Bridging the Gap in Decoding Instruction: From Research to Explicit Teacher Training

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Abstract: This article examines how the science of reading research is being applied to elementary teacher preparation programs in a Canadian province. Background information is explored regarding the research on the underlying failure of teacher preparation programs in embedding comprehensive decoding instruction in their course work. Three overarching themes from the research are described: 1) understanding language constructs is imperative; 2) effective preparation must involve robust coaching and mentoring; and 3) the Peter Effect impacting university instructors is a major barrier. By understanding and acknowledging the gap between the science of reading research and university programming, steps towards change can be made to improve teacher training and thereby improve student achievement.

Keywords: Teacher Preparation Programs, Preservice Teachers, Decoding Instruction, Science of Reading

Introduction

Reading development is the most studied aspect of human cognition (Moats, 2020). Although the act of reading projects the illusion of it being a simple and straightforward process, especially to those who read proficiently, it is an incredibly complex and remarkable feat. Unlike speaking, reading is not hard-wired into the brain for natural development (Seidenberg, 2017). Reading requires new neural pathways to develop so that a person can extract meaning from code, understand it and relate to it (incorporating background knowledge, inferencing, visualizing, and aspects of language comprehension) plus manage that information (executive functioning) all within seconds simultaneously (Castles et al., 2018). Consensus has been reached on how children learn to read, what causes reading challenges, and effective instructional methods to mitigate reading difficulties, such as those associated with dyslexia (Moats, 2020; Seidenberg, 2017). The specific term therein is the science of reading (SOR), and it has been defined by The Reading League (2022), as "a vast, interdisciplinary body of *scientifically-based* research about reading and issues related to reading and writing" (p.6) which is derived from decades of research across thousands of peer-reviewed experimental and quasi-experimental studies in multiple languages. Yet, countless educators are unfamiliar with the SOR's indisputable research base (Castles et al., 2018). Instead, they use many outdated meaning-based instructional approaches, such as: (a) whole-word, (b) whole-language/three-cueing systems, and (c) balanced literacy.

The overarching focus of this research was on the university's role in preparing elementary teachers to teach decoding specifically and examining whether the SOR research is incorporated into programming. A basic literature review was conducted to examine the wide body of research regarding decoding instruction in elementary teacher preparation programs, which is the basis of this article. The keywords *science of reading, elementary teacher preparation programs,* and *word decoding instruction* were searched on a scholarly database. Twenty-three peer-reviewed articles published between 2012 and 2022 were analyzed based on their examination of elementary teacher preparation programs specific to decoding instruction. In addition, key government reports such as the 2001 Report of the National Reading Panel (n.d.) from the United States and the more recent, and Canadian, Ontario Human Rights Commission Right to Read Inquiry (2022) was also examined regarding their recommendations for teacher preparation.

Three pressing themes emerge from the literature about TPPs: understanding language constructs is imperative; having expert mentors guide learning through field experiences is indispensable; and teacher educators must possess this knowledge to teach it, known as the Peter Effect (Binks Cantrell et al., 2012). Unfortunately, the findings show that elementary teacher preparation programs continue to ineffectively prepare prospective teachers to provide robust decoding instruction aligned with the SOR which continues to have an impact on student achievement.

The Context: A Brief Summary of Reading Instruction History

Codebreaking versus meaning-making approaches to reading instruction was once "the great debate," as Chall described it in 1967 (Hikida et al., 2019), and led to the era of the "Reading Wars." In essence, educators debated whether children learn to read based on breaking the code of letters and sounds and thus focusing on phonics in reading

instruction, or whether children learned to read based on making meaning of the text and hence focusing on literature-rich environments and guessing words based on context. As depicted in Table 1, this involved three traditional approaches to reading instruction contending for application in education; whole word, whole language, and phonics (Kilpatrick, 2015), which later was diffused into balanced literacy to placate all sides (Seidenberg, 2017). Regardless of these traditional approaches, they all relied on observational data and research from teacher practitioners and educational gurus like Kenneth Goodman, a university professor in the United States, and Marie Clay, an educator in New Zealand, rather than a broader scope of multidisciplinary empirical research involving psychology, linguistics, and neuroscience (Seidenberg, 2017; Stewart, n.d.).

Table 1.1

Traditional Approaches to Reading Instruction

Approach	Assumptions about how reading works	What makes it problematic in learning to read based on SOR
Whole Word	When learning to read, readers need to memorize each individual word as a whole unit. They can ask for help when they get stuck on a word or guess based on the shape and look of the word.	Reading words is not based on our visual memory, though it might seem that way to proficient readers who have developed automaticity. Expecting children to memorize each word as a whole unit is not how neuroscience has proven reading works in the brain. Our brain processes each letter through our speech and "speech associations that occur during reading are too rapid and automatic to be perceived" (Moats, 2020, p.10). This automaticity is developed over time and is faster than naming objects. For example, we can read the word *chair* faster than we can name a chair that we see, but we do it by processing each letter sound correspondence from left to right. Therefore, it is imperative that readers attune to each letter and not the general shape.
Whole Language	Learning to read will occur naturally by immersing students in literature-rich environments. Readers use the three-cueing system to make sense of text: first, semantics and context based on meaning (*what might make sense?*); second, syntax and sentence structures (*does it sound right?*); and last, visual (*does it look right?*). This is often embedded in reading assessment analyses as MSV (meaning, structure, visuals).	When solving unknown words, students are encouraged first to guess what would make sense based on context, pictures, and common sense. This leads to ineffective strategies that cause students to rely on comprehension as a compensation strategy which is what neuroscience research shows poor readers do to the detriment of building reliable brain networks connecting speech to print. (Wise Channel, 2013). Simply put, neuroimaging has shown that strong readers use the language pathways in the brain to link sounds to letters when learning to read (Seidenberg, 2017). As texts become more complicated and pictures are reduced, students have not built enough skills with letter and sound correspondences to progress efficiently.
Phonics	Readers use letters to sound words out. For phonetically irregular words, they must be memorized or guessed based on context.	Word recognition is not explicitly taught through a systematic approach to phonics instruction that examines patterns in both regular and irregular words. Phonics is a prominent component of SOR research,

	Words are stored in the visual memory.	but the teaching of it must be approached in a comprehensive. The SOR research indicates that a structured approach following a developmental scope and sequence that is explicitly taught is the most effective way to teach children how to read.
Balanced Literacy	Readers must be immersed in a literacy-rich environment that includes meaningful texts for enjoyment, leveled texts for progression, and instruction through guided reading groupings based on student needs.	Providing a rich reading environment is important to reading development. However, what is often lacking in a balanced literacy approach is a deep knowledge of reading progression based on SOR. Guided reading instruction is often haphazard in the way phonics is approached and assessment is cumbersome and does not lead to explicit next steps that educators and students understand in terms of developmental progression.

Sources: Data Adapted from Kilpatrick, 2015, Seidenberg, 2017, Moats, 2020.

The pervasiveness of meaning-making approaches to reading instruction is still remnant in schools (Hanford, 2022-present; Moats, 2014) even though it does not sufficiently heed the neuroscience research involved in reading development. School districts purchase commercialized materials unaware that "many of the most widely used classroom teaching manuals and materials in language arts omit systematic teaching about speech sounds, the spelling system, or how to read words by sounding them out" (Moats, 2020). Teachers then turn to these resources because they are available on-site, recommended by others, and most importantly, have never learned about reading development based on the SOR research that was also being conducted during this period.

While the reading wars within educational contexts ensued, much multidisciplinary research was devoted to examining the reading processes and providing a structured approach to reading instruction (Hindman et al., 2020; Seidenberg, 2020, Stewart, n.d.). Therefore, the battle over determining how children learn to read is over because "cognitive science has determined the nature and development of the neurological, cognitive, learning, and behavioral processes involved in reading" (Hurford et al., 2016, p.899). Despite this extensive SOR research that has falsified earlier meaning-making assumptions about reading instruction (Seidenberg, 2020), the pivotal role language constructs play in learning to read continues to be ignored in educational contexts, specifically phonological awareness, the alphabetic principle, and morphologic awareness (Clark et al., 2017; Hikida et al., 2019, Hudson et al., 2021; Hurdford et al., 2016; Leland, 2013).

Notably, however; significant government initiatives have investigated the research and produced recommendations in reports for their nations. Studies from the United States (The National Reading Panel, 2001), England (The Rose Report, 2006), Australia (National Inquiry into the Teaching of Literacy, 2005), and Canada (National Strategy for Early Literacy (NSEL) 2009) report similar findings regarding TPPs and reading instruction (Washburn et al., 2016). The most common of these is known as the five pillars of reading instruction: phonemic awareness, phonics, vocabulary, fluency, and comprehension from the United States (Report of the National Reading Panel: Teaching Children to Read, n.d.). Most recently in Canada, the Ontario Human Rights Commission (2022) produced an executive summary reiterating that learning to read is a fundamental human right and provided key recommendations to educators to align instruction and assessment practice with the SOR research. To those on the periphery of education, it may come as quite a surprise that the importance of learning to read warrants this kind of emphatic attention in Canada today. But to those familiar with the decades of reading research that has yet to permeate standard instruction in most elementary schools, this call to action is yet another reminder that change has yet to occur within the education system itself. One foundational place to shift this ongoing history of outdated practices is with teacher preparation programs (TPPs) in universities.

Teacher Training in Decoding Instruction

While the SOR research has grown, educators' training has changed very little. The positionality of the university is not just as the keepers of knowledge and the place to be educated, but also as the seekers of knowledge through the ongoing research universities provide that is current, relevant, and transformative. When pre-service teachers (PSTs) apply for any university, they should be assured of this. As Moats (2020) explains, "professional preparation programs have a responsibility to teach a defined body of knowledge, skills, and abilities that are based on the best research in the field. This is no less important in reading than it is in medicine or law" (p.12). Yet when it comes to TPPs, half of the universities are failing to do so. Drake and Walsh (2020) reviewed TPPs in the United States with a team of experts through the National Council on Teacher Quality (NCTQ). The study, a follow-up to the initial one done in 2013, focused on the content in course syllabi and textbooks regarding the National Reading Panel's (n.d.) five pillars of reading instruction and concluded that despite the improvement, 49% of TPPs continue to lack emphasis on these critical areas, especially phonemic awareness. As a result, "teachers do not use the identified, effective practices in one or more of these five areas with enough frequency or quality, leading to students' persistent reading difficulty" (Hindman et al., 2020, p.5198). The importance of shifting this is, therefore, dire.

A number of studies on TPPs and effective reading instruction have similar findings: PSTs are not receiving coursework to adequately prepare them with the foundational knowledge and skills to provide evidence-based decoding instruction in line with the SOR (Binks-Cantrell et al., 2012; Castles et al., 2018; Clark et al., 2017; Cochran-Smith et al., 2015; Hikida et al., 2019; Hindman et al., 2020; Hudson et al., 2021; Hurford et al., 2016; Leland, 2013; Moats, 2014; Moats, 2020; Purvis et al., 2016; Sayeski et al., 2016; Seidenberg, 2017; Washburn et al., 2016). As Hurford et al. (2016) assert, "colleges of education are providing content regarding reading acquisition that is far from the consensus that emerged from the National Reading Panel and encouraging a considerable variety of positions regarding teaching reading, all of which bears little resemblance to what is known about the science of reading" (p.892) and reported that 78% of elementary education programs scored 0 out of 4 in terms of coursework adequately addressing supporting struggling readers. In addition, some of the coursework PSTs are receiving is contrary to the SOR research (Moats, 2020; Ontario Human Rights Commission, 2022).

This trend of TPPs ineffectively preparing PSTs continues because teachers cannot teach what they do not know. That applies not only to those teaching in the K-12 system, but to those teaching at universities as well and is referred to in that context as the *Peter Effect* (Binks-Cantrell et al., 2012). In universities that prepare teachers, what PSTs learn is entwined with the professor's depth of knowledge and all too often it is not inclusive of the SOR (Binks-Cantrell et al., 2012; Hurford et al., 2016; Moats, 2020; Purvis et al., 2016). According to Purvis et al. (2016), "the metalinguistic knowledge of teacher educators has been highlighted as a barrier to the provision of adequate instruction for pre-service teachers in language structure (Joshi, Binks, Hougen, Dahlgren, Ocker-Dean, & Smith, 2009; Moats, 2014)" (p.56). Relatedly, in the Hurford et al. (2016) study using phonological processing tasks, PSTs, in-service teachers, and university instructors all performed poorly on measures regarding their understanding of reading acquisition and language constructs. Binks-Cantrell et al. (2012) also examined teacher educators' knowledge of language constructs and found that significant improvements were needed to properly prepare PSTs. As Hurford et al. (2016) put it, "those who teach reading courses must be knowledgeable of the science of reading and must be held responsible for presenting information to pre-service teachers. It is the most efficient and effective way to ensure that our nation's students, particularly students at risk for reading failure, learn to read" (p.900).

The Peter Effect is a significant barrier in effectively preparing PSTs to provide decoding instruction which impacts all students. It is especially critical considering that reading instruction based on the SOR has the potential to boost student achievement in reading exponentially, especially for those who are in jeopardy of reading problems (Young, 2021). When teachers are properly trained, they are more likely to offer universal instruction that benefits all, beginning with language constructs.

Understanding Language Constructs

One of the best predictors of reading success is knowledge of sound-symbol correspondences (Sayeski et al., 2016). This is an early reading skill that is necessary to enhance future success, beginning in kindergarten. In fact, all children benefit from explicit and systematic instruction when learning to read (Washburn et al., 2016)

and foundational decoding skills are essential for elementary children as well as older struggling readers to optimize reading interventions (Hudson et al., 2021; Hurford et al., 2016; Moats, 2020; Sayeski et al., 2016). When students do not receive such instruction, their reading problems do not diminish with time, they increase (Clark et al., 2017; Washburn et al., 2016). Thus, teachers must be knowledgeable and skilled to explicitly teach decoding.

To be an effective reading instructor, one must know how reading acquisition occurs which is based on how the language systems work (Castles et al, 2018). Again, this is not intuitive because one knows how to read. Castles et al. (2018) illustrate it this way: watching a proficient concert pianist perform and determining that teaching a child to play the piano with that level of skill would simply require them to be immersed in rich piano music would be foolish. Yet, that ideology (whole language) still pervades the education system when it comes to learning to decode. Just like learning to play the piano proficiently requires the development of skills by practicing them in a logical sequential way, it is the same with decoding. Thus, one must understand how to break the skill into its component parts to be able to teach it effectively.

Teaching students decoding involves understanding the alphabetic writing system in depth so that students can be instructed in the multiple facets of phonemic awareness, decoding phonetically, and incorporating time for systematic, incremental practice (Hurford et al., 2016; Moats, 2014). This explicit, systematic, and strategic approach to decoding instruction is referred to as **structured literacy**. The better a teacher understands the dynamics of the alphabetic writing system, the more likely they are to use them (Washburn et al., 2016).

Decades of study into the knowledge and skills of pre-service and in-service teachers continue to show that they lack the depth of understanding of language structures that would lead to their ability to provide this explicit instruction (Hudson et al., 2021; Purvis et al., 2016; Washburn et al., 2016). When educators have accurate phoneme production and understand the sound-symbol connections, it supports them in identifying student errors so that they can provide corrections by modeling how to blend and segment properly for students (Sayeski et al., 2016). Furthermore, "without such knowledge, teachers are not able to respond insightfully to student errors, choose examples for concepts, explain and contrast words and their parts, or judge what focus is needed in a lesson" (Moats, 2020, p.17). This leads to teachers being more likely to promote ineffective meaning-making strategies such as guessing, bypassing, or diminishing the importance of accuracy (Moats, 2014), all of which are not supported by the SOR.

Hudson et al. (2021) conducted a systematic literature review examining the content knowledge of foundational literacy skills (phonological awareness, phonics, morphological awareness) that K-5 teachers gain through teacher preparation programs. They found that teacher training and scaffolded support contribute to deepening the understanding of foundational reading skills for teachers and results in improved student outcomes. Hikida et al., (2019), examined intervention studies aimed at increasing knowledge of PSTs and found clear growth in teacher understandings of sound and word-level reading processes (i.e., phonics, morphemes, orthographic knowledge). In the Purvis et al. (2016) study, 121 PSTs took a pre/post-test on basic language structures to determine if having direct instruction in this area can be beneficial to educator understanding. The effect size of the intervention was 2.01 indicating that teachers can learn the concepts in a relatively short amount of time.

Once teachers have this conceptual understanding of the language structure's role in decoding, the next step is to apply the knowledge (Binks-Cantrell et al., 2012). This leads to the next key theme in the literature regarding TPPs – opportunities to practice and facilitate responsive instruction.

Mentoring and Field Experience

A mentor who has expertise in the SOR and structured literacy instruction is critical for providing coaching to facilitate educator growth and shrink the "research-to-practice gap" (Hudson et al., 2021, p.S311). Cochran-Smith et al. (2015) critique existing TPPs, noting that "for many preservice teachers, the transition from coursework to fieldwork is disheartening, as our review suggests, and the transition from student teaching to first-year teaching is equally

problematic" (p.113). To teach using the SOR, more in-depth training, and feedback loops are needed – more than typical teacher training modes provide (Hindman et al., 2020). It is one thing to be aware of what to teach, *how* to teach decoding is quite another. PSTs need opportunities to practice pacing, structuring differentiated group learning opportunities, and making instructional decisions in the moment with the guidance of an expert to become proficient (Ehri & Flugman, 2018; Moats, 2014; Pomerantz & Condie, 2017).

Embedded training is the solution because it allows for deliberate practice within actual classrooms which Hindman et al. (2020) define as the *Science of Learning*. This should not be confused with generic practicum field experiences that rely on in-service teachers' cooperation and faith that they are well-suited to be a mentor because in-service teachers may not have the expertise needed (Ehri & Flugman, 2018). Nor should adding more practicum experiences be the go-to as they "may not serve the goal of preparing powerful teachers who can step beyond the status quo" (Hoffman et al., 2019, p.246).

Hudson et al. (2021) found that modeling, lesson consultation, feedback, and coaching from an expert contribute to transferring coursework to classroom practice. The research of Hindman et al. (2020), recommends educators be trained on small portions of reading instruction and observed and coached in an "iterative and spiraling manner" (p.5202). The International Literacy Association and National Council of Teachers of English report in its research advisory (2017) that it is essential that field experiences are full of opportunities for pre-service teachers to have explicit guidance and mentoring over prolonged experiences within different settings and with different demands (ex. 1-1 instruction, small group, whole group, and in different demographics) because teaching children to read and to decode is challenging. Hikida et al. (2019), wrote that "what the tutoring context provided was a way for preservice teachers to appreciate how the teaching of reading processes is often more complex than they had expected" (p.188). To move from inert to enacted knowledge – skill in action when interacting with students –authentic application through embedded field experiences with mentoring is required (Pomerantz & Condie, 2017).

Conclusion: Research Reflects Reality

The literature regarding improving TPPs to better support elementary PSTs with decoding instruction has been abundantly clear for decades alongside government reports emphasizing this need. The lack of educator training in evidence-based reading development combined with outdated materials and resources in schools (Moats, 2014) produces a continuation of ineffective teaching practices (Seidenberg et al., 2020). The SOR research must be embedded into coursework so that PSTs thoroughly learn about language constructs and have significant opportunities to practice and receive feedback from mentors. This requires university instructors to be knowledgeable and design courses that encompasses thorough and iterative opportunities for PST to gain foundational knowledge of reading development before they are responsible for students at the outset of their career.

The cycle of underprepared new teacher graduates evolving into well-meaning, yet uninformed reading instructors is alarmingly problematic in early education. Considering the role reading instruction plays in future academic success combined with the SOR research base that has been available for decades, it is beyond time to break this cycle.

It is necessary to provide elementary PSTs with TPPs that prepare them to start their teaching careers confidently and with effective and evidence-based skills for *how* to teach their students. Because when a grade one teacher is fully qualified to teach their six-year-old learners about phonemes, graphemes, and morphemes through engaging, multimodal lessons within an enriched literature environment full of books, letter tiles, songs, visuals, hand gestures, nursery rhymes, play, and routine, the world of possibilities for those young readers is full of budding potential.

Limitations

The articles encompassed in this literature review were selected because of their robust analysis of TPP regarding the application of SOR. However, they are based on studies of American universities. Although the cognitive process of reading development is the same between Americans and Canadians because of the alphabetic system, TPPs are not necessarily equivalent. Therefore, future research is warranted within the Canadian context of TPPs

and how they apply the SOR within their coursework. The Ontario Human Rights Commission Right to Read Executive Study (2022) is likely the beginning of Canada's closer look at its TPPs.

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