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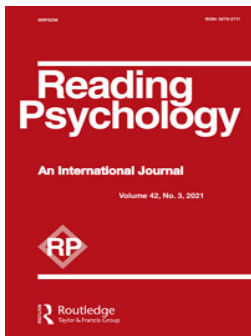
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# The Role of Background Knowledge in Reading Comprehension: A Critical Review

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## ABSTRACT

A critical review was conducted to determine the influence background knowledge has on the reading comprehension of primary school-aged children. We identified twenty-three studies that met our criteria and focused on the links between background knowledge and reading comprehension of children in the mid to late primary years. Review findings highlight that higher levels of background knowledge have a range of effects that are influenced by the nature of the text, the quality of the situation model required, and the presence of reader misconceptions about the text. Our findings also indicate that background knowledge impacts differentially on stronger and weaker readers. Readers with lower background knowledge appear to benefit more from text with high cohesion, while weaker readers were able to compensate somewhat for their relatively weak reading skills in the context of a high degree of background knowledge. Implications of the findings for early years classroom practice are outlined, together with suggested future research directions.

## ARTICLE HISTORY

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## Introduction

The ultimate purpose of reading is to extract and construct meaning from all kinds of text (Snow, 2002). Reading comprehension is core to

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academic progress, because it underpins content-area learning in all subjects. Research in reading over the last 40 years has increasingly emphasized the importance of background knowledge as a significant contributor to the reading ability of middle school students (Recht & Leslie, 1988), college students (Chiesi, Spilich, & Voss, 1979; Garner & Gillingham, 1991; Spilich, Vesonder, Chiesi, & Voss, 1979) and adults (Walker, 1987). This critical review is concerned with the role played by background knowledge in reading comprehension for primary school-aged children, and the implications this has for instruction.

## Theoretical Underpinnings

The Simple View of Reading (SVR) (Gough & Tunmer, 1986) holds that reading comprehension is the product of two distinct yet related skills: *decoding*, the ability to recognize individual written words, and *language comprehension*, the process of interpreting words and connected discourse. During the early stages of learning to read, the ability to decode is the most crucial factor in the reading process (Castles, Rastle, & Nation, 2018; Juel, 1988). Once children have achieved accuracy and fluency with decoding, complementary models exist to explain the activity of reading comprehension.

Reading involves the interaction between the skills and cognitive processes of the reader and the linguistic characteristics of a text. The reader needs to integrate text information with prior knowledge to form a mental representation of the meaning of the text (Van Dijk, Kintsch, & Van Dijk, 1983). Schematic views of reading, such as the Construction-Integration model, postulate that reading is comprised of interactions between the literal, propositional representation of a text (the textbase) and a related schema formed from background knowledge (Kintsch, 1998; Kintsch & Van Dijk, 1978). The textbase, held in working memory, includes explicit information from the text, as well as local inferences used to construct meaning. For most readers, the textbase is automatically constructed and requires little conscious effort (Tapiero, 2007). Elements of this textbase are then integrated with the reader's preexisting schemata, contained in long-term memory, to form a representation of the meaning of the text (the situation model). The situation model differs from the textbase in that it is not a verbatim record of the text. Instead, it is a dynamically constructed representation of the text and its interaction with the reader's preexisting schemata. Situation models are cumulative; as a person reads and learns more about a given topic, the schemata and any resultant situation model will change through growth, reorganization and error correction (Kintsch, 2009).

Low skilled readers (those in the lowest quartile of the population) typically construct a less detailed situation model than skilled readers

because they are less likely to have a coherent textbase and/or well-formed schemata (Kintsch, 1998; McNamara, Ozuru, & Floyd, 2011). Without an effective textbase that is coherent with the content of the text, the reader has access to little information that can be integrated with any related schemata (Kintsch, 1998). A less coherent textbase results in a poorer understanding of the text; an inability to recognize differences between characters or recall information from the text would exemplify a poor understanding due to an incoherent textbase. In contrast, problems associated with schemata tend to manifest as inference generation difficulties. Inferencing is the process by which a reader integrates information from the text with background knowledge in order to fill in detail and links not explicitly stated in a text (McNamara & Magliano, 2009). The ability to infer meaning from text has been recognized as a predictor of reading comprehension at a range of developmental stages and is one of the drivers of sophisticated reading ability (Cain & Oakhill, 1999; Oakhill & Cain, 2007).

### ***The Role of Domain Knowledge***

The Construction-Integration model identifies a critical role for background knowledge in reading (Kintsch, 1998; Kintsch & Van Dijk, 1978). Knowledge can be classified according to its specificity; *background knowledge* comprises all of the world knowledge that the reader brings to the task of reading. This can include episodic (events), declarative (facts) and procedural (how-to) knowledge as well as related vocabulary (Kintsch, 1998). A subset of background knowledge, *domain knowledge*, refers to knowledge of a specific and defined field (Alexander & Jetton, 2000).

Long-term memory stores knowledge as a series of propositions that are activated during reading (Tapiero, 2007). These propositions are connected and organized into various schemata that comprise an individual's understanding of a particular concept. The schemata representing a concept will differ from reader to reader, as schemata are built from the accumulation of individual knowledge and experience. Schemata may differ in the quality (how "true" or useful), quantity and organization of information (Kendeou, Rapp, & van den Broek, 2003; Langer, 1984; Rumelhart, 2017). When reading, the schemata (and related knowledge propositions) associated with that text are activated in order to contribute to the construction of the situation model. When readers lack knowledge elements required to properly integrate the textbase, they build a less effective situation model and thus have more difficulty understanding the text (Chiesi et al., 1979; Kendeou et al., 2003; Kendeou & Van Den Broek, 2007). Low skilled readers are less able to select and recall premises required to make inferences about a text, and are also less able to

suppress irrelevant information during the integration phase of comprehension building (Cain, Oakhill, Barnes, & Bryant, 2001).

Knowledge in long-term memory can be further categorized according to availability and accessibility. *Availability* refers to whether relevant knowledge is held in long-term memory. *Accessibility* refers to the ease with which available knowledge can be retrieved, with more accessible knowledge requiring less time and effort for retrieval. Knowledge that is available may be more or less accessible; knowledge that is not available cannot be accessed at all.

The accuracy of stored knowledge can vary; items are encoded in long-term memory irrespective of whether they are accurate. Students bring a range of knowledge to the task of reading, some of which may be inaccurate; in fact, for young children, holding misconceptions is often the norm rather than the exception (Borges, 1999; Vosniadou & Brewer, 1994). Thus, schemata often hold a mix of information that varies in accuracy.

It is important to note that background knowledge differences do not fully account for variation in reading comprehension abilities of accurate decoders. Although comprehension is sometimes conceptualized as a function of decoding ability and the presence of relevant knowledge, studies examining the comprehension of children using available knowledge show that there are a number of sources of comprehension failure, even when the underlying knowledge-base required for comprehension appears sound (Barnes, Dennis, & Haefele-Kalvaitis, 1996; Cain et al., 2001). These multiple processes, including aspects of language comprehension and ability to select relevant background knowledge, cumulatively and interactively influence cognitive processing during reading.

### ***The Role of Working Memory and Cognitive Load***

Working memory is an aspect of executive function that is crucial in reading (Ericsson & Kintsch, 1995; Kintsch, 1998). In the Construction-Integration model, working memory plays an important role in short term information retention and transfer to long-term memory. In the context of reading, working memory is a temporary storage system that functions to support the reader to briefly hold text propositions and actively process coherence gaps in order to produce the textbase. Integration of the textbase with background knowledge to form the situation model also occurs within the working memory system.

Cognitive Load Theory (CLT) incorporates a model of how working memory functions during learning tasks, including reading (Sweller, 1994; Sweller, van Merriënboer, & Paas, 2019). During any learning event, the limited capacity of working memory acts to constrain information transfer to long-term memory. CLT builds on earlier theories first developed by Baddeley and Hitch (1974), who described working memory as having

a limited storage capacity when processing novel information (such as reading an unfamiliar text). However, working memory has a virtually limitless capacity for information retrieved from long-term memory (Ericsson & Kintsch, 1995; Sweller et al., 2019). The number and complexity of information units being processed in working memory at any one time is sometimes known as the cognitive load, with a greater number and/or complexity of information units resulting in a higher load (Sweller et al., 2019). The likelihood that something will be read, understood and learnt (i.e., be encoded into long-term memory) depends in substantial part on the ability of working memory to adequately process and integrate new information into existing schemata. This is influenced by the degree of cognitive load imposed by the complexity of the written material during reading (Kintsch, 2009).

For comprehension to occur, working memory must not be too heavily burdened. When cognitive load exceeds the limits of available working memory, the situation model formed is less detailed and elements of the textbase and situation model are less likely to be encoded in long-term memory. For readers who have little background knowledge, Kintsch (2009) theorized that the act of integrating the textbase with any available knowledge is effortful to the point that it can overload working memory and lead to comprehension breakdown. Relative experts in a particular topic with high background knowledge find the act of integrating the textbase and knowledge more automatic and effectively effortless, lowering working memory (and hence cognitive load) demands. Accessibility also has a role to play in the load imposed by the act of reading; low accessibility of knowledge requires an effortful search for the relevant knowledge and hence increased extrinsic load (Kintsch, 2009).

### ***The Role of the Text***

The other actor in reading is the text itself. Texts differ in terms of their stated purpose, linguistic features, and text coherence and cohesion (Halliday & Hasan, 2014). *Cohesion*, sometimes known as the microstructure, represents the visibility of the link between phrases and sentences. High-cohesion texts sometimes provide a greater level of explanatory detail to compensate for a reader's lack of background knowledge. *Coherence* (macrostructure) represents the extent to which the text provides information and cues to help the reader relate information across different parts of the text (Graesser, McNamara, & Louwerse, 2003). High-coherence texts provide explicit clues as to the relationships within and between sentences and typically include linguistic devices such as headings and connectives (like *because* and *however*) to help link or contrast ideas. This has the effect of reducing the cognitive load required to

understand the text (Beck, Omanson, & McKeown, 1982; McKeown, Beck, Sinatra, & Loxterman, 1992; McNamara, Kintsch, Songer, & Kintsch, 1996; McNamara et al., 2011).

The cohesion and coherence of a text determines the ease with which a reader can bring background knowledge to bear. Low-coherence and low-cohesion texts require the reader to more actively process a text as they are required to make more inferences, to bridge sentences and ideas. In addition, a reader facing a low-coherence text needs to rely more heavily upon their background knowledge to help fill the coherence gaps by making inferences. Low cohesion texts force readers to more actively process the text; they make demands that mean a reader may not even observe cues to draw on prior knowledge to establish meaning (McKeown et al., 1992). This is particularly true for readers with less background knowledge. These additional demands mean that a higher level of active processing is required to obtain the text-base, reducing the amount of working memory available to activate weak schemata. This results in the creation of a poor situation model and reduced comprehension. Text coherence and cohesion can be affected by linguistic features such as the number of T-units, the minimally terminable unit of language, present in the text (Hunt, 1965).

It has been suggested that the influence of background knowledge on reading varies by age (Cunningham & Stanovich, 1997; Graesser & Bertus, 1998) and genre (Berkowitz & Taylor, 1981). Narrative texts differ from conversation in that they are stories that are tied together by story grammar units and linguistic markers of coherence and cohesion (Stein & Glenn, 1979). Expository texts sit at the formal end of the continuum and involve descriptions that usually contain knowledge that is new to the reader (Paul & Norbury, 2012). These texts make particular demands on the knowledge of the reader as such texts, by definition, are written to inform by building on a reader's existing knowledge of a particular topic (Beck & McKeown, 1991).

### ***Teaching Reading***

The degree to which teachers recognize that differences in the background knowledge of children can account for some of the variation in reading is contestable (Strutt, 2011). Reading processes can be described as skills (automatic once learnt, such as decoding) and strategies (techniques deliberately employed to support comprehension, such as summarizing) (O'Brien & Cook, 2015). Reading instruction beyond the early years has traditionally focused on encouraging children to use generic reading comprehension "strategies" such as finding the main idea of a text, exemplified by the Strategies To Achieve Reading Success (STARS) program (Adcock & Davies, 2012; Adcock & Krensky, 2012). However, others have argued that these so-called "strategies" are actually comprehension



outcomes rather than teachable reading strategies (Muijselaar et al., 2018; Shanahan, 2018). Investigation of teaching approaches such as “finding the main idea” show a mixed evidence base for their efficacy (Langdon Sjostrom & Chou Hare, 1984; Ramsay, Sperling, & Dornisch, 2010; Stevens, Park, & Vaughn, 2019). Given this weak evidence, it is striking that these methods have a dominant position in classroom instruction (Dole, Nokes, & Drits, 2009), particularly given that the duration of instruction in these techniques does not moderate reading comprehension performance beyond fifteen hours of instruction (Elleman, 2017; Stevens et al., 2019). Teaching programs that are underpinned by these approaches, such as the Fountas and Pinnell Systems of Strategic Actions (Pinnell & Fountas, 2007), are intended to be used across a range of texts and may be the focus of instruction at the expense of the careful accumulation of knowledge (Hirsch, 2019). Traditionally, and in some cases, still today, teachers have left the task of building background knowledge in the hands of the parents. This is a surprising position given a demonstrated socio-economic status (SES) gradient associated with children’s preschool oral language exposure and acquisition of world knowledge (Gilkerson et al., 2017; Hart & Risley, 1995, 2003).

The aim of this critical review, therefore, was to examine the published evidence regarding the degree to which variation in children’s background knowledge contributes to differences in reading comprehension in the mid to late primary years of schooling. The Construction-Integration model of discourse processing holds that levels of comprehension are differentially associated with the reading process and the development of comprehension. As a result, we examined studies with a particular emphasis on the differential effects of varying background knowledge on children identified as being skilled and low skilled readers. A further purpose of the review was to examine the interaction between the linguistic features of a text and a reader’s background knowledge. In particular, we aimed to investigate the effects of differing levels of text cohesion on children’s reading comprehension.

## **Method**

### ***Inclusion Criteria***

#### ***General study characteristics***

We included empirical studies published between 1950 and 2020 that either used a knowledge-building intervention or examined correlations between preexisting knowledge and reading performance. Intervention studies were included if they used pre-teaching activities or full teaching sequences designed to increase the relevant background knowledge of children. Assessments of preexisting knowledge were either a measure of

general knowledge unrelated to the target text or a specific assessment of knowledge and skills related to the passages used for comprehension. Reviews of the literature were excluded.

### *Outcome measures*

The primary outcome of interest was reading comprehension ability. Therefore, included studies featured at least one form of objective, quantitative reading comprehension measure, such as curriculum-based outcome measures (e.g., Key Stage assessments), standardized tests (e.g., Iowa Test of Basic Skills (Hoover, Dunbar, & Frisbie, 2001) and Gates-MacGinitie Reading Test (MacGinitie & MacGinitie, 1992)) or researcher-designed assessments of reading comprehension. We included studies that used a variety of measures, such as: open-ended recall, cloze, multiple choice questions and cued recall outcomes. Studies were not included if they used assessment items that were explicitly trained in an intervention.

Studies eligible for inclusion in this review needed to include a reading comprehension measure in which the child read an extended text and was required to recall and/or answer questions related to the content of the text. We were interested only in passage-level rather than sentence-level text in order to inform classroom practices that could be useful in promoting comprehension of complex written texts. Studies were also excluded if they used electronic passages or hypertext in order to avoid confounding due to modality effects.

### *Participant groups*

This review included studies involving participants from age six to 12 enrolled in formal, mainstream education classes taught in English. In Australia, this age range comprises children who are in middle to late primary school. Studies conducted in languages other than English were excluded due to external validity concerns including the potential limitation in providing generalizability of findings to the target population (i.e., English-speaking children enrolled in mainstream schools).

Groups of unselected, typically-achieving children, children with developmental language disorder, or children at risk for language and reading problems were included in the review. Studies that targeted children with clinical diagnoses such as autism spectrum disorder or other neurodevelopmental or sensory disabilities were excluded from the review, as were studies targeting second language learners. This was because the aim of this review was to capture the effects of background knowledge on the range of students for whom a Tier 3 intervention or atypical approach was not yet required. As we aimed to characterize children across the range of reading abilities reflected in a typical classroom, studies that

specifically aimed at the lowest achieving readers to the exclusion of typically achieving children were also excluded.

### **Research design**

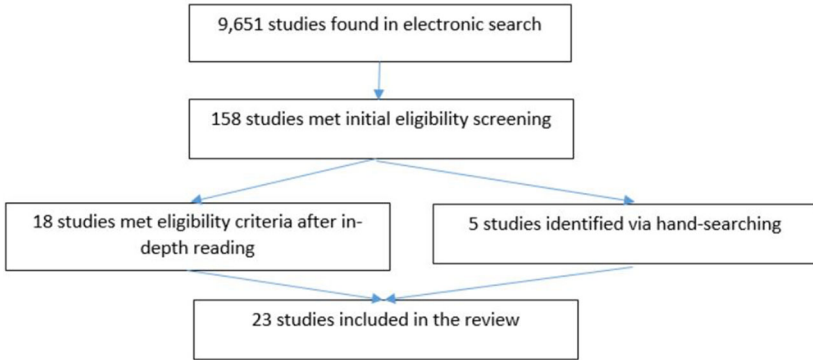
Experimental and quasi-experimental designs were included. For studies linking background knowledge with reading comprehension in which there was a categorization according to preexisting background knowledge but without a specific intervention, a method for defining the population according to degree to which children could recall relevant knowledge was required. Intervention studies were required to include a “business as usual” control condition, with or without exposure to the materials, or a weaker intervention used to mirror usual classroom instruction. Studies that compared less and more skilled readers were included, even in the absence of control groups, as the focus of these studies was the differential effect of interventions on the two groups of readers. Included studies needed to have a methodology that was sufficiently detailed that it could be faithfully replicated. The studies were examined using the Glasgow Critical Appraisal Checklist (Morrison, Sullivan, Murray, & Jolly, 1999), which was adapted from the Critical Appraisal Skills Program ([www.casp-uk.net](http://www.casp-uk.net)). The Glasgow Checklist was selected because it had a subsection directly related to the quality and replicability of education research.

### **Procedure**

We used a critical review methodology. A critical review synthesizes material from diverse sources, analyzing it in order to produce a hypothesis or model based on the data and study outcomes (Grant & Booth, 2009). The outcome of a critical review differs from other similar review types in that it is often an evaluation of the relevant body of work in order to construct a conceptual contribution that embodies existing theories or to derive a new theory (Grant & Booth, 2009).

### **Identification and retrieval of the studies**

A number of databases were searched, in order to identify the largest possible number of eligible studies that assessed the relationship between background knowledge and reading comprehension in primary school children. An electronic search using ERIC, PsycINFO and Web of Science was conducted using the keywords *read*\* AND *knowledge* and *read*\* AND *information*. In addition to the electronic search, the reference lists of the retrieved studies were hand-searched in order to identify any missing articles not captured by the original search and five additional studies were identified this way. Initial eligibility screening focused on the age-range of participants, study design



**Figure 1.** Number of included studies before and after eligibility screening.

and text type used in the study. This initial screening identified 158 studies fulfilling the criteria noted above. Of the 158 studies that met initial eligibility criteria, 18 were identified that used a background knowledge measure or a knowledge building intervention and explicitly linked it to a measure of reading comprehension. [Figure 1](#) displays the number of studies found as a result of the searches.

### ***Study Characteristics***

Eligible studies were coded according to their characteristics by the first author. For detailed information about the coded characteristics, see [Table 1](#) below.

### ***Descriptive characteristics***

Across the 23 eligible reports, most were published in the 1980s and 1990s, with six published in the last 15 years. The majority of the 23 studies used a quasi-experimental design and were conducted in the United States. The sample sizes ranged from 20 to 674, and involved children from ages six to 12 in classroom settings. Participants in papers reviewed in this study were representative of the spread of reading abilities present in typical classrooms and were from a variety of SES backgrounds. The studies varied in the degree to which they reported gender, SES and ethnicity, so these details were not coded.

Expository text was utilized in 20 of the 23 studies, in contrast to only six requiring comprehension of various narrative forms. This is consistent with the wider field of research focusing on expository text due to its difficulty; attempts to quantify the relationship between background knowledge and genre in older children and adults have found that narrative texts are less demanding on background knowledge than expository



**Table 1. Methodological Characteristics by Study**

Text genre	Researcher developed texts?		School Year		Reader type	Background measure type				Researcher developed background measure?				PostTest reading measure				Researcher developed reading measure?					
	N	Year	N	Year		Multi-choice	Close	Intervention	Background Knowledge	Free Association	Woodcock-Johnson III	Open Ended Questions	Researcher developed background measure?	Pretest Reading Measure	Retell	Multi-Choice	Close Reenactment		Summary sentence	T/F Association	Woodcock-Johnson III	Open Ended Questions	
Adams et al. (1995)	NARR	Y	106	4-7	N	Y	Y					Y	CAT	Y	Y						Y	Y	
Beck et al. (1982)	NARR	A	48	3	N			Y					WPA	Y	Y							Y	Y
Best et al. (2008)	NARR/EXP	A	61	3	N			Y					WJIII	Y	Y							Y	Y
Callahan and Drum (1984)	EXP	A	20	5-6	A				Y				CAT, MAT	Y	Y						Y	Y	Y
Converti et al. (2016)	EXP	Y	59	4	N	Y							WJIII	Y	Y					Y	Y	Y	Y
Connor et al. (2017)	EXP	Y	418	K-4	N	Y		Y					WJIII	Y	Y					Y	Y	Y	Y
DeWitz et al. (1987)	EXP	Y	101	5	N	Y							ITBS	Y	Y					Y	Y	Y	Y
Freebody and Anderson (1983)	EXP	Y	88	6	N								U							Y	Y	Y	Y
Holmes (1983)	EXP	Y	56	5	N			Y					-								Y	Y	Y
Kim et al. (2021)	EXP	Y	674	1	N			Y					MAP, D	Y	Y				Y		Y	Y	Y
Langer (1984)	EXP	A	161	6	N				Y				ITBS								Y	Y	Y
Lipson (1982)	EXP	A	28	3	N								U		Y							Y	Y
Marr and Gormley (1982)	EXP	Y	33	4	N						Y		MAT								Y	Y	Y
McKeown et al. (1992)	EXP	Y	48	5	N			Y					MAT	Y							Y	Y	Y
McKeown et al. (2009)	NARR/EXP	Y	119	5	N								TN, WJIII	Y	Y	Y					Y	Y	Y
McNamara et al. (2011)	NARR/EXP	A	65	4	N						Y		WJIII	Y	Y							Y	Y
McNamara et al. (1996)	EXP	A	36	4-6	N	Y							WJIII	Y	Y							Y	Y
Pearson and Johnson (1979)	EXP	Y	20	2	A	Y							MAT	Y	Y							Y	Y
Recht and Leslie (1988)	NARR	Y	64	7-8	N	Y							SRA	Y	Y				Y		Y	Y	Y
Reutzel and Morgan (1990)	EXP	A	168	5-6	N				Y				GM	Y	Y				Y		Y	Y	Y
Stahl and Jacobson (1986)	EXP	Y	61	6	N			Y					GM	Y	Y						Y	Y	Y
Taft and Leslie (1985)	EXP	Y	57	3	N				Y				-	Y	Y							Y	Y
Yochum (1991)	EXP	Y	90	5	N to A	Y							U	Y	Y							Y	Y

Key:

Text Genre: EXP = Expository, NARR = Narrative.

Researcher Developed texts: Y = Yes, A = Adapted version created.

Reader Type: N = Normal range, A = Above average.

Pretest Reading Measure: MAT = Massachusetts Achievement Test; ITBS = Iowa Test of Basic Skills, CAT = California Achievement Test.

WJIII = Woodcock-Johnson III, SPR = Scientific Research Associates achievement comprehension subtest, GM = Gates-MacGinitie Test, TN = Terra Nova reading comprehension test, D = Dynamic Indicators of Basic Early Literacy Skills, MAP = Measures of Academic Progress, U = unspecified standardized assessment.

texts (Nelson, 1998; Olson, 1985; Spiro & Taylor, 1987; Wolfe & Woodwyk, 2010).

### ***Excluded studies***

A number of otherwise relevant studies were excluded from this review. A series of experiments, utilizing a novel knowledge base, were excluded because some or all of the text was read to students (Barnes et al., 1996; Cain et al., 2001). Others examined single sentence reading so did not meet the connected text requirement (e.g., McNamara and McDaniel (2004)). A significant number of studies relied on activation of background knowledge but had no measure of that knowledge (e.g., Brandão and Oakhill (2005)).

## **Results and Discussion**

### ***Methods Used to Assess Comprehension and Knowledge Vary Between Studies***

One of the striking aspects of the reviewed studies was the variability in measures employed to measure both reading comprehension and background knowledge. Reading assessment types varied from free recall (e.g., Adams, Bell, & Perfetti, 1995; McKeown, Beck, & Blake, 2009; McNamara et al., 1996); cued recall (Best, Floyd, & McNamara, 2008; Callahan & Drum, 1984); cloze (Callahan & Drum, 1984; Connor et al., 2017; Dewitz et al., 1987); multiple choice questions of various forms (Connor et al., 2017; Kim et al., 2021; McNamara et al., 2011; Reutzel & Morgan, 1990; Stahl & Jacobson, 1986; Yochum, 1991); summary (Callahan & Drum, 1984; Freebody & Anderson, 1983; Recht & Leslie, 1988); sentence recognition (Stahl & Jacobson, 1986); true/false questions (Freebody & Anderson, 1983); to reenactment (Recht & Leslie, 1988). Even when using the same assessment method, scoring varied. For example, when using a recall measure, some researchers examined organization of ideas (Langer, 1984), some tallied ideas (Best et al., 2008; Callahan & Drum, 1984; Recht & Leslie, 1988), while others scored the quality and accuracy of recall (Cervetti, Wright, & Hwang, 2016; Recht & Leslie, 1988). This variation was surprising given the considerable effort and attention that has been devoted to examining ways in which reading comprehension can be accurately measured (Bowyer-Crane & Snowling, 2005; Hua & Keenan, 2017; Pearson & Johnson, 1972).

Variation in outcome measures across studies is problematic for two reasons. Firstly, it is difficult to make direct comparisons of background knowledge effects, and secondly, different levels of comprehension are assessed by each of the measures. For example, tasks which assess a

reader's memory of the literal aspects of text, such as summaries, sentence recognition and cloze items, probe a surface level representation of the text: the textbase constructed by the reader (McNamara et al., 1996; Tapiero, 2007). In contrast, methods addressing a reader's inferences, such as questions requiring integration of prior knowledge with information not directly stated in the text, measure the complexity and detail of the reader's situation model, probing a deeper understanding of the text (McNamara et al., 1996).

The variation in comprehension measures indicates that there is not necessarily one consistent interpretation across studies of what it means to actually *comprehend* a text and what the outcomes of comprehension should and could look like to classroom teachers. The studies do not have a common view on what children will know and be able to do as a result of reading, and hence, what methods would be best for measuring these outcomes. As a result, comparisons and consideration of general trends across the studies needs to be treated with caution. Despite these caveats, there were a number of key observations and outcomes that were consistently reported across the studies and these are discussed below.

### ***Background Knowledge Impacts Differentially on Different Levels of Comprehension***

We consistently found that higher levels of background knowledge enable children to better comprehend a text. Readers who have a strong knowledge of a particular topic, both in terms of quantity and quality of knowledge, are more able to comprehend a text than a similarly cohesive text for which they lack background knowledge. This was evident for both skilled and low skilled readers (Marr & Gormley, 1982; Reutzel & Morgan, 1990; Taft & Leslie, 1985).

Reading relies heavily on aspects of an individual's executive functioning, such as working and long-term memory performance, generic reading skills, such as decoding and semantic skills that are applicable across texts, and the availability of background knowledge specific to the text being read (Wren, 2000). Several studies included in the review demonstrated a compensatory effect for knowledge and reading ability; low skilled readers with strong knowledge were able to compensate for generally poor comprehension skills (Adams et al., 1995; Holmes, 1983; Recht & Leslie, 1988). There appears to be to be a tradeoff between knowledge and general reading ability at this age; a child with a strong knowledge-base can compensate to some extent for poor reading skill, and a child with strong reading skill can compensate to some extent for deficiencies in knowledge (Adams et al., 1995; Cervetti & Wright, 2020).

The findings of this review highlight that the compensatory effect of background knowledge is most pronounced in the development of the textbase. Recall and summary measures assess the ability of the reader to retrieve the meaning of the text but they do not require the reader to integrate what they have just read into preexisting schemata (Kostons & van der Werf, 2015). Recht and Leslie (1988) focused on the textbase level and demonstrated that high-knowledge readers were able to compensate for poor reading skill to the extent that they were able to summarize and recall to a similar degree to high-knowledge, skilled readers. The effects of background knowledge in the construction of a textbase for skilled readers was less significant (McNamara et al., 1996; Recht & Leslie, 1988), to the point where, in the well-known Recht and Leslie (1988) so-called “baseball study”, there was no statistically significant difference in the recall between less-skilled and skilled, high-knowledge children. McNamara et al. (1996) reported a similar effect whereby readers with sufficient background knowledge were able to recall elements of the text irrespective of their general reading abilities. The authors hypothesized that the ability to recall information is directly related to the formation of an adequate textbase (McNamara et al., 1996). The textbase can serve as an efficient retrieval structure, and so propositions can be retrieved successfully, regardless of whether the reader understands the relationships between them (Kintsch, 1998).

The compensatory effect of knowledge was less pronounced when children were asked to make inferences. Adams and colleagues (1995) demonstrated that children with greater domain knowledge were more capable of making inferences about a narrative text. Interestingly, although low-skill readers did gain some benefit from increased knowledge, it was not as pronounced as that gained by above-average readers. In contrast to the effects of knowledge on the textbase, low-skill readers were not able to fully compensate for below-average reading skill while inferencing (Adams et al., 1995). This was consistent with findings from a number of other studies (Holmes, 1983; Reutzel & Morgan, 1990; Stahl & Jacobson, 1986).

The review also indicated that the effects of increased knowledge depend on a child’s reading skill. Low skill readers with high knowledge are able to compensate for poorer reading skills in textbase construction (McNamara et al., 1996; Recht & Leslie, 1988). This, in turn, enables a more effective situation model to be produced; however, this model is still not as detailed as that formed by an above-average, high-knowledge reader. Therefore, although recall is strong, these readers still find inferencing difficult (Adams et al., 1995; Holmes, 1983; McNamara et al., 1996; Reutzel & Morgan, 1990; Stahl & Jacobson, 1986). For stronger readers, the impact of knowledge is most pronounced in the integration of the textbase into a more complete schema to develop the situation



model. These children gain less benefit in the development of the textbase but increased knowledge facilitates the formation of a more coherent situation model. These observations are consistent across studies comparing the performance of low and high knowledge readers (Best et al., 2008; Taylor, 1979; Yekovich, Walker, Ogle, & Thompson, 1990).

### ***Knowledge Interacts with the Coherence and Cohesion of the Text***

Understanding a text is moderated by an interaction between background knowledge and the text's coherence and cohesion. In each of the reviewed studies, cohesion had differential effects on the reader depending on their level of background knowledge. McNamara and colleagues (1996) determined that readers with less knowledge were more able to recall key features and answer inferential questions after reading a highly cohesive and coherent text. These children benefit from texts that do much of the processing for them because the cohesive text provides more support for the textbase and resultant situation model production (McNamara et al., 1996; Reutzel & Morgan, 1990). In contrast, high knowledge children developed a more complete situation model, and hence a greater understanding of the text, when the text had lower cohesion. For these readers, the additional processing required for low cohesion text forces them to produce a more complete situation model (McNamara et al., 1996). When faced with a more cohesive text, high knowledge children seem less likely to actively process the text and monitor their comprehension as a result of the ease with which they can form the textbase (McNamara et al., 1996). This "reverse cohesion effect" seems to be a specific instance of the expertise reversal effect described in the CLT literature, whereby instructional techniques differ depending on levels of prior knowledge (Sweller et al., 2019). The expertise reversal effect notes that novice learners benefit from consistent, heavily guided instruction or texts, whereas experts (higher-knowledge learners) benefit more from reduced guidance or support (Sweller et al., 2019).

The findings of this review suggest that cohesion demands are partially responsible for the degree to which text genre impacts on the comprehension ability of children to compensate for lower reading ability using prior knowledge. Across several studies included in this review, there was a much greater impact of knowledge on the ability of children to read expository texts as compared to narrative texts (Best et al., 2008; McNamara et al., 2011; Nelson, 1998). Several factors may contribute to this finding. Firstly, working memory demands of expository texts are more pronounced than for narrative texts, as the schema associated with narrative text structure are usually more practised for younger children than expository texts (Best et al., 2008; Williams, Hall, & Lauer, 2004). A

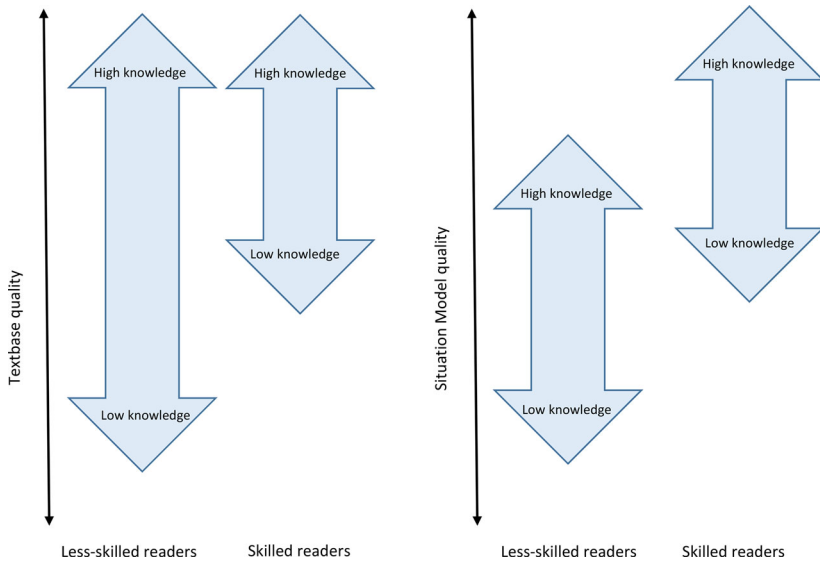
lower demand on working memory with narrative texts may allow a greater focus on encoding the information in long-term memory (Tapiero, 2007). An alternative explanation is that the demands on prior knowledge imposed by expository texts are significantly greater than those imposed by narrative text – consequently, the impact of poor prior knowledge may be far more pronounced with expository texts (Cervetti & Wright, 2020; Wolfe & Woodwyk, 2010).

### **Misconceptions Can Be an Inhibiting Factor in Reading Comprehension**

Several studies highlighted the significance of the quality of knowledge for reading comprehension, particularly the impact of reader misconceptions. In the study by Lipson (1982), children identified as *high* and *low skill* readers were asked to recognize and recall information from an expository text. During this task, children relied more heavily on prior knowledge than on the text; when information in the text contradicted prior knowledge, children would preference prior knowledge. When asked to recall the contents of the article, *low skill* readers were much more likely to omit contradictory information from the text and replace with their misconception. Holmes (1983) conducted a similar study, dividing participants into *above* and *below* average readers to determine any differential effects of reading ability. She observed similar effects to Lipson, noting that above-average readers were more likely to identify contradictions between prior knowledge and information in the text. Below-average readers were more reliant on their (incorrect) knowledge and struggled to resolve inconsistencies between the text and prior knowledge (Holmes, 1983). This effect was observed in another review study (McKeown et al., 1992). The ability to notice and address breakdowns in comprehension is one of the features of a competent reader (Barnes et al., 1996). This ability may be related to differing levels of organization of knowledge in long-term memory (Holmes, 1983; Langer, 1984). Higher levels of schematic organization are characterized by more precise definitions of terms, superordinate concepts and analogous relationships between ideas (Langer, 1984). Schemata that had a greater level of organization enabled readers to recall and utilize information more readily from related expository texts.

### **Contribution of the Findings to a Wider Context**

For children in middle to late primary school, depth of background knowledge has significant implications for their ability to read texts of various genres. Arguably the strongest contribution of this review to the current body of research is the contrast in the compensatory effects of



**Figure 2.** Differences in the effects of background knowledge for above and below average readers on textbase and situation model quality.

background knowledge on particular levels of comprehension described in the Construction-Integration model for skilled and low-skill readers. [Figure 2](#) depicts these differential effects and their relationship to general reading skill. In the formation of an accurate textbase, knowledge can help a reader identify cohesion gaps in the text and construct bridging inferences to repair these gaps. As this review has demonstrated, when a low-skilled reader has strong knowledge relevant to the text, they can compensate for below average reading skill to the point where their recall of a text is similar to that of a skilled reader with similar knowledge (see [Figure 2](#)).

Background knowledge also affects the quality of the situation model formed during reading. The stronger and more detailed the background knowledge, the stronger the situation model representation of the text will be. Therefore, a stronger knowledge base can compensate for less skilled reading, although not completely (see [Figure 2](#)). The fact that background knowledge cannot fully compensate for less skilled general reading highlights the importance of teaching foundational skills thoroughly and not just relying on the development of a stronger knowledge-base. Several studies in this review (Adams et al., 1995; Holmes, 1983; Reutzel & Morgan, 1990; Stahl & Jacobson, 1986) demonstrated a gap in the quality of the situation model formed by knowledgeable readers of differing reading skill, a finding which is supported by other studies with older students (Kraal, Koornneef, Saab, & van den Broek, 2018; O'Reilly & McNamara, 2007) and in other forms of discourse (Barnes et al., 1996; Cain et al., 2001). This residual difference in reading skill has variously been

attributed to difficulty identifying text relations, integrating information from the text with background knowledge and generating relevant inferences at the right time (Cain et al., 2001; Cervetti & Wright, 2020; Perfetti, Landi, & Oakhill, 2005; Rapp, Broek, McMaster, Kendeou, & Espin, 2007).

Therefore, although background knowledge is an important component of reading comprehension, it is not the only component and thus can only partially compensate for less skilled and strategic reading. This partial compensation model differs from some descriptions of the impacts of background knowledge, which claim greater degrees of compensation. (Recht & Leslie, 1988).

The impact of low background knowledge can be ameliorated by enhancing the cohesion of a text – low knowledge readers benefit from greater cohesion in the text because they lack the necessary prior knowledge to generate bridging inferences. When the text lacks cohesion, the low knowledge reader is generally unable to make connections between separate ideas in the text. By contrast, high knowledge readers gain from cohesion gaps because it forces them to access background knowledge to understand the text. In a follow-up study to that described in this review, O'Reilly and McNamara (2007) found that this reverse cohesion effect exists only for less skilled readers. They attribute this difference to the fact that more skilled readers are already making strategic decisions and actions that actively repair comprehension deficits.

The finding that different tools for assessing reading comprehension are used across various studies is not surprising; it has been a debated topic for some time (e.g., Dochy, Segers, & Buehl, 1999; Johnston & Pearson, 1982). However, the range of test types, and the various levels of comprehension that each assessed, was greater than expected given attempts over time to develop consistent measures of reading.

### ***Limitations of the Reviewed Research Studies***

Few studies specifically compared a measure of background knowledge with a measure of reading comprehension for younger children. Some attempted a knowledge activation strategy (such as pre-reading) or a framework like a concept map but neglected the measurement of what children knew either before the intervention or as a result of the knowledge-building intervention.

The absence of a standardized measure of reading comprehension made some comparisons difficult. As mentioned previously, measures used across the studies were generally researcher-developed and unique to the study. This use of custom measures is understandable given the short duration of the studies; however, the presence of standardized (and comparable) measures would have allowed a more robust analysis.

One of the concerns about generalizing from the literature included in this review is the degree to which the situation model and the resultant schema construction are stable. The stability of a schema is measured by the longevity of understanding of the text. In most of the studies, the time elapsed between reading and the subsequent assessment was brief. In a few studies there was a longer time between reading the text and comprehension. Given that the purpose of many of texts in the included studies is specifically to inform the reader, it would have been useful to have a greater indication of long-term retention.

Most interventions in this study were short-term, ranging from two to 12 hours of instructional time. In a middle primary classroom, time is typically spent building students' knowledge in less well-defined domains such as 'The American Revolution' and 'Classification'. Due to the larger scope of these domains, they require a lengthier instructional phase than those in the studies in this review. Development of longer-term interventions designed to specifically build a larger knowledge-base would have contributed to the understanding of the effects of knowledge building in the regular classroom. The effectiveness of this approach is hinted at in the two exceptions to this generalization: the Model of Reading Engagement (MORE) (Kim et al., 2021) and the Content-Area Literacy Instruction (CALI) (Connor et al., 2017) models. Both attempted to systematically build a knowledge base over a longer period of time. Both models showed positive and significant effects on proximal reading measures and smaller effects on texts that were more distal to the content that was being studied as part of the program. These two studies suggest the potential for longer scale knowledge building, and a greater emphasis on this in the literature would be welcome.

### ***Limitations of the Review***

One limitation of this review was the exclusion of research completed in non-English speaking populations. Although the intention of this criterion was to increase the ecological validity of the findings, a substantial body of research relating to the links between background knowledge and reading comprehension has been conducted in non-English speaking populations. These exclusions were a reflection of the resources available to the research team, consisting of people fluent only in English. An adjustment to include these studies would have strengthened the review.

### ***Recommendations for Practice and Future Research***

In examining the outcomes of this review, it becomes more clear that background knowledge is not just an incidental aspect of reading instruction. Instead, explicitly teaching background knowledge should be

considered foundational to increasing competency in reading. The outcomes of this review indicate that development of background knowledge is as, if not more, important now as it has ever been in the past, if even just for the “simple act” of comprehending a text (Willingham, 2006). Thus it is imperative that English and Language Arts educators must focus on the explicit teaching of domain knowledge in English and Language Arts classrooms in order to build their students’ reading comprehension capacity.

Findings from this review suggest that children would benefit from exposure to background knowledge in a specific, explicit and sequenced way (Connor et al., 2017; Kim et al., 2021): a so-called “knowledge rich” curriculum (Hirsch, 2019) in addition to teaching of comprehension strategies such as summarizing. This contrasts with the more prevalent approach of teaching generic reading comprehension strategies” (such as determining the main idea, inferring and locating information) as the prime focus of reading instruction (Griffith & Duffett, 2018; Moats, 2000). The recommendation for the development of background knowledge also runs counter to the prevailing view in Australian education circles that, due to the prevalence of online information sources, knowledge building is less relevant and necessary than in the past and less relevant than the building of so-called soft-skills such as critical thinking and collaboration (Schleicher, 2018).

The differential impacts of background knowledge on reading comprehension have implications for the selection of reading materials for the instruction of primary aged children. There seems to be a “Goldilocks” principle at play in the selection of texts; if the process of comprehension is too effortful then mental resources go toward maintaining meaning and not storage and learning, whereas if comprehension is not effortful enough then inscription to long-term memory is less likely to occur. In terms of CLT, the load imposed by maintaining meaning becomes too high and encoding information in long-term memory is inhibited (Kintsch, 2009). If the reading process is too easy, readily accessible memories are not created. Using several matched texts written at particular levels of cohesion for particular domains as part of an instructional sequence may enable a text choice that is just difficult enough to enable active processing but not so difficult that comprehension cannot occur (McNamara et al., 1996).

Future research should focus on several questions related to knowledge structure, availability and accessibility. The ability to recruit background knowledge in the act of reading may be a function of the stability of that knowledge in long-term memory. Given the purpose of reading many texts, particularly for school-aged children, is to learn new information, the ability of children to form a stable knowledge-base is of great

importance. In particular, given that long-term knowledge retention is one of the aims of formal schooling, future studies could be conducted to determine whether the compensatory effects of relevant prior knowledge when reading allow the resultant knowledge constructed to be better retained over a longer period than that measured in most of the studies in this review.

There is some suggestion that the ease with which children can activate relevant schemata (knowledge accessibility) affects subsequent comprehension. Future studies could test whether comprehension is affected by relevant knowledge accessibility, and whether there is a difference in the degree to which knowledge accessibility has an impact on the reading comprehension abilities of high and low skill readers.

Finally, studies involving a more ecologically sound knowledge-building intervention for the purpose of improving reading comprehension could be conducted. Interventions that have a stronger link with the way in which a knowledge-base is developed in typical classrooms could be tested for their effects on the reading of related texts. This may inform how instruction may be adapted to best develop comprehension.

## Conclusion

The role of background knowledge has been a well-recognized and researched aspect of reading comprehension for the last four decades. Knowledge plays an integral role in most theories of reading, yet remains an under-addressed aspect of reading instruction for teachers. This review built upon the existing literature by describing the various ways in which background knowledge partially, not completely, compensates for reading skill deficiencies. Although misconceptions may be an inhibitor in comprehension, the presence of rich schemata gives readers a greater opportunity to build a strong understanding of the texts they read. This review highlights the importance of the systematic and sequential building of background knowledge for an increased ability to comprehend a range of texts in upper-primary school children. It also focuses on the interactions between text coherence, background knowledge and learning from text, and so has implications for text selections for learning and for teacher pre-service education and professional development.

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