



## **A Systematic Review of Technology-enhanced Assessment of Monolingual and Bilingual Written Language Comprehension**

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### **Introduction**

Throughout the last decade, a traditional language classroom is no longer the only space where formal learning occurs. Paper-based textbooks are being substituted with appealing technology-driven courses featuring web-based classes, hyperlinks, digital presentations, and video materials. This shift towards digital education, which escalated more notably during the COVID-19 pandemic, undoubtedly affects language assessment settings that provide information on one's language development and literacy, e.g., through gauging comprehension of written language.

The challenges that are brought by written language comprehension assessment are some of the most pressing ones and are universal to general language assessment, among which are validity in interpretation, accountability for results, ethical issues, language tester's competence, and feedback (Bachman, 2013). Feeble written language comprehension in language learners may become one of the causes of negative developments, among which are financial hardships, crime, and even massive functional illiteracy in societies (Seidenberg, 2013). That is, it may not only impinge on one's academic success but also lead to problems in social life due to the inability to comprehend what others write and an eventual failure to communicate. In this regard, it is expedient to examine what has been established so far in the literature about the assessment of written language comprehension skills in the digital context.

Such factors as word repertoire, motivation, and bilingualism can also affect written language comprehension (Cates-Darnell, 2002). That is why educators need to consider these factors and make use of assessments of multiple types and forms to amply understand the strengths and needs related to the development of written language comprehension in language learners.

Given that bilingualism is one of the factors to be considered while assessing written language comprehension, the research questions are:

RQ1: What are the key findings on monolingual written language comprehension assessment in the literature of the past 15 years (from 2005 to date)?

RQ2: What are the key findings on bilingual written language comprehension assessment in the literature of the past 15 years (from 2005 to date)?



RQ3: According to the same literature, what technology-enhanced tools are used to assess written language comprehension?

The choice of a 15-year period was purposeful. A small study before conducting the review has shown that new theoretical developments on the topic have occurred mostly in the past 15 years and can be accounted for in this brief report (Lotherington, 2020). In addition, many previous review studies covered periods of appropriately 10 to 15 years (e.g., Hwang & Fu, 2019; Zou, Huang, & Xie, 2019).

## Method

In this study, we adhered to a systematic approach of conducting a review proposed by Xiao and Watson (2019), organized as follows: literature identification (step 1), screening (step 2), eligibility (step 3), inclusion (step 4).

For answering RQ 1, we turned to Taylor & Francis and Wiley, arbitrarily selected reputable science databases, but found a relatively limited number of journal articles and book chapters ( $n = 7$ ). Hence, we opted for using Google Scholar, with its far-reaching scope, via the custom range of the past 15 years and relevance sorting. We screened for the most relevant literature, firstly, by using dash (-) before irrelevant concepts, secondly, by a purposive sampling technique (for RQ 1 data identification and screening, Figure 1). According to Sharma (2017), this technique implies making the researcher's own decisions concerning items' topic applicability. The retrieved research items ( $n = 44$ ) were further checked for indexation in science databases featuring peer-reviewed research, and only 31.81% ( $n = 14$ ) of items were there (for RQ 1 data eligibility results, Figure 3).

For answering RQ 2, Google Scholar was chosen at the onset with the custom range of the past 15 years and relevance sorting. The screening was done by inserting dash (-) prior to irrelevant concepts and a purposive sampling technique (for RQ 2 data identification and screening, Figure 2). The retrieved research items ( $n = 39$ ) were verified for eligibility, and only 28.20% of the units ( $n = 11$ ) were indexed (for RQ 2 data eligibility results, Figure 4).

For answering RQ 3, steps 1 and 3 were skipped, because they had already been completed. Publications from the pool of previously fetched items ( $n = 25$ ) were checked for relevance via keyword search, e.g., technology, online, digital, web, etc. As a result, 48% of the research items ( $n = 12$ ) fitted the screening criteria (for RQ 3 data screening results, Figure 5).

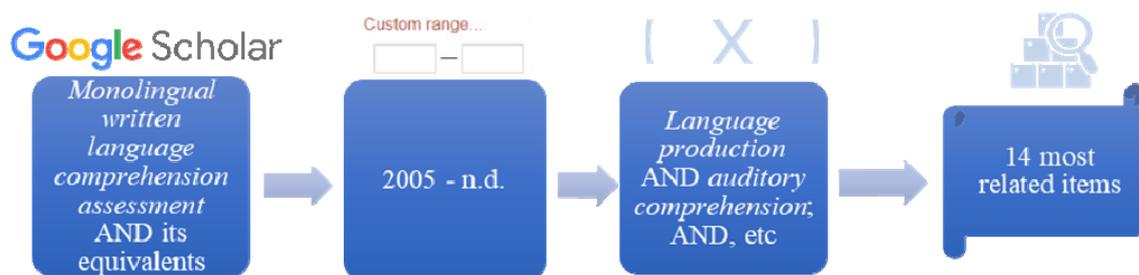


Figure 1. The RQ 1 data identification and screening by using Google Scholar search.

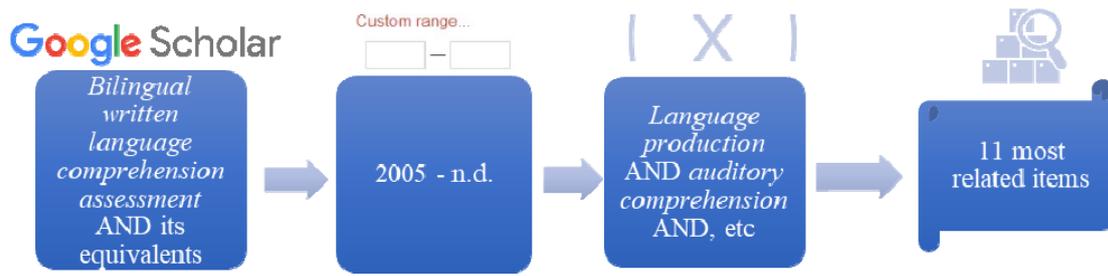


Figure 2. The RQ 2 data identification and screening by using Google Scholar search.

### The Database Contexts of the Reviewed Literature

Figure 3 illustrates information about the database sources of the studies that represent the monoglossic perspective of written language assessment included in the review. Our observation is that nine out of 14 reported studies are evenly apportioned between the three databases: Wiley, APA Psych, and Semantic Scholar, each having three.

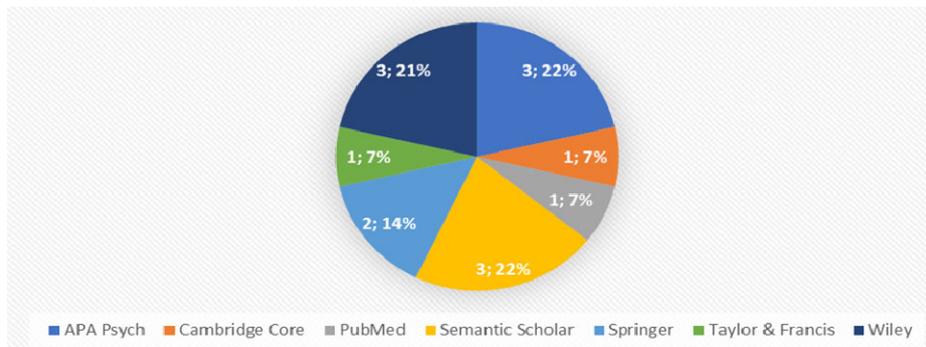


Figure 3. Research outputs per database upon RQ 1 data eligibility check.

Figure 4 presents information on the retrieved research outputs (n = 11) making up the multilingual perspective of written language assessment with their distribution across 5 database sources. We note that 64% of 11 reported studies (n = 4) are indexed by Semantic Scholar.

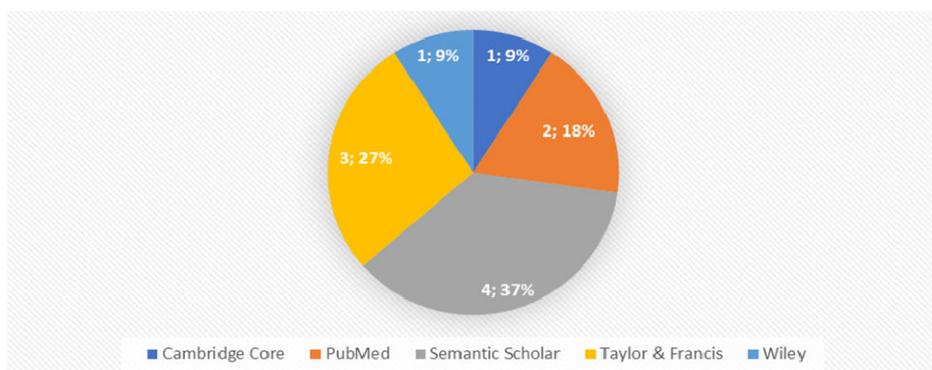


Figure 4. Research outputs per database upon RQ 2 data eligibility check.

Figure 5 demonstrates the distribution of reviewed studies representing both monoglossic and multilingual contexts of written language comprehension assessment performed through technology-mediated instruments.

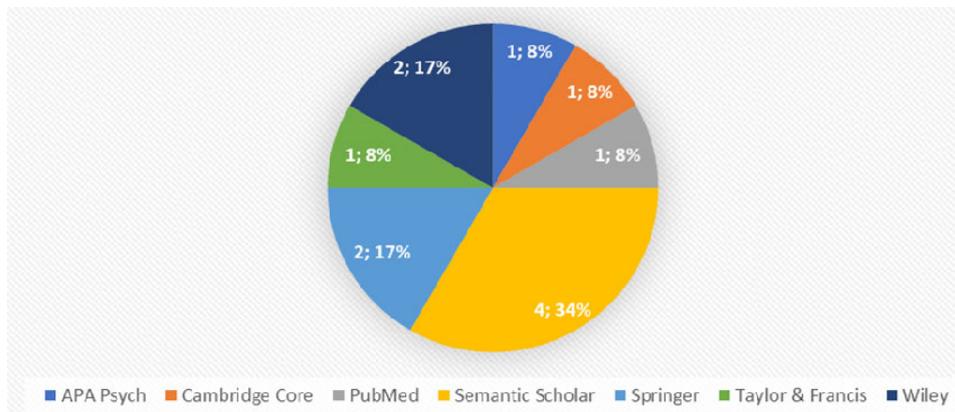


Figure 5. Research outputs per database upon RQ 3 data screening.

### The Monoglossic Perspective of Written Language Comprehension Assessment

More than a half (57%) of the 14 studies reviewed here have been primarily focused on teaching strategies and tools. This research interest has been motivated since assessment itself implies certain instruments that are utilized in language pedagogy to measure one's reading competence.

One of the surprising findings of the review is that the spark of interest in studying assessment tools for monolinguals falls from the year 2016 and onwards. To some extent, this interest may have developed due to a recent drop in reading literacy. This is made evident following the plummeting reading scores of many countries based on the results of the Program for International Student Assessment (PISA) of 2015 (OECD, 2016). We suppose this crisis has possibly contributed to the rise of attention to finding tools and strategies in the assessment of written language comprehension that provides timely and constructive feedback for helping to increase reading literacy.

The feature that sets these instruments apart is the difference in technical representation. Taking into consideration these differences and major focuses, we thematically divided the reviewed studies of written language comprehension assessment into the following groups: (i) subcomponents; (ii) types (iii) Internet-based tools; (iv) computer-mediated tools; (v) video recordings as a tool.

Three studies (Adams, 2017; Afflerbach, 2016; Trumbull & Lash, 2013) were conducted to conceptualize the subcomponents of written language comprehension than provide with actual assessment tools. However, they advocated for taking these subcomponents, such as phonemic awareness, sight word knowledge, application of phonics, fluency, literal and inferential comprehension, into consideration to choose a suitable assessment tool. When having information about one's text comprehension problems, formative assessments may help to instruct them how to read effectively and may reinforce their abilities to take over their progress.

Speaking of assessment types, another trio of studies (Siegler, Fazio, & Pyke, 2011; Theall & Franklin, 2010; Torres, 2019) provided their synopses in the context of written language comprehension assessment. Based on the findings, the formative assessment takes place throughout a single class or a whole course and pursues to advance one's development of written language comprehension via approaches maintaining definite needs of assessed individuals. This assessment brings the set of instruments to spot misapprehensions, struggles, and gaps in the skill development and assesses how to close the gaps, and as a result, stands out as an assessment for learning. Summative assessments give

insights into one's breakthroughs in reading comprehension at the end of an educational cycle, e.g., a course segment, or at the end of a training program, which stands out as an assessment of learning. This type of assessment has a robust impact on the final grade. A sole summative assessment is valuable for educators only since it is the most sensible way of marking and recording the results of students. If adopting a purely formative assessment paradigm, students' learning experience will be enhanced, but extra energy from instructors is expected.

Two studies (Kim et al., 2017; Wijekumar, Meyer, & Lei, 2017) elaborated on the Internet-based programs, viz Strategic Adolescent Reading Intervention (STARI) and Intelligent Tutoring System for the Text Structure Strategy (ITSS), that aim at enhancing the level of written language comprehension skill. The final part of each program entails the web-based assessment tool checking the vocabulary level and fluency in written language processing after training. The results of both studies indicated the importance of a student's background knowledge and reading experience before assessing written language comprehension. In particular, students are able to exhibit abundant vocabulary on a range of diverse topics, from straightforward (e.g., school) to more complex (e.g., war) words after engaging in the STARI training of non-fiction literature and novel readings (Kim et al., 2017). While taking a standardized test, seventh graders that are guided by the ITSS can comprehend text ideas clearer and refine them by applying the centrality of connections (Wijekumar, Meyer, & Lei, 2017).

Four studies in the reviewed literature (Auphan, Écalle, & Magnan, 2019; Hermena et al., 2017; The Northwest Evaluation Association, 2017; Snyder, Caccamise, & Wise, 2005; Xia, Kochmar, & Briscoe, 2019) presented the computer-facilitated assessment systems. They are mainly used for the assessment of different subcomponents of written language comprehension from orthographic discrimination to gist comprehension. The suggested systems were proved to be highly automatic, while one of them is adaptive to one's performance during assessment (Snyder, Caccamise, & Wise, 2005). Thus, in the process of assessment, once students incorrectly answer a question, the Independent Comprehensive Adaptive Reading Evaluation (ICARE) system automatically adjusts to their written language comprehension level by offering a series of measures that are easier than the ones encountered before.

The tasks consist of text-connecting inferences, gap-filling inferences, semantic categorization, summaries of the read texts, literary responses and many more. Upon each assessment trial, the systems automatically prepare a detailed report of the language learner's performance in written language comprehension and expose problems in it. One of these studies (Hermena et al., 2017) compared the use of a tablet-based assessment with traditional paper-based for testing written language comprehension. The study showed that no increasing reading times or poor comprehension are revealed upon conducting a technology-enhanced assessment.

What we find one out of the ordinary in this review is the study examining both teaching strategies and the assessment of written language comprehension in language art learners by using video recording devices (Magnusson, Roe, & Blikstad-Balas, 2019). The results established that using them is convenient for handling verbal observation protocols to evaluate further teaching strategies used to engage students in language art readings and the subsequent assessment of their written language comprehension skill. The study demonstrated that explicit reading strategies are not prevalent in the educational context of the participating classrooms. The researchers envisaged a likelihood of whirling implicit instruction on written language comprehension into an explicit one through modifications to oral instructions and introducing a student education autonomy.

## **The Bilingual Perspective of Written Language Comprehension Assessment**

Following the approach that we used for examining the studies of written language comprehension assessment from a monoglossic perspective, we thematically divided the reviewed studies and report on them in this order: (i) general suggestions for revision of the written language comprehension assessment; (ii) specific suggestions for revision of the written language comprehension assessment.

Six studies (García & Torres-Guevara, 2010; Goldstein & Kohnert, 2005; Grech & Dodd, 2011; Kroll et al., 2015; Shohamy, 2011; Stavans & Hoffmann, 2015) out of the reviewed literature condemned the predominant monolingual paradigm for assessment of multilingual competence. The studies urged that reproducing a monoglossic perspective is wrong since it only represents an ultimate native-like proficiency in each of the assessed languages and assumes bilingual individuals are the totality of a native-like monolingual competence in each of their languages. Simply saying, it is undue for a bilingual user to be considered as comparable to the two monolinguals. Given that bilinguals are assessed by monolingual criteria, they seem to be incredibly disadvantaged in measuring their skills, e.g., non-target language replies are typically disregarded or result in penalties. One of the studies (García & Torres-Guevara, 2010) attempted to find justification for this state of affairs: no content base, financial constraints, and insufficiency in bilingual assessors.

To modify the existing paradigm, the reviewed studies suggested using an assessment stimulus measuring what is permissible in both languages. Namely, one of the studies (Goldstein & Kohnert, 2005) stated that both conceptual vocabulary (the total number of notions recognized across the languages) alongside the overall vocabulary (the sum of labels used for those notions) have to be considered when providing an assessment of bilingual written language comprehension. Another study (Shohamy, 2011) illustrated how bilingual test-takers could get an advantage from using their two languages during an assessment. For instance, using both Russian and Hebrew while reading questions may result in better assessment results.

All the examined studies see the urgent need for a specialized assessment of bilingual children supported by either bilingual speech-language pathologists, peer mediators, or taught parents. As an additional measure, one study (Grech & Dodd, 2011) recommended developing a worldwide corpus of bilingual speech and disorders in addition to the features of language acquisition.

Five studies (Carlson & Meltzoff, 2008; Chibaka, 2018; Darzhinova, 2019; Proctor et al., 2010; Sanchez et al., 2013) proposed concrete measures to expand the prevailing language assessment paradigm by making it sensitive to the heterogeneous nature of bilinguals, despite the potential obscurities.

On the example of Spanish-English bilinguals, the studies (Carlson & Meltzoff, 2008; Sanchez et al., 2013) employed the so-called multidimensional bilingual approach, which entails the assessment of competence levels of both languages at once. The authors found that bilingual tasks deliver an in-depth report on analytical reading skills and executive functioning in a bilingual's written language comprehension. A similar approach was followed in the study of Russian-English bilinguals (Darzhinova, 2019) for automatic calculation of the processing speed and recording comprehension accuracies in two languages. Successful conformity with sensitivity to the heterogeneous nature of bilinguals can be met with the use of proficiency tests (Chibaka, 2018) and bilingual cloze written language comprehension tests (Proctor et al., 2010).

## Discussion

Based on the first part of our systematic review, the lack of some fundamental components in language learners as mistakes in word-recognition instruction, syntactic and semantic processing failures weaken the development of the written language comprehension skill as well as the process of reading itself and can lead to reading misapprehensions and poor assessment outcomes. Therefore, it is crucial to concentrate our attention on the development of teaching strategies and choice of formative and summative types of assessment tools that are able to enhance written language comprehension skill in language learners.

Also, it must be noted that an emphasis is positioned on endeavors to obtain effective instruments for written language assessment, and as it turns out, the majority of them are technology-driven. No wonder that it is so. Using technology in written language comprehension assessment can afford the prospective of learner-sensitive and interactive assessment of the skill in a short time. These tools were identified: the

Internet-based, video recordings in combination with verbal observation protocols, as well as computer and tablet-mediated assessment tools. The majority of tasks included in the reviewed assessment tools are akin to what conventional assessment offers but their delivery is interactive, e.g., gap-filling inferences and summaries of the read texts in an on-screen mode.

We found the use of video recordings in conjunction with verbal observation protocols unusual for assessing one's written language comprehension, as these tools are mainly employed in social research (Erickson, 2011). This fusion of tools can be effective in accomplishing the two objectives at once. First, one can observe the strategies that educators employ to teach their students how to comprehend written text with the use of premeditated intellectual activities, such as inquiring, visualization, or recapping. Second, it is feasible to probe difficulties in comprehending written texts that are encountered by students in the course of classroom readings.

As a whole, using technology-mediated tools does not aggravate written language comprehension in the course of assessment and is proved to be not more difficult than regular reading assessment sessions employing paper-based materials. Such technology-enhanced assessment systems and tools can be used to produce quality assessments and may even outperform conventional approaches.

Based on the second part of our systematic review, we observed that monolingual assessment is adapted to bilinguals. The possible reasons for that include financial limitations, insufficiency in bilingual assessors as well as the absence of a content base for establishing such a bilingual assessment. Notwithstanding these shortcomings, the reviewed studies stressed at least two reasons not to decrease bilingual assessment. First, when developing bilingually, individuals demonstrate a dynamic behavior featuring a mixture of first and second languages and as a result, needs to be assessed in such a way to have a clearer picture of their performance. Second, controlling for different variables while testing, among which is a bilingual status, may, after all, show more elevated scores than when not taking bilingualism into consideration.

There is a huge benefit of being able to rely on one of the languages' vocabulary while confronted with information incomprehensible in another language in written language comprehension assessment. In this regard, the monolingual way of assessing bilingual (immigrant in many cases) students does not guarantee to show the reality of their full spectrum of knowledge. In order to have bilingualism taken into account, the examined studies developed or recommended a number of tools and approaches to the assessment of written language comprehension. They are used for collecting the data on processing speed and comprehension accuracies in both of the stimuli languages or rendered for thorough reports on executive functioning and analytical reading skills of bilinguals.

Comparing the number of studies of the two perspectives of written language comprehension assessment, we determine a higher number of publications relevant to the monoglossic perspective of such an assessment. This would seem to suggest the monolingual construct still dominates the corresponding assessment paradigm in spite of other proposals.

## Conclusion

Bilingualism, as one of the major variables of written language comprehension assessment, is ignored and overlooked in the current language assessment mode. However, there is a growing need in such an assessment that allows bilingual populations to utilize their multiple languages and encourage their mixing during an assessment. It is crucial to appraise both languages together, with a view to reaching accurate and ethical decisions regarding one's understanding of the text and an overall reading literacy level. The existence of a multitude of language combinations in most nation-states impedes the development of approaches to assessing both languages in bilingual learners.

We advocate for tackling the outlined challenge with the use of technologies. The digital nature of such an assessment can produce comprehensive and quick data on bilingual student's progress and regress for better learning and improve the assessment interactivenss. What is more critical, technology-enhanced

tools for written language comprehension assessment can give details on how bilingual students tackle the emerging comprehension problems in the course of written language processing and explore the intricate heterogeneity of their linguistic repertoire.

In sum, we acknowledge the need for more technology-enhanced tools that can capture a more accurate profile of a language user's written comprehension interactively and, thus, access reliability and validity of the assessment. Only bringing the dual linguistic stimulus to the forefront may achieve a reliable assessment of written language comprehension in bilingual individuals.

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