# The undeniable relationship between reading comprehension and mathematics performance

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In a world driven by literacy, there is still unfortunately a stigma about teachers who are not English, language arts or reading teachers, undertaking teaching of reading skills and/or strategies in their courses. The maths world still does not accept reading as a major component; however, the consequences are too noticeable to ignore. It is time for the education system to accept the importance of implementing reading skills in mathematics classes to curtail the issues that arise with students doing poorly in maths because it is much more than the manipulation of numbers. Fuchs et al. (2015) clarified "[w]ord-problem (WP) solving differs from other forms of mathematics competence because it requires students to decipher text describing a problem situation and derive the number sentence representing the situation" (p. 204). Content-area teachers are becoming aware of the relationship between these two subjects and are adding reading into the mathematics curriculum because of the necessity. Bernadowski (2016) stated "[i]n an era of accountability and standards-based instruction, it is no secret that content area teachers are finding themselves in the throes of literacy instruction" (p. 3). The purpose of this literature review is to identify how reading comprehension contributes to the mathematics performance of elementary and middle school students.

## Introduction

For many, mathematics does not correlate with reading; however, the available research suggests otherwise. Walkington (2018) explained,

> ... one reason why mathematics achievement may be so closely linked to reading is that many mathematics problems involve considerable reading demands. Mathematical information is often presented in verbal (rather than symbolic) formats, with significant unraveling and decoding of the English language needed to extract relevant relations (p. 363).

Reading and mathematics are usually not taught by the same teacher; however, adding reading comprehension strategies in mathematics classrooms may help instruction and student comprehension. Walkington (2018) stated,

> [m]athematics teachers could develop an understanding of what factors make reading mathematics problems difficult and implement strategies to assist students in overcoming these difficulties. Particularly, discipline-specific reading behaviors that are endemic to the genre of mathematics story problems could be developed and cultivated (see Shanahan & Shanahan, 2008) (p. 407).

Even when math teachers understand the importance of reading comprehension in mathematical performance, it is not an easy task for them to include reading components in their lessons. Bernadowski (2016) stated,

> [a]lthough the mantra that 'every teacher is a teacher of reading' is still not internalized by all content area teachers, many have demonstrated more interest in including literacy in their classrooms, but they may still lack the necessary knowledge base to do so effectively (D'Arcangelo, 2002; Vacca, 2002) (p. 3).

The purpose of this literature review is to identify how reading comprehension contributes to the overall mathematics performance of elementary and middle school students.

## Positioning the researchers

### Teachers as researchers

The lead authors, Anna L. Gomez and Elena Pecina, were both in their sixth year of teaching with elementary and middle school experience during the writing of this review, Gomez, a fifth-grade reading teacher, and Pecina a mathematics teacher. Both were teaching in the same successful, low-income school in south Texas. Both hold a Bachelor of Science in Interdisciplinary Studies with a concentration in Bilingual Education EC-6; both are bilingually certified in all subject areas as educators in the State of Texas. Both authors had recently obtained Masters degrees in school counselling and were State certified.

Pecina personally experienced the United States educational system as a second language learner. She was born in Laredo, Texas, but raised in Nuevo Laredo, Tamaulipas, Mexico. When the co-author was eleven years old, her mother decided to immigrate to the United States. Unfortunately, many American teachers have the misconception that Mexican students are naturally gifted and successful mathematicians. There are also some teachers guided by another misconception that mathematics is conceptually taught the same, no matter the country or culture. The notion that mathematics is a universal language has some foundational truth to it; however, both misconceptions about specific ethnicities being mathematically gifted and that maths is learned the same way is detrimental for students forced to learn maths in a different language, and much more so, in a different country.

As a student, Pecina understood that calculations were universal, but the language, context, and approach were completely different from the one she was exposed to in Mexico. For example, she had to learn a new measurement system, the customary system. She was only knowledgeable about the metric system at that time. Not only did this affect her in maths, it is easy to see the effect it would have on processing other forms of measurement. Additionally, the approach to learning the times tables was very different from the one she learned at her previous school in Mexico. As a second language learner, she believes that mathematics is contextually and culturally based, and that maths teachers need to consider this when teaching English learners.

As educators, we have experienced how reading comprehension plays an important role in solving mathematical word problems. Maths students are not just required to gain knowledge and master mathematical skills, but must also learn comprehension skills to be successful in the subject area. To foster awareness in the education field, the authors see the need for research on this topic. The authors have seen teachers who focus only on teaching their subject content and overlook what students need, thereby ignoring the importance of text comprehension and how it contributes to academic performance elsewhere. Teachers should not set their focus solely on their specific content area; reading should be incorporated and embedded throughout the daily lessons. Teachers should be aware of how reading contributes to the success of students in all academic areas. When this awareness occurs, teachers' effectiveness increases, and they see themselves as the reading teachers that they are destined to be. The lead authors understand and currently witness the urgent need for incorporating reading skills in all academic areas to create critical thinkers, problem solvers, and college-ready students.

### Graduate researcher

With close to fourteen years of English, Language Arts, and Reading (ELAR) teaching experience at the middle and high school levels, Sara Abi Villanueva is a firm believer that teaching comprehension skills, no matter the content area, positively impacts learning outcomes. As she is studying for a graduate degree in special education with a concentration in reading, she is familiar with research concerning issues in literacy and comprehension. Since reading occurs in all subject areas, the argument that reading has no bearing in science, social studies, or even in music classes, to list a few, is questionable. Working with students with learning disabilities, giftedness, and all those in between, the third author understands and advocates the need to incorporate comprehension skills and activities in non-reading courses from elementary onwards.

### Professor of educational research

Our fourth author, Professor Tonya Huber, has had the privilege of teaching the foundations of educational research for three decades. She challenges graduate students to investigate the familiarity of teaching to hone their skills by delving into the topics about which they are passionate and deepening their own knowledge bases as well as enriching the profession through presentation and publication. Grounded by the work of Paulo Freire, Huber encourages educators to develop the liberatory pedagogist's critical consciousness: "Experience teaches us not to assume that the obvious is clearly understood. So it is with the truism … All educational practice implies a theoretical stance on the educator's part" (Freire, 1970, p. 250). To constantly explore one's own theoretical stance is the challenge for teachers who intend to engage their students in "authentic dialogue" (p. 181), and the basis of dialogue is literacy.

## Language diversity and mathematics

Many English learners struggle with learning English because they do not yet have the basics and foundations of their native language, making the building and scaffolding from those missing basics much more difficult. For instance, children searching within their schema for terms in their language will not be successful if their native vocabulary is lacking (i.e., children trying to interpret the term *denominator* when they have yet to learn it in their native language). Educators must also consider the types or levels of native language spoken at home. For instance, most Spanish-speaking children in the authors' hometown do not speak formal Spanish; many speak a form of *Tex-Mex* or *Spanglish,* where a combination of English and Spanish slang make a unique language of its own. However, state exams are given in formal Spanish using both terminology, grammar, and syntactical structures that students are not accustomed to. Research shows that "language diversity in the school context influences how schools operate in relation to curriculum practice with serious effects on how [educators] need to reconsider mathematics teaching and learning" (Chronaki & Planas, 2018, p. 1102). There are pertinent questions that come to mind "in a world that urges [educators] to consider: 'How many people today live in a language that is not their own? Or no longer, or not yet, even know their own and know poorly the major language that they are forced to serve?' (Deleuze & Guattari, 1987, p. 19)" quoted in Chronaki and Planas (2018, p. 1102).

Understanding that students come to school with an array of literacies, many of which are far from fluent, the teacher's next step is to create bridges from those literacies to the academic ones, such as mathematics. Chronaki and Planas (2018) urged teachers to "consider nomadic or youth cultures and their vernacular or colloquial languages used in their everyday localities, where increased use of pop culture, social media and digital texts tend to recreate and transform the context for communicating mathematical ideas and activity (De Freitas & McAuley, 2008)" (p. 1103). Bridging literacy gaps in academics is a daunting task for any educator. If it was not challenging enough to tackle the issues that arise with one or two non-English languages in the classroom, now educators need to consider the challenges of multiple literacies. However, as formidable as this challenge can be, the advantages of multiple literacies in the classroom outweigh the rest.

## Definitions

In the research under review, the lead authors identified 12 definitions that will help readers have a better understanding of the topic. Since not all the readers are familiar with educational terminology as employed by the authors and researchers cited in this review of literature, adding the definitions of the terms is fundamental. The aim of providing definitions in Table 1 is to help readers discern the relationship between reading comprehension and academic performance in mathematics, as reported in the research. Also provided is a list of commonly used acronyms in reference to English learners (see Table 2).

Table 1: Terms and definitions related to reading comprehension and academic performance

| Term | Definition | Reference |
|---|---|---|
| Disciplinary literacy | "or content-area specific literacy, consists of literacy skills and knowledge that support students' understanding of concepts related to a particular field of study, such as science and mathematics" | Stoffelsma & Spooren, 2019, p. 906 |
| Inferential | "teachers enquire about situations and scenarios that cannot be located within the text; students must form logical links between facts and processes by incorporating previous knowledge and by establishing inferences that favour the construction of coherent representations" | Rojas Rojas et al., 2019, p. 1834 |
| Language compre-hension | "the ability to attribute semantic meaning to spoken words, […] word definitions, or listening comprehension" | Melby-Lervåg & Lervåg, 2014, p. 410 |
| Lexical access | "or rapid automatized naming, which involves recording a visual symbol onto a sound-based representation by retrieving its lexical referent from long-term memory" | Kuzmina et al., 2019, pp. 640-641 |
| Phonological awareness | "awareness of and access to the sound structure of oral language" | Kuzmina et al., 2019, p. 640 |
| Phonological memory | "temporary memory storage of phonological information similar to the phonological loop in models of working memory" | Kuzmina et al., 2019, p. 641 |
| Phonological processing | "refers to an individual's sensitivity to the sounds of the language and to the capacity to use these sounds to decode linguistic information" | Kuzmina et al., 2019, p. 640 |
| Problem translation | "refers to the ability to translate the language that is embedded in the math word problem into a coherent verbal representation, indicating that the solver has understood the problem" | Swanson et al., 2019, p. 69 |
| Reading compre-hension | "the product of decoding and language comprehension" | Melby-Lervåg & Lervåg, 2014, p. 415 |
| Scaffolding | "provides support and keys for students to tackle tasks and problems with reading comprehension in order for them to have an active role in building coherent mental representations of scientific processes" | Rojas Rojas et al., 2019, pp. 1828-1829 |
| Second-language learners | "were operationally defined as children/youths who either use or study two languages. In addition, the child/youth must be exposed to each language either regularly at home with at least one parent or in school for at least 4 hours per day" | Melby-Lervåg & Lervåg, 2014, p. 415 |

Table 2: Common names and acronyms for English learners

| Term | Definition | Reference |
|---|---|---|
| EAL | English as an additional language | Trakulphadetkrai et al., 2020, p. 473 |
| EL | English learners | MacDonald & Banes, 2017, p. 25 |
| EOs | English only speakers | MacDonald & Banes, 2017, p. 26 |
| FLE | English as the first language | Trakulphadetkrai et al., 2020, p. 473 |

## Method

### Search process

A preliminary literature review search was conducted using WorldCat in the TAMIU library catalogue. The following filters were selected for the search: TAMIU Killam Library, peer reviewed, article, database, last five years, and English language. In using the mentioned filters, along with the search terms *reading comprehension* and *math performance,* the WorldCat database yielded 785 sources. Many of these sources did not pertain to the topic of this literature review. Of these 785 sources, the first two lead authors searched the titles for the following terms: *text comprehension, reading comprehension, math and reading performance, struggling in reading, academic performance,* and *second language learners.* Titles without at least two or three of these terms were eliminated from the search process. However, the search yielded too many sources for both the lead authors to look through, which meant the search process would have to begin again. In order to narrow the source output, Galvan and Galvan (2017) explained that one "can limit the search by adding additional keywords with Boolean operators such as AND, OR, and NOT" (p. 29). With this in mind, a more effective review search was completed by using keywords with Boolean operators and the same filters, which proved beneficial.

In this first modified search, the number of results were filtered by entering "text comprehension" AND "math performance." Five sources were located, but only two were relevant to the topic. Three out of the five sources found with these search terms were duplicated. In the second search, the words used were "reading comprehension" AND "math performance" AND "secondary students." Only one source was located, but the title was irrelevant to the topic of this literature review. In the third search, authors used "reading comprehension" AND "science reading comprehension." They located 24 sources, but three of the sources were the same. From this search, only two out of the 24 were relevant sources for this literature review. The other 19 articles' titles and abstracts were unrelated to the topic being reviewed. The fourth search consisted of the following terms, "word problems" AND "text comprehension." Four out of the 27 located sources under this search term were relevant to the topic. The other 23 articles' titles and abstracts were irrelevant. The fifth search terms were "word problems" AND "struggling in reading." This search yielded one relevant source for the review.

The following filters were used on the sixth search using the ERIC EBSCO database: Boolean phrase, all publication type, language-English, and article document type. The following terms were used, “science” AND “reading comprehension” AND “scaffolding”. The years 2014-2020 could not be searched; instead, the years searched were 2015-2019. This search yielded five sources; however, based on titles alone, only one source was found to be relevant. The lead authors realised that the ERIC EBSCO searches were not yielding as many relevant sources as they had hoped, so they decided to search WorldCat again.

In WorldCat, the following filters were used again: TAMIU Killam Library, peer reviewed, article, database, last 5 years, and English language. In the seventh search, the terms “reading comprehension” AND “academic performance” AND “learning” AND “achievement” AND “relationship” were used. Seventy-nine sources were found; again, based on titles, only one was relevant to the topic. On the eighth search, “reading” AND “first language” AND “second language learners” AND “phonological awareness” were used, and forty-five sources were yielded. Only one was used and the other 44 were disregarded based on titles. In the ninth search, “mathematics word problems” AND “performance” were searched. Based on titles only, one out of the 16 sources was relevant to the topic. Nine sources were yielded in the tenth search with the terms “at-risk students” AND “comprehension” AND “qualitative.” Only one title was relevant to the topic. On the eleventh search, the terms “mathematical” AND “reading” AND “secondary students” were used; 54 sources were yielded, but only one was relevant based on the title.

The twelfth and thirteenth searches were conducted using Google Scholar; the searches were based within the last 5 years as well. In the twelfth search, the following terms were used: “math word problems” AND “reading comprehension” AND “elementary school” AND “ELs.” Parameters were set to include only peer reviewed journals. In this search, one out of 47 sources was relevant to the topic; the other 46 articles were excluded based on the titles. For the thirteenth, the following terms were used: "mathematics" AND "reading comprehension" AND "relationships" AND "working memory" AND "English as an additional language" AND "elementary" AND "academic achievement." The authors narrowed the search for articles from 2014 to present. This search yielded 53 results and based on titles, only one was relevant.

The last two searches were conducted using Scopus; the date range was set for 2014 to 2020. The fourteenth search included the following terms: “reading comprehension” AND “math problems” AND “English language learners.” Unfortunately, the search yielded zero results. Broadening the search, the following terms were used in the fifteenth, and last search: “reading” AND “comprehension” AND “math” AND “problems.” This search yielded 11 sources, of which one was relevant. The terms and results for each search are recorded in Table 3.

Table 3: Audit trail

| | Database | Dates reviewed | Search terms | Sources located | Relevant sources | Author (year) |
|---|---|---|---|---|---|---|
| 1 | WorldCat | 2014-2019 Oct. | "text comprehension" AND "math performance" | 5 | 2 | Fuchs et al. (2018) [5]; Kuzmina et al. (2019) [7] |
| 2 | WorldCat | 2014-2019 Oct. | "reading comprehension" AND "math performance" AND "secondary students" | 1 | 0 | |
| 3 | WorldCat | 2014-2019 Oct. | "reading comprehension" AND "science reading comprehension" | 24 | 2 | Ardasheva et al. (2019) [2]; Rojas Rojas et al. (2019) [11] |
| 4 | WorldCat | 2014-2019 Oct. | "word problems" AND "text comprehension" | 27 | 3 | Fuchs et al. (2015) [4]; Fuchs et al. (2018) [5]; Swanson et al. (2019) [6] |
| 5 | WorldCat | 2014-2019 Oct. | "word problems" AND "struggling in reading" | 1 | 1 | Swanson et al. (2019) [6] |
| 6 | EBSCO | 2015-2019 Oct. | "science" AND "reading comprehension" AND "scaffolding" | 5 | 1 | Rojas Rojas et al. (2019) [11] |
| 7 | WorldCat | 2014-2019 Oct. | "reading comprehension" AND "academic performance" AND "learning" AND "achievement" AND "relationship" | 79 | 1 | Stoffelsma & Spooren (2019) [12] |
| 8 | WorldCat | 2014-2019 Dec. | "reading" AND "first language" AND "second language learners" AND "phonological awareness" | 45 | 1 | Melby-Lervåg & Lervåg (2014) [9] |
| 9 | WorldCat | 2014-2019 Oct. | "mathematics word problems" AND "performance" | 16 | 1 | Walkington et al. (2018) [14] |
| 10 | WorldCat | 2014-2019 Nov. | "at-risk students" AND "comprehension" AND "qualitative" | 9 | 1 | Bernadowski (2016) [3] |
| 11 | WorldCat | 2014-2019 Nov. | "mathematical" AND "reading" AND "secondary students" | 54 | 1 | Anselmo et al. (2017) [1] |
| 12 | Google Scholar | 2014-2020 Oct. | "mathematics" AND "reading comprehension" AND "relationships" AND "working memory" AND "English as an additional language" AND "elementary" AND "academic achievement" | 52 | 1 | Trakulphadetkrai et al. (2020) [13] |

| | | | | | |
|---|---|---|---|---|---|
| 13 Google Scholar | 2014-2020 Oct. | "math word problems" AND "reading comprehension" AND "elementary school" AND "ELs" | 47 | 1 | MacDonald & Banes (2017) [8] |
| 14 Scopus | 2014-2020 Oct. | "reading comprehension" AND "math problems" AND "English language learners" | 0 | 0 | |
| 15 Scopus | 2014-2020 Oct. | "reading" AND "comprehension" AND "math" AND "problems" | 11 | 1 | Özcan & Do□ an (2018) [10] |

Note: Rather than 17 relevant sources, because of duplications, there were 14 relevant sources as indicated by the numbers in square brackets [], last column.

Table 4: Methods

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| Anselmo et al. (2017) | 298 students in total; 166 males; 132 females<br><br>*Demographics*:<br>214 White; 64 African American; 10 Hispanic or Latino; 10 Multiracial. "The current study incl-uded 298 students that attended a rural middle school in the Southeast. The participating school enrolled students in the 6th, 7th, and 8th grades" (p. 1151).<br>*Region:* North Carolina, USA. | M-CMB computation, M-CAP, and MAZE probes were used in this research (p. 1150).<br><br>"probes were group administered in language arts classrooms and scored by teachers who had been trained to administer and score based on standardized procedures" (p. 1152).<br><br>*Assessments:*<br>SPSS; North Carolina End of Grade Math (NC-EOG-M) (p. 1152). | Maths performance reflects on basic reading skills such as, "reading comprehension […] a stronger part of math ability than calculation skills and should not be ignored when considering overall math skills" (p. 1157). |
| Ardasheva et al. (2019) | 17,000 students in total<br><br>*Demographics:*<br>35% were ELs, 204 regular education, Grade 7 students; age range 11-13 years old; 56% female participants<br><br>*Region*: Pacific Northwest urban middle school (p. 145-155). | "... study sought to generate descriptions of current and former ELs' science reading comprehension and vocabulary knowledge profiles, in comparis-on to those of non-ELs" (p. 154). "... explore the relative contribut-ions of language-specific and meta-cognitive knowledge to science reading comprehension of current and former ELs, the bilingual student population at the heart of the present study" (p. 154).<br>*Assessments:* Washington English | There's a correlation between academic vocabulary and reading comprehension, and researchers conclude, "vocabulary to be the strongest predictor of science reading comprehension in both current and former ELs. Contrary to other studies, academic vocabulary knowledge was not a predictor of current ELs' reading |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| | | Language Proficiency Assessment (WELPA; General Academic Vocabulary Measure GAVM; Vocabulary-of-Science Scale-Earth Systems VSS-ES; Science Reading Comprehension-Earth Systems SRC-ES; Memory Strategies MS, and Vocabulary Self-Efficacy VSE (p. 155). | comprehension" (p. 161). |
| Bernadowski (2016) | 1 eighth-grade mathematics teacher<br><br>*Demographics:*<br>18 students; 10 males, 8 females; 6 students identified with learning disabilities; 2 students with speech and language differences; 10 students who were considered "on grade level"<br><br>*Region:* Western Pennsylvania (p. 7) | "The researcher's primary purpose was to document the techniques implemented by the teacher as she modeled think-alouds while teaching students to answer word problems in their math journals" (p. 7).<br><br>*Assessments:* "Data were triangulated by using semi-structured interviews, observations, and artifacts to document the participant's progress in teaching her students to write more effectively in the content area" (p. 7). | By reviewing and being vigilant in one's own teaching practices, "educators have the ability to improve their own instruction while providing a catalyst for student success" (p. 13). Teacher self-evaluation led to students' incorporation of "new reading strategy to solving word problems, and talk about math in ways that allowed deep understanding of processes useful in environments permeated by mathematical mysteries" (p.13). |
| Fuchs et al. (2015) | Total 206 children from 54 2nd-grade classrooms in 14 schools.<br><br>*Demographics:*<br>At the start of 2nd grade, the mean age was 7 years 6 months; 52% female; 78% received subsidised lunch; 59% African American; 26% non-Hispanic White; 9% White Hispanic; 5% other (p. 208)<br><br>*Region:* Not mentioned | *Assessments:*<br>WJ-III Visual Matching, WM Test Battery for Children, WJ-III Concept Formation, Woodcock Diagnostic Reading Battery-Listening Comprehension, Mathematic Assessment Battery, Word Identification Fluency (pp. 208-209). | Emphasis on a student's working memory (WM) in word problems (WP) shows the importance between comprehension and maths as seen in text comprehension (TC) (pp. 216-219). |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| Fuchs et al. (2018) | 325 students "selected to represent high, average, and low reading and mathematics performance […] from 133 2nd-grade class-rooms in 24 schools" (pp. 154-155).<br>*Demographics:* mean age 7 yrs 6 m; 50% female; 78% low socio-economic status; 48% African American ; 31% non-Hispanic White; 15% White Hispanic; 7% other; 6% had an identified disability; 11% were EL (p. 155).<br>*Region:* Urban district in USA (p. 155) | "employed a stringent model that simultaneously controlled for TC and early word-problem skill, both of which have been shown to share variance with language" (p. 161).<br><br>*Assessment:*<br>"WP language was assessed with WP assessment" (p. 156). | Researchers concluded that "[l]anguage predicted each of the WP outcomes substantially and significantly more strongly than the contrasting mathematics outcome involving pure calculations. This provides strong evidence for the role of language in WP solving" (p. 161). |
| Swanson et al. (2019) | 142 students in total<br><br>third-grade students from 12 classes in four public schools<br><br>*Demographics:*<br>77 boys<br>65 girls<br>71 Hispanic English language learners<br>71 monolingual English speakers<br><br>*Region:*<br>Southwestern USA<br>(p. 71) | "ELL status was determined by scores on the California English Language Development Test (CELDT)" (p. 71).<br><br>"Monolingual and ELL children with and without MD were administered an array of individual and group measures" (p. 73).<br><br>*Pre-assessments:*<br>CELDT, Raven Colored Progressive Matrices Test, Wechsler Individual Achievement Test, Comprehensive math Achievement Test, Test of Math Ability, Test of Reading Comprehension (p. 71). | Different strategies are needed for reading com-prehension, such as "examining text releva-nce and selecting and inhibiting information according to importance is a necessary process for improving comprehen-sion" (p. 78).<br>Researchers stated that "paraphrasing relevant propositions contributed to significantly higher word problem-solving accuracy scores at post-test, even after controll-ing for pretest reading comprehension and calc-ulation performance" (p.79). |
| Kuzmina et al. (2019) | 3,296 students in total<br><br>*Demographics:*<br>first graders<br>49% girls<br>mean age was 7.3 yrs. | In two assessment cycles, "[c]hildren were assessed on a one-to-one basis by trained testers using a computer-assisted software" (p. 645). | Phonological processing is "predictive not only for tasks that included arithmetic operations but also for number recogni-tion tasks" (p. 653). |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| | (p. 645)<br><br>*Region:*<br>The participants were from the Tatar Republic region located in the central part of Russia (p. 645) | *Assessments:*<br>The instrument used was "Russian version of iPIPS, which is based on PIPS monitoring system" (p. 645).<br><br>"To examine the achievement level of students over time, we applied the vertical scaling procedure, using the dichotomous Rasch model" (p. 646). | Phonological processing is another component that is "significantly to not only storing inform-ation, but also transcod-ing processes per se" (p. 653).<br>Researchers state "reading performance was also a significant predictor of mathematic-al performance" (p. 654). |
| MacDonald & Banes (2017) | 29 students in total<br><br>*Demographics:*<br>15 were Hispanic;<br>6 White;<br>5 African Americans;<br>1 Pacific Islander;<br>1 Alaska Native;<br>1 Hmong;<br><br>13 students' native language was Spanish;<br>1 student's native language was Hmong;<br><br>Grade 4 students<br>In Applegate Elementary, 42% of the students are ELs;<br><br>*Region:*<br>suburban neighborhood, California<br>(pp. 25-26) | "This inquiry project was conduc-ted in a fourth grade classroom at a public Title 1 school" (p. 25).<br>"four focal students were selected for in depth data analysis. These focal students were either reading at a first or second grade level, and were because they represent the reading levels of a large portion of the class. Two of the focal students were ELs and two students were EOs" (p. 26).<br>Each of the students completed three rounds of data collection that consisted of "(1) retell a presented word problem in their own words (2) solve the problem using one of the three strategies, and (3) retell the problem again" (p. 27).<br>*Assessments:*<br>Retell rubric (p. 24); California English Language Development Test (CELDT) (p. 25); state and district assessments (p. 27) | "Reading comprehens-ion is strongly correlated with students' success on mathematical word problems" (Vilenius-Tuohimaa, Aunola & Nurmi, 2008 in MacDonald & Banes, 2017 p. 26).<br><br>Researchers found that using different strategies such as discussing with a partner, drawing, and writing improved students' comprehension of word problems (p. 31). |
| Melby-Lervåg & Lervåg (2014) | *Literature review:*<br>82 studies<br><br>576 effect sizes were calculated for reading comprehension and underlying components (p. 409) | "The target constructs in this study were reading comprehension, language comprehension, phonological awareness, and decoding. For each of these constructs, criteria were established to determine the types of measures that represented each" (p. 415). | Researchers concluded, "first-language learners demonstrated modera-tely better reading comp-rehension skills than did second-language learners" (p. 425).<br>There is an undeniable connection between "[g]ood language and |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| | | *Databases:*<br>Eric EBSCO,<br>Medline,<br>PsycARTICLES,<br>ProQuest dissertations,<br>PsycINFO,<br>Google Scholar<br>(p. 416). | decoding skills […] associated with good reading comprehension skills, and the impact of language comprehension on reading comprehension increased with age" (p. 425). |
| Özcan & Doğan (2018) | 185 first grade students<br>74 female students (40%);<br>111 males students (60%);<br>The study was carried out at an elementary school in Kadıköy, which is one of the districts of Istanbul and is the most crowded and cosmopolitan city in Turkey (p. 4).<br><br>*Region:* Public elementary school, Istanbul, Turkey. (p. 1) | "Bracken Basic Concepts Scale: Expressive Form was applied to 185 students at the beginning of the year over 15 days (in the first half of October), and mathematical problem solving and reading comprehension measurement tools were applied at the end of the educational year (in the first half of May). Applications were done individually (for Bracken Basic Concepts Scale), or in a classroom (for both mathematical problem solving and reading comprehension questions), assigned by the school administration" (p. 5).<br><br>*Assessments:*<br>Bracken Basic Concepts Scale; a mathematical problem solving test; a reading comprehension test. (p.4) | "Results of this study show that, not only early math skills but also reading comprehension was a powerful predictor of mathematical problem solving"<br>"Some children develop algorithm skills (e.g. the ability to compute) quite well, but they had difficulty with word problems (Fuentes, 1998), and because of the difficulty in word problems, they need to translate words into mathematical symbols"<br>Researchers found "[i]n addition to mathematical computations, the need for comprehending what he/she read is very important while solving math word problems" (p. 8). |
| Rojas Rojas et al. (2019) | *Demographics:*<br>three teachers;<br>141 fourth-grade students;<br>2 low-socioeconomic schools;<br>48 class sessions.<br><br>*Region:*<br>Santiago, Chile<br>(p. 1833) | "The present study follows a mix-method approach: an exploratory sequence design and an embedded multiple case study frame […]" (p. 1833).<br><br>*Assessment:*<br>Sanchez' Pedagogic Practice Analysis System<br>(p. 1827). | Successful teacher "uses reading in class to build knowledge through the formulation of inferential questions aimed at having students construct a coherent represent-ation of the text they had read" (p. 1843). |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| Stoffelsma & Spooren (2019) | *Demographics:*<br>133 English language learners<br>predominantly male<br>age range 18 to 42<br><br>Integrated Science student: Mean age 25.7 years.<br><br>20 different languages spoken by students (p. 913)<br><br>*Region:*<br>Ghana (p. 905) | "To measure the English reading proficiency of the students, a total of 54 reading test items were selected from two internationally recognized reading comprehen-sion tests: 26 from the PISA 2000 Reading test (OECD, 2006) and 28 items from the Pearson Test of English Academic (PTE Academic)" (p. 912).<br>*Assessment analysis:*<br>Rasch model (p. 913).<br>"Simple mediation analysis was used to investigate the assumed relations between academic English reading proficiency and academic achievement" (p. 913). | Researchers state, "students' academic English reading proficiency is important for their academic achievement in a multi-lingual academic context" (p. 917). |
| Trakulpha-detkrai et al. (2020) | *Demographics:* "The EAL children in our study came from 11 different countries (China, Egypt, Germany, Iceland, India, Italy, Pakistan, Poland, Portugal, Romania or Uganda) and they spoke 10 different first langu-ages (Arabic, German, Icelandic, Italian, Konk-ani, Luganda, Polish, Romanian, Telugu or Urdu) in addition to English" (p. 478).<br>EAL ranged from 46.8% to 73.7%; eligible for free school meals ranged from 20.6% to 32.4%.<br>35 EAL children (16 boys: 19 girls); 31 FLE children (17 boys: 14 girls)<br>"Fifty-two urban sch-ools across the south of England were approach-ed because of their repo-rted statistics of EAL children in their schools. Nine schools were | "The data collection took place between December 2014 and March 2015, and in June 2016. A battery of five tests was administered to each child and this took around an hour per child to complete" (p. 479).<br><br>*Assessments:*<br>Trends in International Mathematics and Science Study (TIMSS) (p. 474);<br>York Assessment of Reading for Comprehension (YARC);<br>C-test, or cloze test;<br>Automated Working Memory Assessment (p. 479) | Researchers found "prominent role language plays in the development and assess-ment of mathematical ability" (p. 484).<br><br>In addition, resear-chers concluded, "FLE learners significantly out-perform EAL learn-ers in the word-based component of the mathematics test only. The results of this study also indic-ate that there are differences in how reading comprehen-sion ability is related to the mathematical word problem solving performance for FLE and EAL learners" (p. 484).<br><br>The study's "results are in line with previous research that has shown English reading comprehension ability to be related to mathem- |

| Authors (year) | Participants | Methods | Findings |
|---|---|---|---|
| | happy to take part in the study and the percentage of EAL chil-dren in these schools" (p. 478). *Region:* South of England | | atical word problem solving performance for EAL learners" (p. 484). |
| Walkington et al., (2018) | *Literature review:* Almost 20 years of maths achievement data from National Assessm-ent of Educational Prog-ress (NAEP) and Trends in International Math-ematics and Science Study (TIMSS) (p. 364). "Examining approxim-ately 1,000 problems solved by three-quarters of a million fourth- and eighth-grade U.S. students" (p. 364). | Researchers investigated that "reading level of mathematics word problems is differentially associated with performance for students from different demog-raphic backgrounds" (p. 364). Researchers focused on "interac-tion of word problem readability, focusing on several key text-based indicators identified in prior research, and student back-ground characteristics, focusing on characteristics where achieve-ment differences are well estab-lished" (p. 364). *Databases:* Not mentioned | Diversity is a factor, e.g. "[g]roups of students that have historically stronger performance in mathematics or reading - including Caucasian students and higher SES students - tend to see less impact on their performance on mathematics test items when the reading difficulty of the mathematics problem is greater" (p. 405). |

Table 5*:* Strengths, weaknesses and gaps found in the literature

| Author (year) | Strengths | Weaknesses/gaps |
|---|---|---|
| Anselmo et al. (2017) | • "Math ability at the secondary level appears to be a conglomeration among many distinct abilities including, but not limited to, reasoning skills, calculation skills, and reading ability" (p. 1156).<br>• "study both extended and challenged previous research findings in regard to the relationships among two M-CBM measures, MAZE probes, and general math proficiency" (pp. 1156-1157). | • "participants were students from one grade and one middle school. In addition, the sample was ethnically homogenous" (p. 1156). |
| Ardasheva et al (2019) | • Population of 17,000 students sampled - "[g]rade 7 students participated in the study. The age of participants ranged between 11 and 13 years old; 56% of participants were female" (p. 155). | • "tentative nature of our findings, which are in need of further explorations using experimental and longitudinal design studies" (p. 160). |
| Bernadow-ski(2016) | • "The researcher spent 5 hours a week over the course of 8 weeks for a total of 40 hours of observation" (p. 7).<br>• "With a background in reading and middle school teaching, the researcher | • "The findings cannot be generalized to other settings. From this, one cannot assume that the think-aloud alone will improve students' abilities to solve math word problems. This study would be difficult to replicate. It is recomme- |

| Author (year) | Strengths | Weaknesses/gaps |
|---|---|---|
| | was able to see what some may not" (p. 13). | nded that a large sample be used if trying to prove such a claim" (p. 12). |
| Fuchs et al. (2015) | • The researchers use a "sample of 206 children from 54 second-grade classrooms in 14 schools" (p. 208).<br>• A wide range of achievement tests were administered to the participants. | • The researchers suggested that "future research should measure knowledge of vocabulary specific to TC measures; this would further strengthen the test of our hypothesis about distinctions between TC and WP solving" (p. 221). |
| Fuchs et al. (2018) | • "WP solving and its potential connections to TC by assessing whether initial arithmetic skill (basic facts) predicts year-end calculations (multidigit problems with and without regrouping) more strongly than both year-end WP measures" (p. 161). | • "relied exclusively on a measure of vocabulary as the indicator of language ability, without indexing syntax or sentence processing" (p. 163).<br>• "the present study's sample was largely from families of low-socioeconomic status" (p. 163). |
| Swanson et al. (2019) | • The researchers mention related studies and outcomes.<br>• Researchers brought awareness about issues with math disabilities (MD). | • "the number of ELL participants with (MD) who took part in the study was relatively small. The small sample size impacts precision in measurement, affecting statistical power" (p. 80).<br>• The researchers also suggested further research to "clarify the effects of para-phrasing specific instructional propos-itions within word problems on near and far transfer measures for students for whom English is a second language" (p. 80). |
| Kuzmina et al. (2019) | • Assessed a large sample size.<br>• The researchers synthesised the data collected about the effect of phonolo-gical processing on mathematics into an organised article.<br>• The study was "consistent with some previous studies that have demonstra-ted that phonological processing affect-ed mathematical performance (Hecht et al., 2001; Krajewski & Schneider, 2009)" (p. 652). | • The researchers used only a two-wave longitudinal design (p. 644).<br>• Another limitation for this study "was the instrument for measuring phonological processing. In fact, phonological processing is represented in this study mostly by one dimension instead of the possible three" (p. 656). |
| MacDonald & Banes (2017) | • "The findings are supported by other research studies" (p. 29). Many researchers are bringing awareness on how reading comprehension affects ELs math performance.<br>• Teachers conducted this article review. They have experienced how ELs struggle with reading comprehension to solve math problems. | • The researchers use a small number of participants (p. 26). Although a diverse group of 29 students, the authors chose two to "represent" the EO population; this goes against the argument that English Learners are all the same. This is not a one-size-fits-all situation.<br>• Researchers concluded, "that retells alone are not enough to determine |

| Author (year) | Strengths | Weaknesses/gaps |
|---|---|---|
| | | whether a student understood a problem" (p. 32). By using a combination of assessments, can offer a more accurate view of students' comprehension of a mathematical word problem. |
| Melby-Lervåg & Lervåg (2014) | • "first-language learners demonstrated moderately better reading comprehension skills than did second-language learners" (p. 425). | • Researchers explained the possibility of bias because "only three of the studies [they] located could be included in the meta-analysis" (p. 428). |
| Özcan & Doğan (2018) | • "One of the striking results of this study was that early math skills were also a predictor of reading skills. As indicated in the literature, mathematics performance and reading skills have been shown to be closely related. For example, Light and De Fries (1995) showed that difficulties in arithmetic were associated with the development of reading ability" (p. 8). | • "Studying only the first grade is a limitation of this study", researchers could have focused on more grade levels in order to strengthen results (p. 8).<br>• Researchers discuss a study, which contradicts the topic of this literature review by stating that early mathematics skills are a greater predictor of mathematics and reading achievement. |
| Rojas Rojas et al. (2019) | • The researchers used a "mix method approach to compare the cognitive scaffolding practiced by teachers during science reading activities in high- and low-performing schools" (p. 1827). | • The researchers used a small number of participants.<br>• Researchers did not "measure the actual level of reading comprehension achieved by students, nor did it gauge the effects of scaffolding on learning" (p. 1843). |
| Stoffelsma & Spooren, (2019) | • The researchers mention related studies and outcomes.<br>• "study added substantially to our understanding of the relation between L2 students' English reading proficiency and their science and mathematics achievement at tertiary level" (p. 917). | • "current study is based on correlational research that could be strengthened by an experimental intervention to investigate a possible causal relationship between language proficiency and academic achievement" (p. 918). |
| Trakulphadetkrai et al. (2020) | • "A significant finding of this study is that general language ability, as measured by the C-test, plays a key role in performance on word-based mathematics assessments for FLE learners" (p. 483).<br>• "A strength of the current study lies with the inclusion of the language ability (C-test) and SWRT alongside a measure of reading comprehension, which allows for a more in-depth investigation of the contribution of different aspects of language and reading ability to the assessment of mathematical knowledge in EAL | • "In our study, on careful consideration of the learner proficiency levels and the consistency of some minor errors, we took a slightly different approach and awarded a point for grammatically and semantically correct variations as well as simple misspellings (e.g. cliff vs clif) as it can be argued that they still demonstrate comprehension by our young participants" (p. 480). |

| Author (year) | Strengths | Weaknesses/gaps |
|---|---|---|
| | children" (p. 484).<br>• "While the current study was situated in the UK and has made references to the UK context, it is our strong belief that our findings are also applicable to other settings" (p. 485). | |
| Walkington et al. (2018) | • "Readability tools like Coh-Metrix provide fine-grained measures that can specify different features of readability. Knowing these specific features allows for more targeted interventions to improve the readability of mathematics items" (p. 405).<br>• "the sample size needed to make sensible comparisons between student demographic groups across a variety of demographic variables" (p. 404). | • There are methodological limitations to this analysis. "[T]he problem-level variables that were available in the NAEP and TIMSS. Specifically, there was no sensible way to separate problem mathematical difficulty from reading difficulty" (p. 404). |

## Findings

This literature review on how reading comprehension is linked to mathematics performance has revealed vital findings concerning the different factors affecting students' achievement in these subject areas (see Figure 1). MacDonald & Banes (2017) stated that "in the field of mathematics, comprehension is crucial for students' success in word problems and in real world application" (p. 26). Many factors contribute to this success; relevant factors that, if not well nurtured, affect math performance are phonological processing, language comprehension, reading comprehension, and problem translation. However, prior to establishing these basics, educators must consider the language(s) that their students speak, read, and write; which language(s) are nurtured at home, and thus have an effect on how that student learns at school.

### Language diversity

Assuming, that all cultures and languages learn maths the same way is detrimental in teaching mathematics to English learners. As explained earlier, the students bring to the classroom an array of languages moulded from the literacies they engage in both at home and within their social lives. It is imperative that educators consider the number of literacies that they are working with in their classrooms. A lack of native language foundation, coupled with cultural nuances, and social literacies create a whole new set of questions educators must think to ask prior to even teaching, one being, *how does all this effect the way we teach math?* Even if educators do their part to address the multiple literacies that they welcome within their classrooms, the issue comes when students take state- or nationally-mandated assessments. A study by Trakulphadetkrai et al. (2020), focused on "Fifty-two urban schools across the south of England" with "the percentage of EAL children in these schools rang[ing] from 46.8% to 73.7%," and "EAL children in [their] study came from 11 different countries (China, Egypt, Germany, Iceland, India, Italy, Pakistan, Poland, Portugal, Romania or Uganda)" (p. 478). The authors noted that these children "spoke 10 different first languages (Arabic, German, Icelandic, Italian, Konkani, Luganda, Polish, Romanian, Telugu or Urdu) in addition to English" (p. 478). It is naïve and academically irresponsible to assume that state- and national-assessments are created to fit the linguistic needs for these students.

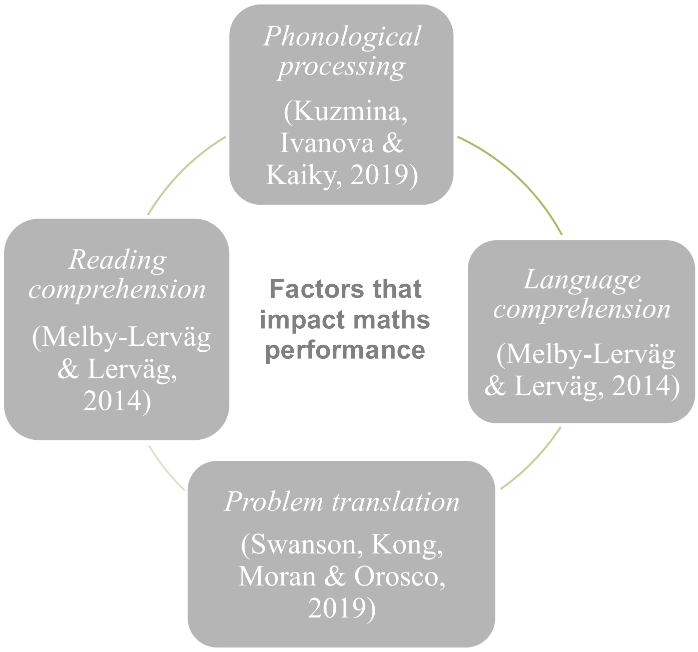


Figure 1: Factors that impact maths performance

Unfortunately, this study applies to too many cities, states, and countries around the world. Trakulphadetkrai et al. (2020) explained that their findings are relevant because "an increasing number of high-stakes mathematics standardised tests around the world place an emphasis on using mathematical word problems to assess students' mathematical understanding" (p. 473). Assessments are not created with the test takers languages or cultures in mind, "[n]ot only do these assessments require children to think mathematically, but making sense of these tests' mathematical word problems also brings children's language ability…into play" (p. 473). With this understanding, educators can now look at four factors that affect overall reading comprehension and mathematical ability.

### Phonological processing

The first factor, phonological processing, is a concept, which is confusing even to experienced educators. Phonological processing is composed of three different categories: phonological awareness, lexical access, and phonological memory (see Figure 2). In order for readers to understand phonological processing, the lead researchers created a comparison figure. The figure consists of a vase with growing flowers. The vase contains the roots, which are healthy and filled with nutrients; without the nurtured roots, the flowers would not bloom. In other words, without well-developed phonological processing skills, processing and/or organising letters that make up certain words would be highly improbable, resulting in limitations dealing with phonological awareness, lexical access, and phonological memory.

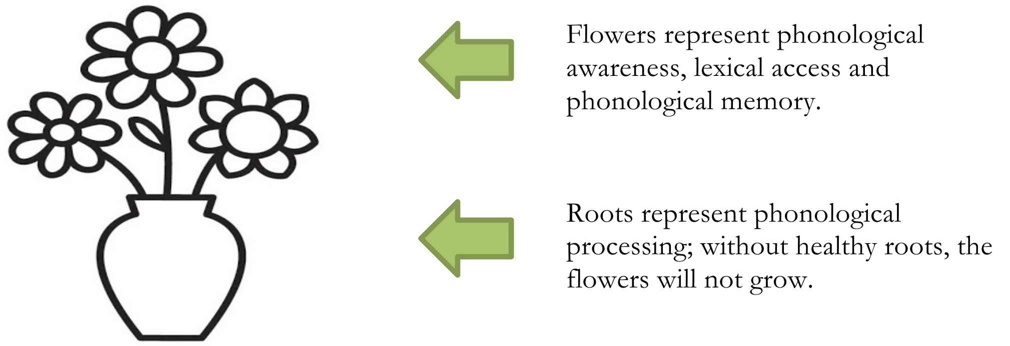


Figure 2: Phonological processing visual

Therefore, whenever readers lack phonological processing skills, reading comprehension becomes a struggle — unorganised decoding skills equal unorganised comprehension, even in content areas like maths. Kuzmina et al. (2019) stated that "phonological processing had an effect on children's number recognition and mathematical performance" (p. 652). For instance, a typical student who lacks reading comprehension and phonological processing can be an excellent math student who solves numeric operations; however, when the math problem is made complex by adding words, the student tends to ignore the question behind the problem. In contrast, when students have a strong phonological processing foundation (see Figure 2), their language comprehension skills can be nurtured so word problems no longer create barriers or limits on a student's mathematical ability.

### Language comprehension

Trakulphadetkrai et al. (2020) discussed the second factor and how "[t]he role of language in mathematics learning and teaching is undeniably crucial" (p. 473). The language comprehension factor should not be mistaken for struggles encountered when learning a new language, as with English language learners. Researchers define language comprehension as "the ability to attribute semantic meaning to spoken words, […] word definitions, or listening comprehension" (Melby-Lervåg & Lervåg, 2014, p. 410). In simple terms, language comprehension is the ability of a student to understand the meaning of written and spoken words. Kuzmina et al. (2019) gave "[a]s an example, languages with more inconsistent spelling-sound correspondence, such as English, show a longer and larger effect of phonological ability on reading (e.g., Torgesen et al., 1997)" (p. 655).

Students with limited English language skills are more likely to struggle to comprehend mathematical word problems. As Trakulphadetkrai et al. (2020) discussed, "Typically, pupils are expected to choose and collate relevant information from the problem, and to use them to solve the problem. Making sense of mathematical word problems can thus present a challenge for EAL learners whose command of English language is still developing" (p. 477). For instance, students with a language deficit, who are provided with oral accommodations on daily math assignments, where teachers read math problems aloud, tend to do much better than students attempting to do work on their own. Again, when adequate language acquisition is not evident, the comprehension process stops growing.

### Reading comprehension

The difficulties mentioned above are usually connected to the reading comprehension factor (see Table 1), since it is a factor that affects all academic areas. Elementary teachers are often so committed to working on students' reading fluency that sometimes focusing on reading comprehension seems irrelevant. According to research, "Murphy and Unthiah (2015) suggest that weaker reading comprehension skills may in part be responsible for lower levels of academic achievement among EAL learners" (in Trakulphadetkrai et al., 2020, p.476). Unfortunately, weaker reading comprehension skills delay the growth of reading comprehension. Some educators might argue that reading comprehension difficulties mostly occur in the lower grades, yet this is not always the case. These issues are not just occurring in elementary settings; surprisingly, they continue throughout the secondary level. When students become older, comprehension difficulty increases as texts become more complex; one cannot assume that age equals background knowledge. Students might not have the schema needed to piece together texts. Anselmo et al. (2017) noted that "[a]lthough secondary curricula consist of content and skills that are more complex, students must have a strong foundation of basic skills to succeed" (p. 1149). This, of course, leads to issues for young adults' access to higher education or better career opportunities. The three factors mentioned above, all correlate with the research by Swanson et al. (2019) that explained problem translation.

### Problem translation

When students do not have the solid foundation of phonological processing and language and reading comprehension, the problem translation factor becomes a struggle for students. Swanson et al. (2019) explained: "[p]roblem translation is a comprehension task in which the word problem (in either oral or written format) is used to construct a text base" (p. 69). For instance, problem translation can be as simple as a teacher asking a student "what are they asking you for in this word problem?" When the student can decipher that he/she needs to either multiply, divide, add, or subtract and does it correctly, they have a well-nourished problem translation skill. Moreover, researchers showed "difficulties in arithmetic were associated with the development of reading ability" (Light & De Fries, 1995 quoted in Özcan & Do□an, 2018, p.8). Again, if students cannot comprehend what is being asked in a word problem, then question interpretation becomes an issue; thus, comprehension becomes unlikely. If students struggle with basic language acquisition, it is even more difficult for them to understand the language of the mathematics discipline. Stoffelsma and Spooren (2019) discussed how “the relatively recent research focus on *disciplinary literacy* […] has produced strong evidence of a positive relationship between reading proficiency and academic performance in science and mathematics education” (p. 906). When a student has developed these four factors and their flowerpot (Figure 2) is thriving, skills, such as excellent fluency and grade-appropriate reading comprehension, will come naturally, and he/she can apply these skills in order to excel, not only in mathematics, but in all content-areas.

## Discussion

### Lingering issues

There are four lingering issues in this area of study. The issues pertain to the lack of using a combination of reading components and/or strategies to improve math performance with a focus on interventions and strategies for second-language learners; more research about high school and university levels, and also other content-areas is still needed. Fortunately, there are ways to help most students who struggle with comprehension. Best practices, interventions, and overall good teaching habits can help students who are unfortunately doing poorly in their mathematics’ courses because of undeveloped comprehension skills.

First, in order to improve mathematics performance, educators need to take into consideration the native language factor. Researchers’ found that “language predicted each of the WP outcomes substantially and significantly more strongly than the contrasting mathematics outcome involving pure calculations” (Fuchs et al., 2018, p. 161). Second-language learners are expected to understand word problems as native speakers; yet, they may lack the vocabulary in their native language. The task of comprehending a word problem is challenging,

> ... for struggling readers as they face additional cognitive demands that proficient readers do not have. When reading word problems, struggling readers are asked to simultaneously decode text, already an area of difficulty, while comprehending and relating these words to mathematics (MacDonald & Banes, 2017, p. 26).

Difficulties like the one mentioned above, make student comprehension even more complex; therefore, more research on second-language learners and reading comprehension and its effect on maths is a necessity.

Additionally, it was found that more research at the elementary and middle school levels has been done compared to secondary and higher education levels. During the literature searches for this review, there were no sources found regarding high school reading comprehension and mathematics performance. Some sources related to the topic were about university-level students; again, only one of these sources could be used for this literature review. Since the research documents the necessity of reading in all core-subjects, further research at high school and university settings is still needed. Finally, learning and cognitive disabilities connected to reading comprehension and mathematics performance have been overlooked in the research. The authors noticed that there is no mention concerning disabilities in most of the literature reviewed; this is a crucial component of learning and is a large population that lacks further study. Since all research analysed in this review demonstrated the basis of reading skills in academic success, the recommendation is that future studies focus on reading comprehension and maths performance in school settings.

## Conclusion

The purpose of this literature review was to analyse the existing research about reading comprehension and its effects on mathematics performance in elementary and middle school settings. The literature shows that "[s]chool readiness of a child requires competence in areas of development," and it is undeniable that "[i]nefficiency in one of the development areas negatively affects a child's school readiness" (Özcan & Do□an, 2018, p.8). It is imperative that all teachers understand the importance of incorporating reading comprehension skills into all core-subjects. Without comprehension, students cannot successfully complete class assignments nor become critical thinkers. Reading skills are vital in comprehending text in mathematical word problems. Trakulphadetkrai et al. (2020) concluded that students need

> ... good knowledge of everyday vocabulary as mathematical problem solving has become increasingly more grounded in everyday contexts. Potential confusion arises when the boundary between these two types of language becomes blurry" (p.473).

It does not matter if a student has a summer job as a cashier or eventually becomes a civil engineer; maths and reading complement each other. Thus, both sets of skills are necessary for any individual. It is necessary for teachers to provide students with strategies "to help lessen the cognitive demand of word problems," and "educational equity for our struggling readers in order for them to reach standards and use these skills in the real world" (MacDonald & Banes, 2017, p. 26). Mathematics is not just about numbers or simple maths operations; reading comprehension is needed to make connections and solve real-world problems. It is time to, little by little, diminish the negative connotations that students have about reading and that many math teachers have towards incorporating reading skills. As educators, parents, and members of the community, it is essential for us to implement reading skills in our daily lives; reading is a necessary, life-long skill that ties into all areas of life, even mathematics.

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