

Relationship Between Working Memory And Literacy Among Elementary School Kids

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Introduction

Working memory plays a critical role in various aspects of literacy among children. According to Gathercole et al. (2007), associations between literacy levels and working memory vary across age as well as expertise level, possibly as a result of the changes in strategies and procedures that underpin literacy development among children. It has been established that low scores in working memory are strongly linked to poor literacy in areas such as computational skills, reading skills, and difficulties in solving numerical problems (Gathercole et al., 2007). The process of learning how to write and read necessitates a stimulating environment and effort. Being literate refers to the acquisition of the ability to decode writing into oral language and encode written language.

Writing and reading also mean comprehension and apprehension of meaning expressed in written language and their expression in written language (Cardoso, Silva, & Pereira, 2013). To acquire written language, phonological and visuospatial processes are critical. Once perceived, such information is stored in the working memory, after which they are transmitted to the long-term memory, allowing learning to take place. Through memory, an individual can store and retrieve oral and written information. Any dysfunction in the processes can potentially affect an individual's ability to write and read (Luo et al., 2013). This study, hence, seeks to investigate how deficits in working memory may lead to literacy impairment in areas such as mathematics and reading. The study is significant as it will help develop a means of improving working memory through training among children with learning disabilities.

Definition Of Terms

Reading disabilities: This refers to a condition whereby an individual shows reading difficulty as a result of neurological factors.

Developmental dyslexia: This is a reading disability characterized by difficulties in fluent or accurate word recognition as well as by poor decoding and spelling abilities.

Working memory: This refers to a cognitive system that has a limited capacity and is responsible for the temporary storage of information before it is available for processing.

Short-term memory: It refers to the capacity for holding a small amount of information but not

manipulating that information in an active and readily available form for a short span of time.

IQ: Intelligence quotient refers to a total score that is derivative of numerous standardized tests intended to measure human intelligence.

Critical Summary Of The Research Articles

In their journal entitled “*Working Memory in Children with Reading Disabilities*,” Gathercole et al. (2007) explores the degree to which working memory impairment leads to the severity of difficulties in learning that children experience, particularly those with reading disabilities. The researchers conclude that the severity of deficits in mathematics and reading among children with reading disability is strongly and closely related to working memory skills. They argue that the association arises since working memory acts as the basis of learning in classrooms, adding that effective management of working memory in learning activities may serve to better the learning problems linked to impairments of working memory (Gathercole et al., 2007). While the authors present credible arguments, their assessment of working memory skills is limited by the fact that their study only relies on verbally-based assessment approaches. This is because, during data collection, there were no robust methods of analyzing nonverbal elements of working memory in the children participants. As a result, it is impossible to make claims regarding the level of domain generality of memory skills being assessed.

In their article, “*Phonological Awareness and the Working Memory of Children with and Without Literacy Difficulties*,” Cardoso, Silva, & Pereira (2013) investigate the relationship between working memory and phonological awareness. The study also explored whether alterations in working memory and phonological awareness can affect the literacy process of children who are intellectually normal. The study concludes that working memory and phonological awareness are directly proportional measures, arguing that children develop phonological awareness skills along with working memory language (Cardoso, Silva, & Pereira, 2013). Therefore, the level of performance of working memory increases as phonological awareness develops and vice versa.

The study findings reveal that the assessment of phonological awareness, as well as the performance of working memory prior to the start of a literacy process, can potentially expedite the prediction of the acquisition of written language. While the study excluded children with alterations in the IQ test audiometric test and those with visual alterations, language delay, grade delay, and neurological alterations language (Cardoso, Silva, & Pereira, 2013), the researchers assumed that the children participants had the similar socioeconomic level, merely because the children were enrolled in a public school that was situated in one municipality. The results of this study can hence not be generalized since differences in socioeconomic factors may influence the findings.

Luo et al.’s (2013) study sought to examine whether training in working memory improves reading skills and working memory among dyslexic children. The researchers established that adaptive and

intensive computerized training in working memory progressively increases the amount of information that dyslexic children can store in working memory (Luo et al., 2013). The authors compared the results from post-training and baseline tests with those of the control group subjected to a relatively low training dose. The comparison indicated that the training essentially increased the working memory of elementary school children. Increased performance was registered in verbal tasks of the working memory, as well as in visuospatial tasks (Luo et al., 2013). The implication is that the effects of working memory training were generalized to numerous capacities. What is more, a considerable training effect was evident for both reading fluency tasks and visual rhyming tasks, both of which registered a substantial effect size. Although the study proved that working memory training can be used to enhance cognitive function, particularly among kids with developmental dyslexia, it failed to look into the persistence of the effects of such training.

Discussion Comparing And Contrasting The Articles Surveyed

All three articles reviewed reported a relationship between working memory and literacy among children. To begin with, Gathercole et al.'s (2007) article established that there exists a strong relationship between working memory skills and the severity of learning difficulties, both in mathematics and in reading, especially among kids with reading disabilities. The key finding in their research was that a child's attainment in reading can independently be predicted by working memory skills. This factor was, however, found to be less in mathematical attainment. The study also demonstrated that reading ability was considerably influenced by children's phonological and language processing abilities. Like in the two other articles, however, Gathercole et al.'s (2007) article mediated the connection between reading ability and working memory using phonological processing skills, verbal abilities, and short-term memory.

However, the study, unlike the other two studies, investigated the link between working memory and fluid intelligence and established that despite the close connection between working memory and fluid intelligence, fluid intelligence had no common independent connection with either mathematics or reading. Such asymmetry of relationship offers a robust basis for classifying working memory as a significant factor that leads to reading disabilities. Similar findings were reported by Luo et al. (2013), who established that mathematical attainment is more generally linked to individual differences, just like measures of short-term memory, phonological processing, and complex span. These findings suggest that phonological capabilities make a significant contribution to the development of the domain of working memory. All three articles demonstrated that complex memory performance is the greatest predictor of computation and mathematical abilities.

The specificity of connections between scholastic attainment and working memory in Gathercole et al.'s (2007) study is consistent with Cardoso, Silva, & Pereira's (2013) findings from other developmental aspects. Both studies established that differences in working memory ability among

school children with problems in reading comprehension and learning difficulties remain even when the children in question have variations in verbal IQ. The findings indicate that working memory performance is not just a representation of verbal ability. Similarly, all three articles reviewed are in agreement that phonological short-term memory and working memory have dissociable connections with learning disabilities. The findings reveal that variations in scores in working memory are not facilitated just by the contribution of phonological abilities or the performance of complex memory tasks.

Luo et al.'s (2013) finding that there are considerable effects of working memory training on working memory tasks, with regards to the verbal, spatial, and executive domains, echo those by Cardoso, Silva, & Pereira (2013), who reported training effects on verbal working memory. The studies contend that recalling words or digits in an inverse presentation order is often considered to involve both the central executive and the phonological loop because the sequence uttered by the person experimenting has to be stored and reversed if the correct answer is to be produced. The impact of these findings is that recalling words or digits in an inverse manner of presentation uses relatively more processing working memory resources compared to recall of forward presentation. In light of this, they are often easier to assess. The study findings further reveal that comprehensive training of the working memory is more effective for word span and digit span backward tasks.

Suggestions For Future Research

While there is some evidence and studies that have established that working memory skills can more generally be dissociated from verbal ability, no study has investigated whether these two factors can be distinguished in the contemporary extensive set of children who have learning difficulties. Future research should hence delve into exploring this existing gap in the literature. The study will add to our understanding of whether working memory performance is just a proxy for children's general ability or not. Such an understanding will enable us to comprehend the potential connection between working memory and literacy and mathematical abilities.

References

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