others, such as setting reading goals (which facilitates the monitoring), asking questions about the text (during reading by teachers and students), and using written activities about the text. Furthermore, we found a vital moderator effect related to who applies the instruction: its effectiveness diminishes if teachers are its applicators. The complexity of applying and preparing these instructions indicates that training teachers to implement is as important as developing RC programs.

Keywords: reading comprehension, meta-analysis, intervention, metacognition, cognitive psychology.

INSTRUÇÃO EM COMPREENSÃO DE LEITURA NA SALA DE AULA: O QUE PODEMOS APRENDER COM METANÁLISES?

RESUMO: A teoria e a pesquisa em compreensão de leitura (CL) deixam claro que a habilidade não decorre automaticamente da capacidade de decodificar um texto, pois envolve componentes linguísticos e cognitivos que precisam operar junto com a decodificação fluente. Por isso, a habilidade de compreender precisa ser encarada como um objeto de ensino, e deve ser alvo de instrução escolar. Pesquisas de intervenção – e as metanálises sobre elas – indicam as propostas instrucionais que favorecem o desenvolvimento da habilidade. Entretanto, a aplicação da evidência científica para a prática do professor em sala de aula não é simples nem imediata, e requer nova elaboração. Este artigo de revisão integrativa examina um conjunto de metanálises de estudos de intervenção em CL, com o objetivo de verificar os tipos de instrução analisados, sua efetividade e os principais aspectos que impactaram esse efeito. Entre os resultados encontrados, destacam-se que o ensino de estratégias favorece todos os perfis de alunos – sem ou com dificuldades, ou sob risco –; e que há estratégias mais recomendadas que outras, como o estabelecimento prévio do objetivo da leitura – que, por sua vez, facilita o monitoramento –, a realização de perguntas sobre o texto – durante a leitura, pelo professor e pelos alunos –, e o uso de atividades de escrita sobre o texto. Ainda, há um efeito moderador importante de quem aplica a instrução: a efetividade diminui quando é o professor quem aplica. Portanto, a complexidade da aplicação e o preparo que ela requer indicam que tão importante quanto a elaboração de programas em CL é a formação dos professores que irão implementá-lo.

Palavras-chave: compreensão de leitura, metanálise, intervenção, metacognição, psicologia cognitiva.

INSTRUCCIONES PARA LEER ENTENDIMIENTO EN EL AULA: ¿QUÉ PODEMOS APRENDER DEL METAANÁLISIS?

RESÚMEN: La teoría y la investigación en comprensión de lectura (CL) aclaran que la capacidad no resulta automáticamente de la capacidad de decodificar un texto, ya que involucra componentes lingüísticos y cognitivos que deben operar junto con una decodificación fluida. Por lo tanto, la capacidad de entender debe verse como un objeto de enseñanza y debe ser el objetivo de la instrucción escolar. La investigación de intervención, y los metaanálisis sobre ella, indican las propuestas de instrucción que favorecen el desarrollo de la habilidad. Sin embargo, la aplicación de evidencia científica a la práctica del maestro en el aula no es simple ni inmediata, y requiere una nueva elaboración. Este artículo de revisión integradora analiza una serie de metaanálisis sobre investigaciones de intervención en CL, con el objetivo de verificar los tipos de instrucción estudiados, su efectividad y los principales aspectos que han impactado este efecto. Entre los resultados encontrados, se destaca que la enseñanza de estrategias favorece todos los perfiles de los estudiantes y que existen estrategias más recomendadas que otras, como el establecimiento previo del objetivo de lectura, la formulación de preguntas sobre el texto y el uso de actividades de escritura en el texto. Aun así, hay un efecto moderador importante de quienes aplican la instrucción: la efectividad disminuye cuando es el maestro quien la aplica. La complejidad de la aplicación y la preparación que requiere indican que tan importante cuanto el desarrollo de programas en CL es la capacitación de los maestros que la implementarán.

Palabras clave: comprensión de lectura, metaanálisis, intervención, metacognición, psicología cognitiva.

INTRODUCTION

The known and persistent gap between Brazilian educational indicators and those of countries with better results reveals a large distance between the science done in universities, research institutions, and the classroom. With this, it becomes increasingly necessary to propose an integration between these education forms, as some researchers pointed out (LENT, 2019). In the area of reading, for example, the scientific information available would be sufficient to impact the outcomes of educational practices positively. The increasing integration of the psychological and neuroscientific approaches in studying cognition and learning processes has produced considerable knowledge capable of explaining the normative development of reading skills and reading learning disorders. Especially in the specific subdomain of word reading, there is much knowledge about what cognitive processes underlie the skill, the neurobiological correlates involving the brain and genetics, and the types of effective interventions (FLETCHER et al., 2009).

Regarding scientific knowledge about the subdomain of reading comprehension - the focus of our interest - there have also been important advances. The classic models of Cognitive Psychology, which described only proficient reading, are now complemented by a model of reading comprehension development that includes the social aspects of cognition and the instructional factor as a central element - which brings clear educational implications, especially when thinking about ensuring the learning of children from socioeconomically disadvantaged backgrounds (CONNOR, 2016).

Thus, a theoretical framework is gradually emerging to explain how children develop reading comprehension skills and why some fail, which may inspire preventive and therapeutic intervention programs. Intervention research is particularly important because it allows us to verify what is effective in fostering the ability to read with comprehension or facilitating remediation in cases of reading disorder. In searching for pedagogical and psycho-pedagogical designs based on scientific evidence, meta-analyses, which assess the effect size of several independent interventions put together, assume special importance by providing the most substantial evidence available and degree of recommendation.

However, the transposition of scientific evidence — the findings of research — into teacher practice in the classroom is neither simple nor immediate. On the contrary, it requires mediation and presupposes a new elaboration: the development of new pedagogical programs. At the same time, the importance we must give to teacher training, both initial and continuing, in order for them to be better instrumentalized around reading comprehension is evidenced. Although Brazilian legislation indicates the use of educational research results to guide teacher training (BRASIL, 2006, 2015), only in 2019 was it made explicit the need to recognize this scientific evidence from different areas of knowledge, which ultimately strengthen the learning, teaching, and development of students in Basic Education (BRASIL, 2020).

In a context where subsidies are sought for constructing programs that favor reading comprehension among elementary school students in public schools, this integrative review article aims to examine a set of meta-analyses of intervention studies in reading comprehension. Thus, we aim to verify the types of interventions analyzed, their effectiveness, and the main aspects that impacted this effect. In short, it is about answering the question: what can we learn from the meta-analyses when we want to plan an effective intervention for the development of reading comprehension? Thus, this work makes sense in the context of a larger project, which involves (1) the construction of a pedagogical proposal aiming to promote the development of reading comprehension among public school students and (2) testing the effectiveness of the proposal through an experimental study (Plataforma Brasil number 70460017.3.0000.5347).

INSTRUCTIONS TO DEVELOP READING COMPREHENSION - EVIDENCE OF EFFECTIVENESS

The Organization for Economic Cooperation and Development (OECD) considers this skill as the ability to understand, use, reflect on, and engage with written texts to achieve particular goals, develop one's knowledge and potential, and participate in society (OECD, 1999). This definition values this learning, which otherwise can turn into personal and social prejudice. In Brazil, different educational indicators reveal an alarming reality, with lagging performances in reading from the beginning of school life that crystallize in the huge adult contingent, unable to understand and interpret long texts (CORSO, H.; CORSO, L.; SALLES, 2019).

Understanding what is read demands from the reader the coordination of text-specific processes, such as decoding fluency and knowledge of the text structure. It also requires the reader to coordinate socioemotional and cognitive processes, hence executive functions, including motivation, and linguistic processes, such as knowledge of syntactic and semantic aspects. These processes of the reader develop over time and interact with each other, having a reciprocal driving effect and being affected by instruction, whether at school or home. In turn, instruction is also affected by the first three processes, as children develop physically, linguistically, socially, cognitively, and emotionally throughout childhood, which influences learning and the effectiveness of instruction (CONNOR, 2016).

Therefore, both proximal and distal environmental influences are decisive for developing these three processes and can be characterized in contexts that favor or hinder them. Low socioeconomic status (SES) can be considered a risk factor for reading development, as indicated by different studies (PICCOLO et al., 2019). Similarly, the effects of disadvantaged settings can be attenuated in a positive academic supportive environment, in which students from low SES families perform on cognitive tasks similar to their high SES peers (PICCOLO; MERZ; NOBLE, 2018).

Reading comprehension scholars, such as Solé (1998), have long insisted on the need for interventions explicitly directed toward the acquisition of this skill, indicating, for this purpose, the teaching of comprehension strategies. At the same time, different intervention research has proven the centrality of explicit instruction on reading comprehension outcomes (FLETCHER et al., 2009). Considering that the development of reading comprehension skills depends on intentional and systematic interventions, this study aims to gather elements from different meta-analyses to propose a new pedagogical approach.

Meta-analysis combines the results of individual studies, so it is performed based on a systematic review of the literature on a specific research question. Thus, while the review is a systematic method that gathers and evaluates all scientific evidence on a given topic, meta-analysis is a statistical technique that integrates the results of the reviewed studies into a summary measure, accurately estimating the effect of the treatment in question (CROMBIE; DAVIES, 2009). As such, meta-analyses represent the most striking feature of evidence-based medicine. Nevertheless, the advantages of this type of analysis has been determining the use of the technique also in other fields, such as cognitive psychology, for example, which has contributed to advances in scientific knowledge of different cognitive processes - including reading. In the educational field, the search for pedagogical practices that gather scientific evidence to be more effective in guaranteeing student learning is of special interest in meta-analysis of studies on the science of reading.

Given the focus of this paper, we sought to gather and examine meta-analyses of studies that looked at the impact of interventions on reading comprehension. Sometimes the outcome variables included, in addition to comprehension measures, measures of word recognition, or even other components of reading. For this purpose, both meta-analyses of studies with typically developing students and those that looked at interventions aimed at the remediation of reading difficulties were consulted. This is justified by the fact that the same cognitive model explains typical and atypical development of the skill.

Finally, the eight studies described and discussed were gathered through searches on the CAPES journals portal, using the combined terms: reading comprehension, reading intervention, and meta-analysis. Articles were included in accordance with the pre-established criterion of being a meta-analysis from interventions with reading comprehension as a central theme, and those written in the English language between the years 1999 and 2018 were selected.

Instruction in strategies versus direct instruction for students with learning disabilities

The empirical evidence gathered from three decades of reading intervention research with students with learning disabilities was synthesized through Swanson's (1999) meta-analysis, which clarified the possibility of improvement in reading disabilities in both the subdomains of word recognition (WC) and reading comprehension (RC). We compared, in terms of effect size, studies that focused directly on reading the word - decoding printed material - through direct, fairly structured, and explicit instruction - those that indirectly influenced reading through instruction in strategies - or instruction in metacognitive skills -, and those that focused on a combination of both. Included were 92 studies that involved treatment in reading and had measures of word recognition and reading comprehension as dependent variables. On average, the WC intervention studies had more treatment sessions than the RC studies (M = 38.60, SD = 42.12 vs. M = 22.78, SD = 23.30, respectively). Conversely, the time for each instruction session in RC was longer (minutes: M = 38.94, SD = 29.20 vs. M = 43.14, SD = 26.45).

The initial analysis of effect sizes of the studies classified by intervention domain (WC and RC), done using Cohen's d, showed a large effect size - 0.72, with the threshold to be considered a large effect being 0.80 - for a prototype intervention study in RC. The effect size is largest in studies where comprehension was assessed using researcher-created measures (0.81) and smallest when normed measures were used (0.45). The prototypical intervention in WC, on the other hand, produced a moderate effect size (0.59). When effect sizes were analyzed according to the instructional model, it was found that the combined model produced larger effect sizes for RC, and the direct instruction model showed larger effect sizes for WC.

Another set of analyses allowed us to identify only a few instructional components that effectively contributed to treatment effectiveness, regardless of the overall instructional model: (1) teacher-directed questioning - dialectical teaching, in which the teacher asks students questions or directs them to ask, thus engaging everyone in a dialogue -, (2) difficulty control of task processing demand - tasks sequenced from easy to difficult, and teacher demonstrating the task and offering assistance -, (3) elaboration - when the teacher offers additional information and explanations -, (4) demonstration - when the teacher offers a model of the steps to follow in front of the task -, (5) small group instruction, and finally, (6) strategy suggestions by the teacher. Hierarchical regression analysis also showed that the last two variables were the ones that contributed significantly to the variance in RC scores.

Instruction in strategies for students with learning disabilities

Sencibaugh's (2007) meta-analysis addresses intervention studies with metacognitive instructional strategies targeting students with learning disabilities. Among the studies - collected between 1985 and 2005 - 15 were included, which met the criteria: experimental design, samples of students from 1st grade to 12th grade, and who received the treatment to increase RC ability. The duration of the interventions ranged from 1 day to 12 weeks, with session time ranging from 25 to 95 minutes.

The variety of strategic instructions was categorized into two types: strategy dependent on visual resources (visual strategies) and strategy dependent on auditory or language resources (auditory strategies). The first involves using pictures or visual skills — such as visual attention therapy, text illustrations, and graphic semantic organizers. The second strategy, termed "auditory," encompasses the use of language in pre-reading activities or post-reading exercises to aid comprehension-such as main idea strategy, summarization, paragraph rephrasing, story retelling, and strategies based on text structures. The meta-analysis found a large effect size for visual strategies (ES = 0.94) and an even larger effect size for auditory strategies (ES = 1.18). Among these, questioning strategies involving self-instruction, paragraph reformulations, and text structure-based strategies produced the most significant results.

Instruction in reading strategies applied by the teacher in the classroom

The meta-analysis by Okkinga et al. (2018) also sought to verify the effectiveness of interventions in reading strategies, specifically in classroom settings, thus in a situation where the teacher himself applies the intervention, unlike previous meta-analyses — in which the researchers themselves instruct small groups. In this case, the authors refer to previous meta-analyses that, by including studies conducted with the whole class, highlighted the moderating effect of who applies the intervention, with teachers being less successful than the researchers themselves in ensuring progress in students' comprehension skills. Possible explanations for this include the teachers' difficulty in understanding the strategies to be applied, the didactic complexity of combining teaching the strategy, demonstrating how it works, and monitoring the groups when the strategy provides for small groups of students interacting with each other.

Fifty-two studies were included in the meta-analysis that, among other inclusion criteria, met the requirement of comparing groups - the experimental group, which underwent the intervention, and the control group, which did not undergo the intervention. The outcome variables of the intervention studies were measures of RC and measures of strategic skills. The reading strategies coded, and whose presence or absence was verified in the studies, were subdivided into "before reading" (e.g., setting the goal to be achieved in reading, predicting the content, and activating prior knowledge), "during reading" - questioning, paraphrasing, making inferences, underlining - and "after reading." As for the duration of the interventions, the mean in hours was 47 hours (standard deviation 55), and the mean in weeks was 17 weeks (standard deviation 11).

Very small effect sizes were found on RC when measured using standardized tests, immediately after the intervention (Cohen's d = 0.186) and sometime after the intervention ended (Cohen's d = 0.167). When comprehension was measured through researcher-developed tests, the effect size was larger, but still small at the immediate assessment (Cohen's d = 0.431), and large at the late assessment through researcher-created tests (Cohen's d = 0.947). Regarding moderating effects in terms of intervention characteristics, setting the reading objectives was shown to have an important contribution to the effect sizes on the outcome variables. Regarding moderating effects in terms of student characteristics, effect sizes of interventions were found to be larger on the strategic skills of students with difficulties - compared to those with typical development. Grade also had a bearing on the effect sizes of the interventions, with those being larger for students between the 6th and 8th grades.

Instruction in writing activities to foster reading comprehension

Graham and Hebert (2011) examined the effectiveness of the writing activity as a tool in improving students' reading, starting from the theoretical perspectives that explain the possible impact of writing on reading. Writing about the text facilitates its comprehension as it provokes the explicitness and integration of the most important ideas from an active position in front of the text, which leads to the selection of information and the transformation and manipulation of the language of the text into one's ideas. The fact that writing characterizes a visible and permanent record facilitates revision, criticism, and the connections that make understanding deeper and deeper. Additionally, there is the theoretical principle that, although distinct, reading and writing activities share certain skills and processes, so that instruction in the process of writing could facilitate comprehension of read texts — for example, by being taught to write complex sentences, the student would more easily understand these types of sentences when read. Finally, it is believed that the process of composing a text to be read by others provides the student with insights that facilitate the understanding of others' texts (i.e., to write he needs to make premises explicit, obeying a logic, which may leave him more attentive, searching for these same questions during the reading of a text).

The meta-analysis included experimental or quasi-experimental studies involving treatments in which elementary school students — starting in 4th grade — and high school students wrote about what they read, were taught to write, or underwent an increase in the amount of writing tasks. The studies, which were to have a measure of RC as the dependent variable, were categorized according to the type

of writing activity: responding in writing to questions about the text or devising written questions about the text; taking written notes; making summaries; making interpretive, analytical, or explanatory written comments; and writing short answers about the text. As a result, the meta-analysis indicated that writing about the material read improves comprehension of the text, which proved true for both general students and students who were not very skilled at reading and writing. The effect size was 0.37 in studies using standardized reading tests, and 0.50 in studies using RC measures developed by the researchers. The beneficial effect of writing activities was confirmed for both expository and narrative texts. Also, four activities were shown to be effective: responding in writing elaborately, writing summaries, taking notes, and answering and/or asking questions. Finally, it was seen that increasing the time that typically developed, 1st through 6th-grade students engaged in writing activities had a positive effect (effect size = 0.35).

The same authors, Hebert, Gillespie, and Graham (2012), conducted a subsequent meta-analysis in which they sought to compare the effects of different writing activities on comprehensive reading. The study synthesized the results of four comparisons: Summary versus Developing and Answering Questions; Answering Questions versus Taking Notes; Summary versus Taking Notes; and Answering Questions versus Extended Writing. On the one hand, the mean scores did not indicate that one type of writing activity favored RC more than another. Nevertheless, the effectiveness of writing varied according to the test that assessed reading comprehension: in the Summary versus Answering Questions comparison, the former activity was more effective in assessing by free recall, and in the Extended Writing versus Answering Questions comparison, the former type of writing activity was more effective in assessing by making elaborate responses about the text.

As for the implications for educational practice, based on this second meta-analysis (HEBERT; GILLESPIE; GRAHAM, 2012), the researchers concluded that the study did not produce evidence to recommend that teachers use one writing activity over another. Rather, the recommendation was that they combine the activities considered in their classrooms.

Instruction in expository text structures for students at different reading levels (with difficulty, without difficulty, and at risk)

The expository texts used in school to present the most different curricular contents admit a classification. According to the information passed on and the didactic objectives, one can find texts of descriptive, grouping, causal, clarifying or comparative structure. By recognizing the type of text, students can identify some indicators in order to anticipate the information and facilitate interpretation because there are expressions typically used in the different structures: a causal text, for example, may contain keywords or expressions such as "The reason why [...]; due to [...]; for the fact that [...]" (SOLÉ, 1998).

Hebert et al. (2016) conducted a meta-analysis on expository text structure instruction's effect on student comprehension. They even pointed out that many researchers consider two factors possibly influential in the effectiveness of text structure instruction: the characteristics of the students who might benefit from the such instruction-their reading level or their grade-and the approaches and strategies used in instruction.

This meta-analysis examined 45 studies conducted with school-aged participants in grades 1 through 12. As a result, teaching students about the structures of expository texts improves RC in all comparison groups used in the studies that comprised this paper. A relevant finding is that instruction in more text structures resulted in larger effects: there was a 0.13 standard deviation increase in effect size for each new structure taught after the first. A qualitative examination of the text types and structures taught, the order in which they were taught, and groupings of text structures revealed little variation in the approach to teaching multiple text structures. Thus, teaching more structures and comparing/contrasting would also lead to greater gains. Thus, it seems logical that knowledge in more text structures, not just one, would improve comprehension.

Another important finding of the meta-regression model was that writing appeared to predict intervention effectiveness significantly. In this study, writing was considered to include note taking,

sentence writing — for instance, short answers to questions about the text — and writing paragraph-sized answers about the text. Studies that included writing had an increased effect size — mean of 0.38 standard deviation units.

Individual instruction for students at risk: components of decoding and comprehension

Elbaum et al. (2000) conducted a meta-analysis of empirical findings related to individual instruction provided by adults to early-grade children at risk for reading failure. Twenty-nine studies were pooled, conducted between 1976 and 1998, with interventions lasting between eight and 90 weeks, and total instruction time between eight and 150 hours. The intervention types, corresponding to the independent variables, were coded as: WR (word reading); RC; mixed (WR and RC); phonemic awareness; visual perceptual skills; unspecified. The outcome variables were: RC; spelling; decoding, oral reading of words, oral reading of passages, subtest-based task compositions, and writing; listening comprehension; written vocabulary; phonemic awareness.

Reported effect sizes were largest in the face of RC (2.41) and mixed (0.50) instruction. Regarding the outcome variables, written vocabulary (0.94) and listening comprehension (0.68) had the largest effect sizes. Regarding the duration of the intervention, the effect sizes were larger for interventions carried out in up to 20 weeks, with an average of 63 instructional hours (0.65), than those with more than 20 weeks, with an average of 61 hours (0.37). Interventions delivered by college students had the largest effect size (1.65) compared to those delivered by teachers (0.36), community volunteers (0.26), or paraprofessionals (0.68).

In summary, it was revealed that students who received individual instruction demonstrated performance of one standard deviation higher than that of the control group. The focus of the intervention on RC had the greatest effects for older students, while instruction with a focus on phonemic awareness or of the mixed type had moderate effects. The meta-analysis also showed that trained volunteers and college students could provide significant help to at-risk students, indicating the possibility of cost savings in offering instruction to children. Importantly, however, this instruction should be supplemental to classroom instruction provided by teachers, not a substitute for it. The findings on small group interventions have also been positive: when highly qualified teachers implement a well-developed intervention, students experience the same academic benefits regardless of whether they are taught individually or in smaller groups.

Reading instruction and its long-term effects: components of decoding and comprehension

The meta-analysis Suggate (2016) developed included experimental and quasi-experimental studies of reading interventions, focusing on phonemic awareness, phonics, fluency, and comprehension approaches. Unlike the previous studies, Suggate dealt with studies that included long-term post-intervention follow-up. In addition to coding the type of intervention and the risk status for the sample's reading difficulty, the intervention's methodological characteristics were coded to clarify why the effect size changes from post-test to follow-up.

Regarding the approaches of the interventions, four types were coded. The phonemic awareness intervention specifically addresses the perception of sounds at the phoneme level - *boi* as b/o/i. The phonemic intervention focuses on associations between phoneme and spelling, incorporating letters or text. Fluency intervention works on the ability to read with speed and accuracy. The comprehension intervention generally involved metacognitive strategies, such as reflecting, summarizing, and predicting.

The main results of this meta-analysis, which included 71 intervention studies using a control group, are presented below: Regular readers were shown to lose their advantages over the control group at follow-up (ES = 0.13) and researcher-administered interventions resulted in larger effect sizes (ES = 0.34) at post-test. Long-term effect sizes were larger in the higher grades, 3rd through 6th grade (ES = 0.43). Phonemic awareness interventions result in larger effect gains at follow-up, while phonics and fluency interventions lost more effect at follow-up. In addition, fluency interventions did not result in

good transfer to reading comprehension, with benefits more directed toward decoding and reading skills at follow-up. The largest effect sizes at follow-up resulted from interventions with comprehension components that were worked on with the older children.

Considering these meta-analyses presented, it is important to compare their evidence and reflect on the implications for educational practice. In fact, as mentioned before, the transposition of scientific results to the teaching activities in the classroom requires mediation and a new elaboration. In order to clarify this issue, we will discuss the main indications of the meta-analyses below, seeking a reflective synthesis that integrates the main findings.

INTEGRATIVE SYNTHESIS OF THE STUDIES AND EDUCATIONAL IMPLICATIONS - DISCUSSION AND FINAL COMMENTS

Reading comprehension theory and research have long insisted that this complex skill does not automatically follow from the ability to decode a text, as it involves linguistic and cognitive components that must operate alongside fluent decoding. Therefore, comprehension skill needs to be seen as an object of teaching, and should be the target of school instruction (SOLÉ, 1998). In this sense, the question that naturally derives from this assertion is: how to teach students to understand what they read? The debate over which is the best literacy method, which still takes over the Brazilian and international educational scenario, is also desirable and necessary in the specific domain of reading comprehension. Cognitive Psychology has been offering important indications for teaching this skill, with intervention research being especially elucidative for understanding what impacts the ability to comprehend (FLETCHER et al., 2009). From the synthesis of the meta-analyses consulted, some conclusions or points for problematization can be presented to answer the initially formulated question.

The studies consulted report the size of the effect of specific interventions on RC — and other components of reading — and the variables that impact that effect (mediating effects), whether they are linked to the characteristics of the sample (e.g., students with or without reading difficulty), the deliverer of the instruction (e.g., the researcher or a teacher), aspects of the instruction itself, or even the instruments used to assess the effect on comprehension skill at the end of the intervention. Considering these variables that impact the effect of instruction needs to be considered in thinking about possible educational applications of the findings of those effectiveness studies.

Of the eight studies consulted, at least six involve interventions based on strategy teaching. The strategy to approach the text characterizes a metacognitive skill. It is known that metacognition is indispensable to textual comprehension. Good comprehenders are aware of the purpose of reading, know how to adapt to the task's demands, and monitor their comprehension. Failures in these metacognitive skills determine difficulties in this process (FLETCHER et al., 2009). Therefore, it is necessary to teach strategies either to treat comprehension difficulties or to facilitate the development of this skill in students with typical development. Meta-analyses have revealed that instruction in strategies, with students with or without learning disabilities, is effective, especially if associated with direct instruction (SWANSON, 1999), involving language as opposed to visual strategies (SENCIBAUGH, 2007), or writing over text (GRAHAM; HEBERT, 2011; HEBERT; GILLESPIE; GRAHAM 2012).

Furthermore, instruction in cognitive strategies appears to maintain effectiveness over time (SUGGATE, 2016). At least four meta-analyses, among those consulted, point to the mediating effect of age on the impact of comprehension instruction. That is, students more advanced in schooling appeared to benefit the most from instruction in different strategies (HEBERT et al., 2016; GRAHAM; HEBERT, 2011; ELBAUM et al., 2000; OKKINGA, 2018), and the benefits of interventions, which included metacognitive components of comprehension, were maintained in the follow up for students as early as 3rd grade (SUGGATE, 2016). Considering this, the mediating effect of schooling time is consistent with the literature on reading development. Using strategies in approaching text is the last stage of that evolution, which reveals a progressive mastery of PR until it becomes fluent (STERNBERG; GRIGORENKO, 2000). On the one hand, only after conquering fluency in decoding - which would happen, with variations, throughout the 3rd grade - does the reader have the cognitive resources left to

"dive" into the text, using those strategies that involve monitoring and regulation. On the other hand, the capacities for planning, monitoring, and controlling one's own activity, corresponding to the psychological concept of metacognition and the related neuropsychological concept of executive functions, have a delayed and culture-dependent development (CORSO et al., 2013), so, understandably, instruction in strategies is less likely to be effective before 3rd grade.

The teacher applied strategy instruction in the classroom context had restricted effectiveness (OKKINGA, 2018). However, this result does not indicate that the same type of instruction, which showed expressive effect sizes in previous studies (SENCIBAUGH, 2007; SWANSON, 1999), should not be used in the classroom by the teacher, but only shows the complexity of this application and the preparation it requires. Thus, for teachers to be more successful in ensuring progress in students' comprehension skills, they must master the strategies to be applied, and be sufficiently trained in their application. And these considerations bring us back to the problematic issue of teacher training, especially in the Brazilian context, not only concerning the quality of this training - understood generically — but also the inclusion of the study of reading, from a perspective of Cognitive Psychology and Neuropsychology, in undergraduate curricula. This would allow understanding how the reader processes a text, how this skill is developed, the difficulties in the process, and the decisive role of explicit and systematic instruction.

Two of the meta-analyses consulted dealt specifically with instruction for children with learning disabilities, and Swanson (1999) and Sencibaugh (2007) reported significant effect sizes for this population's reading intervention studies. This is very important considering the large number of students who have difficulty understanding read texts: the estimated prevalence of specific difficulty in comprehension-not due to decoding failure-ranges from 5 to 10% (FLETCHER et al., 2009). Okkinga's (2018) meta-analysis, in turn, makes clear that an improvement in this perspective can occur in the classroom context: struggling students benefitted more from teacher instruction in comprehension strategies than typical students.

The benefits of the reading comprehension skill intervention, which combines decoding instruction with strategic instruction, were clear in Swanson's (1999) study. This finding is relevant when considering the educational implications of the research findings. It is known that text processing involves more than decoding (WR and fluency) and encompasses higher-level cognitive processes - for example, the ability to make inferences - so that comprehension difficulties can occur in the absence of failures in more basic processes. And it remains true that the latter condition comprehension, and are necessary for it to happen, although not sufficient. However, the different aspects of reading - WR, fluency, and RC - not only happen on a continuum, but they are also skills that continue to improve the more they are trained. Thus, especially in public schools, with students who may have gaps in the most basic processes, it is recommended that teaching continue to focus on decoding skills.

Another important aspect to consider regarding reading comprehension instruction is assessment. It was seen that effect sizes change according to the tests used in the studies, generally larger when developed by the researchers than when standardized tests are used. These differences in assessment results according to the instruments used are to be expected because the instruments vary, both in terms of the material read — sentence, text, text genre, etc. — and the tasks — gap-filling, open response, multiple choice, etc. — or the cognitive demands involved — memory, inference, vocabulary, etc. (FLETCHER et al., 2009). Tests developed by researchers in the studies may concern the aspects stimulated during the intervention, which would justify the more expressive results. In the educational context, what is evident is the importance of evaluating students' reading, periodically and constantly to monitor their evolution, track cases of difficulties, and plan in a more personalized way the teaching, according to the results obtained - which is desirable (CONNOR, 2016). Additionally, it is worth considering the beneficial effect of small group instruction, evidenced in the meta-analyses of Swanson (1999) and Elbaum et al. (2000). Such findings reinforce the indication to monitor students' progress in order to verify the level of reading development at which they are, which would facilitate the gathering of students of the same level into groups that could receive individualized instruction according to their needs (CONNOR, 2016).

Therefore, it is concluded that the meta-analyses consulted offer evidence in favor of educational programs to promote reading comprehension:

- Broadly include comprehension strategies. Able to teach students to be active and critical in front of the text, they favor the development of comprehension skills in all profiles of students, with or without difficulties or at risk of developing them;
- Specifically, adopt the most effective strategies. Before reading: establish its purpose since students can better monitor their own comprehension by knowing what they want to learn from the text. During reading: ask for passages of the text to be rephrased, explained, or translated with other words, and ask questions about the text, both the teacher and the student;
- Teach about the different expository text structures and ask for their identification during reading. Signal words can be used to guide comprehension during reading and be useful in summarizing later (strategies after reading);
- Include writing activities extensively, a powerful resource for helping students understand what they have read, either by writing elaborate responses to questions about the text, or by taking notes or writing summaries. The use of writing lends itself especially to strategies after reading;
- Associate to the summary proposals the teaching of graphic organizers, such as tables, a very effective visual strategy.

All the activities highlighted place the teacher in a decisive role in the effectiveness of the proposals. He presents and explains the strategy and demonstrates (modeling) them to the whole class or small groups. Sometimes the teacher must engage students in a dialogue about the text read, as in the example of the strategy of asking questions about the text - the teacher asks them or directs the students to ask them. Thus, as important as the program's design is the training of the teachers who will implement it. This training needs to include study of reading comprehension and equip the future teacher to teach the skill.

REFERENCES

BRASIL. Resolução CNE/CP nº 1, de 15 de maio de 2006. Institui diretrizes curriculares nacionais para o curso de graduação em Pedagogia, licenciatura. *Diário Oficial da União*: seção 1, Brasília, DF, p. 11, 16 maio 2006.

BRASIL. Resolução CNE/CP nº 2, de 1 de julho de 2015. Define as diretrizes curriculares nacionais para a formação inicial em nível superior (cursos de licenciatura, cursos de formação pedagógica para graduados e cursos de segunda licenciatura) e para a formação continuada. *Diário Oficial da União*: seção 1, Brasília, DF, p. 8-12, 2 jul. 2015.

BRASIL. Resolução CNE/CP nº 2, de 20 de dezembro de 2019. Define as diretrizes curriculares nacionais para a formação inicial de professores para a Educação Básica e institui a Base Nacional Comum para a formação inicial de professores da Educação Básica (BNC-Formação). *Diário Oficial da União*: seção 1, Brasília, DF, p. 46-49, 15 Apr. 2020.

CONNOR, Carol McDonald. A Lattice Model of the Development of Reading Comprehension. *Child Development Perspectives*, v. 10, n. 4, p. 269-274, 2016. <https://doi.org/10.1111/cdep.12200>

CORSO, Helena Vellinho; CORSO, Luciana Vellinho; SALLES, Jerusa Fumagalli. Intervenção em habilidades de compreensão de leitura. *In*: CARDOSO, Caroline de Oliveira; DIAS, Natália Martins

(org.). *Intervenção neuropsicológica infantil*: da estimulação precoce-preventiva à reabilitação. São Paulo: Pearson Clinical Brasil, 2019. p. 337-355.

CORSO, Helena Vellinho *et al.* Metacognição e Funções Executivas: relações entre os conceitos e implicações para a aprendizagem. *Psicologia*: Teoria e Pesquisa, Brasília, DF, v. 29, p. 21-29, 2013. <http://doi.org/10.1590/S0102-37722013000100004>

CROMBIE, Iain K.; DAVIES, Huw T. What is Meta-Analysis? *Hayward Medical Communications*, v. 1, n. 8, p. 1-8, 2009. Available at: http://www.bandolier.org.uk/painres/download/whatis%20copy/Meta-An.pdf. Accessed at: 13 Aug. 2019.

ELBAUM, Batya *et al.* How Effective Are One-to-One Tutoring Programs in Reading for Elementary Students at Risk for Reading Failure? A Meta-Analysis of the Intervention Research. *Journal of Educational Psychology*, v. 92, n. 4, p. 605-619, 2000. <http://doi.org/10.1037/0022-0663.92.4.605>

FLETCHER, Jack *et al. Transtornos de aprendizagem*: da identificação à intervenção. Porto Alegre: Artmed, 2009.

GRAHAM, Steve; HEBERT, Michael. Writing to Read: A Meta-Analysis of the Impact of Writing and Writing Instruction on Reading. *Harvard Educational Review*, v. 81, n. 4, p. 710-744, 2011. Available at: https://www.studentachievement.org/wp-content/uploads/Writing-to-Read.pdf. Accessed at: 6 Mar. 2019.

HEBERT, Michael; GILLESPIE, Amy; GRAHAM, Steve. Comparing Effects of Different Writing Activities on Reading Comprehension: A Meta-Analysis. *Reading and Writing*, v. 26, n. 1, p. 111-138, 2012. <http://doi.org/10.1007/s11145-012-9386-3>

HEBERT, Michael *et al.* The Effects of Text Structure Instruction on Expository Reading Comprehension: A Meta-Analysis. *Journal of Educational Psychology*, v. 108, n. 5, p. 609-629, 2016. <http://doi.org/10.1037/edu0000082>

LENT, Roberto. *O cérebro aprendiz*: neuroplasticidade e educação. Rio de Janeiro: Atheneu, 2019.

OECD – Organização para Cooperação e Desenvolvimento Econômico. *Tecnologia e economia*: a chave para relacionamentos. Paris: OECD, 1999.

OKKINGA, Mariska *et al.* Effectiveness of Reading-Strategy Interventions in Whole Classrooms: A Meta-Analysis. *Educational Psychology Review*, v. 30, n. 1, 2018. <http://doi.org/10.1007/s10648-018-9445-7>

PICCOLO, Luciane; MERZ, Emily; NOBLE, Kimberly. School Climate is Associated with Cortical Thickness and Executive Function in Children and Adolescents. *Developmental Science*, v. 22, n. 1, 2018. <http://doi.org/10.1111/desc.12719>

PICCOLO, Luciane *et al.* Interventions to Improve Language Skills in At-Risk Population: Preventing Reading Disabilities in Children from Low-SES. *In*: MORET-TATAY, Carmen; BERNABÉ-VALERO, Gloria. (org.). *Pensamientos, emociones y conductas humanas*: actualizaciones en investigación psicológica. La Laguna: Latina, 2019. p. 19-43.

SENCIBAUGH, Joseph. Meta-Analysis of Reading Comprehension Interventions for Students with Learning Disabilities: Strategies and Implications. *Reading Improvement*, v. 44, n. 1 p. 6-22, 2007. Available at: https://files.eric.ed.gov/fulltext/ED493483.pdf. Accessed at: 14 May. 2020.

SOLÉ, Isabel. *Estratégias de leitura.* Porto Alegre: Artes médicas, 1998.

STERNBERG, Robert; GRIGORENKO, Elena. *Teaching for Successful Intelligence.* Arlington Heights, IL: Skylight, 2000.

SUGGATE, Sebastian. A Meta-Analysis of the Long-Term Effects of Phonemic Awareness, Phonics, Fluency, and Reading Comprehension Interventions. *Journal of Learning Disabilities*, v. 49, n. 1, p. 77-96, 2016. <http://doi.org/10.1177/0022219414528540>

SWANSON, H. Lee. Reading Research for Students with LD: A Meta-Analysis of Intervention Outcomes. *Journal of Learning Disabilities*, v. 32, n. 6, p. 504-532, 1999. <http://doi.org/10.1177/002221949903200605>

AUTHORS' CONTRIBUTIONS

Author 1 - Project coordinator, data reading and analysis (meta-analysis), and text writing.
Author 2 - Data collection (meta-analysis), data reading and analysis, and text writing.
Author 3 - Data reading and analysis (meta-analysis), writing, and proofreading.

DECLARATION OF CONFLICT OF INTEREST
The authors declare that there is no conflict of interest with this article.