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Advancing the Science of Teaching Reading: Introduction to the Special Issue

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Abstract

In this introduction to the special issue, "Advancing the Science of Teaching Reading," we explore how the four articles featured in this special issue address important themes, such as teaching practices as essential factors for student literacy development, identifying active ingredients, and effective approaches to integrating active ingredients. We recognize that the four studies are just examples, and future research is needed to explore different areas and approaches, addressing teacher instruction, teacher development, and approaches that creates the conditions under which children can develop the literacy skills. We also reflect on the relation of the Science of Teaching Reading to the Science of Reading, and propose two directions in which the Science of Teaching Reading should be expanded: including writing on an equal footing with reading (the Science of Writing, the Science of Teaching Writing, and the Science of Teaching Reading and Writing), and acknowledging that approaches to teaching reading and writing must respond to the full diversity of learners, teachers, and contexts. In conclusion, we suggest future directions to advance the field.

Key words: Science of Reading, Science of Teaching Reading, Writing, Diversity

The Science of Teaching Reading

The Science of Reading (SOR) encompasses a large body of research findings about the skills and developmental accomplishments that portend successful reading outcomes. In other words, the SOR is focused on the *learner*—what skills and capacities children learning to read need to grasp (e.g., the alphabetic principle), master (e.g., automaticity in mapping phonemes to graphemes), or continue to develop (e.g., vocabulary knowledge) if they are to become competent readers. While this body of work has been of enormous value to those interested in understanding reading development, it does not give direct guidance to teachers seeking to help children acquire those skills and develop those capacities. Unfortunately, though, the SOR findings have often been interpreted as dictating a particular approach to creating the conditions under which children can develop the literacy skills that the SOR highlights as necessary. That is, in our view, an unjustified interpretation. For example, the finding that phonemic awareness is a robust predictor of success for young literacy learners does not compel the conclusion that phonemic awareness needs to be directly taught for 20 min a day for all students for an *entire* school year. Participation in phoneme deletion and blending exercises is one way to acquire phonological awareness, but so is engaging in writing, especially if invented spelling is encouraged. Phoneme-grapheme mapping skills can be taught equally successfully with an analytic or a synthetic phonics program (National Institute of Child Health and Human Development, 2000), and some children acquire them by starting with syllabic reading or by self-teaching from memorized texts. Another example is knowledge of letter names, which has a strong evidence base for its role in word reading and spelling (e.g., Foulin, 2005). However, this research does not provide guidance for teachers on how to effectively teach alphabet letters in the classroom—specifically, how much time to spend on each letter for which students, and in what

order or sequence. Other examples of unjustified interpretations and misinterpretations are found in Shanahan (2020). Our claim here is not that the methods endorsed by the SOR proponents are necessarily wrong, but simply that they are also not necessarily right. SOR literature tells us about *what learners need to know*, not about how they should learn it.

In our effort to address the SOR in a way that can make a significant impact on both research and practice, we have previously argued that the Science of *Teaching* Reading deserves dedicated attention and its own research agenda (Kim & Snow, 2021; also see Shanahan, 2020 for a need for "a Science of Reading Instruction"). This research agenda should include questions related to classroom teaching practices (e.g., content, intensity, conditions, context), sources of classroom teaching practices, the learning and development of preservice and in-service teachers, and systemic factors such as policies (e.g., language of instruction, teacher education). Underlying these arguments is the recognition that students' literacy acquisition is influenced by multiple micro- and macro-environmental factors and that teaching is a key driver of literacy acquisition. In essence, deeper understandings from basic science, implementation science, and policies, and their interconnections are necessary to make meaningful progress in student literacy acquisition.

Articles in This Issue

To stimulate interest in and broaden our understanding of the Science of Teaching Reading, this special issue sought studies that investigate literacy instruction in classroom settings; it features four empirical papers. The studies by Capin et al. and Mosher and J. Kim focused on teachers' instructional practices in the classroom, aligning with the idea that teacher instruction is a key driver of student learning in the Science of Teaching Reading. Crosson et al.'s study focused on teaching active ingredients, specifically morphological analysis instruction, to support vocabulary and reading comprehension while Y.-S. G. Kim et al.'s study examined the

impact of combinations of active ingredients as part of integrated reading-writing instruction on language and literacy outcomes. Capin et al.'s work utilized a systematic review and meta-analysis of classroom observations, whereas the other three studies employed randomized controlled trial designs in real classroom settings at both primary and middle school levels with students from diverse linguistic, socio-economic, and cultural backgrounds (Crosson et al.; Y.-S. G. Kim et al.; Mosher & J. Kim).

Capin and colleagues conducted a systematic review of classroom observation studies of reading instruction, drawing data from 66 studies in K-12 schools that included 1,784 teachers. They discovered that 23% of instructional time was dedicated to reading comprehension, an increase from earlier reports, such as Durkin's study (1978-1979). They also found that teachers frequently engaged in initiation-response-evaluation conversation patterns, a prevalent practice in Durkin's study, and that studies conducted after 2000 reported more research-based reading comprehension practices. This study underscores that understanding classroom practices is fundamental to the Science of Teaching Reading, highlighting that the content of classroom teaching practices evolves over time while certain practices, such as initiation-response-evaluation conversation patterns, continue to be used consistently.

Mosher and J. Kim examined the role of teacher language scaffolds in supporting academic vocabulary learning and reading comprehension, using data from Grade 3 students. Their work is situated within the context of schema instruction, with teacher language support conceptualized as temporary dialogic support. They found that teachers varied in their use of language scaffolds, such as the number of times target vocabulary words were used, language extension strategies, and text-related questions. Higher levels of teacher language scaffolds led to improvements in students' recall of text information (Effect Size [ES] = .17), near-transfer

comprehension task (ES = .17), and mid-transfer comprehension task (ES = .18). This study contributes to our understanding of effective instructional approaches that promote learning, showing that providing more opportunities to hear and use words and think about text and content enhances learning and comprehension (Snow, 2014).

Crosson and colleagues investigated the effects of morphological analysis on vocabulary and morphology, as well as reading comprehension outcomes, working with middle school multilingual students who were English learners or former English learners. They focused on generative word learning through the morphological analysis of bound Latin roots, including cross-linguistic analysis. Their approach resulted in significant effects on proximal measures of root meaning knowledge (ES = 0.98), orthographic processing of target words (ES = 0.76), word meaning (ES = 0.57), and a near-transfer task—syntactic and semantic violation (ES = 0.42). It also showed moderate effects on a mid-transfer task involving morphological analysis of words containing taught bound morphemes but untaught words (ES = 0.32). However, there was no detectable effect on reading comprehension. This study highlights the importance of morphological awareness in vocabulary learning for L2 adolescent learners, extending the predominant focus on prefixes and suffixes to include roots for generative word learning.

Y.-S. G. Kim and colleagues reported on the impact of an integrated reading and writing instruction approach using SRSD Plus for students in Grades 1 and 2. Grounded in the connections between reading and writing and the interactive and dynamic literacy model (Kim, 2020, 2022), SRSD Plus includes explicit and systematic teaching of self-regulation and reading and writing strategies, oral language (vocabulary and sentence proficiency) and transcription skills (spelling and handwriting fluency) within the context of informative essay reading and writing. The study found that SRSD Plus improved students' writing quality (ES = .57),

productivity (text length; ES = .57), and planning (ES = .30) in informative essays and an untaught genre, opinion writing (ES = .34 in writing quality; ES = .22 in writing productivity). Positive effects were also observed in discourse knowledge (ES = .23), vocabulary (ES = .72), sentence proficiency (ES = .45), and spelling (ES = .14). However, there was no detectable effect on handwriting fluency or a distal measure of word reading fluency. This study emphasizes the importance of leveraging reading-writing connections to support students' literacy acquisition.

Further Questions for the Field

These studies collectively enhance our understanding of the Science of Teaching Reading by demonstrating some specific ways of creating the conditions under which children can develop literacy skills in real-world classroom settings. However, these represent just a few examples of areas and instructional approaches, and they raise important questions in the field. One such question concerns teachers' instructional practices in the classroom and the sources of teacher learning for various instructional methods. Specifically, the findings from the Capin and colleagues' classroom observation study prompt many questions about the nature of the initiation-response-evaluation (IRE) patterns that are widely observed. The purposes, uses, and outcomes of IRE can vary significantly: it can be used as a simple check on students' understanding without further probing, or it can be used to establish the shared understanding of a text that is prerequisite to comprehension-promoting discussion. The first approach may be appropriate for assessing literal comprehension and conducting quick reviews, provided meaningful feedback is given. The second approach, using IRE as a preparation for the deeper, open-ended questions that help students unpack the meaning of texts, is necessary for fostering higher-order inferential and evaluative comprehension, which requires synthesizing ideas from different parts of the text and/or background knowledge as well as critical, analytic reading. Given

the prevalence of IRE patterns in classrooms, future research that specifies a taxonomy of this instructional approach and specifies when it has positive impacts on student learning is needed. Another important example related to instructional approaches in the classroom is highlighted in the study by Mosher and J. Kim, which demonstrated variations in teacher language scaffolds that promoted student learning. The question of instructional practices and teacher development in pedagogical approaches is also relevant to the research conducted by Crosson and colleagues on morphological awareness and by Y.-S. Kim and colleagues on reading-writing connections. Although these latter studies did not specifically focus on teachers' instructional practices, understanding current instructional approaches in these areas *and* other areas is essential for advancing the field of the Science of Teaching Reading.

These studies raise also questions about teacher characteristics and their learning more broadly, including both preservice and in-service training, which may contribute to variations in teaching practices. Coupled with a growing body of literature demonstrating significant variation in teacher knowledge about literacy development and instruction (Hudson et al., 2021; Piasta et al., 2009), a critical question emerges: What are the links among teacher knowledge, instructional practices, and student literacy outcomes? This is the hypothesized theory of change (Cunningham et al., 2023; Desimone, 2009; Hamre et al., 2012), yet there is limited empirical evidence examining these connections. This line of inquiry also necessitates a deeper understanding of teachers' professional learning and development.

Another area of research as part of the Science of Teaching Reading is experimental studies that investigate the active ingredients for literacy acquisition as well as effective combinations of active ingredients that are feasible in classroom settings. The active ingredient question was examined in Crosson and colleagues' study. Specifically, one key active ingredient

in vocabulary learning is understanding morphological structure, as many words, especially in content areas, are composed of multiple morphemes. Some interpretations of the Science of Reading, particularly those popularized in the media, have primarily focused on grapheme-phoneme correspondences. However, research clearly demonstrates the critical role of semantic processes, such as morphology, in word reading, spelling, reading comprehension, and written composition (Kim, 2020; Kim & S. Graham, 2022; Snow et al., 1998; Taylor et al., 2015). The work by Crosson and colleagues provides valuable insights into developing an instructional approach that evaluates active ingredients for improving morphological awareness and vocabulary among adolescents.

The work of Y.-S. G. Kim and colleagues aligns with efforts to examine how to incorporate multiple component active ingredients to improve literacy outcomes. While identifying individual active ingredients is important, it is equally crucial to understand how to integrate multiple skills or active ingredients based on theory and prior evidence. The question of how to best incorporate multiple active ingredients are applicable to all aspects of literacy, including word reading and spelling (e.g., phonological, orthographic, and morphological components), reading comprehension, language or listening comprehension, and written composition. Integrating multiple active ingredients is also pertinent to the literature on reading-writing connections. Y.-S. G. Kim et al.'s study, along with a body of literature on reading-writing connections, underscores the need for both researchers and practitioners to seriously consider the relation between reading and writing to support students' literacy acquisition and overall learning. While theories of reading and writing provide a deep understanding of individual skills, a substantial body of work consistently demonstrates that reading and writing are mutually reinforcing communication acts (Langer & Applebee, 1987) that show a high degree

of relationship across development (Kim et al., 2024 for a meta-analysis) and to a large extent share foundational skills and knowledge (Kim, 2020, 2022; Fitzgerald & Shanahan, 2000). Therefore, instructional approaches that leverage the reading-writing connection merit further investigation (Kim & Zagata, 2024).

Overall, the work reported in this special issue highlights the need for continued research to advance our understanding of creating the conditions under which children can develop literacy skills in real-world classroom settings. Future studies should adopt a range of perspectives, methods, and contexts to broaden our understanding of the SOR and writing.

Expanding the Scope to the Science of Teaching Reading and Writing

Based on the growing body of literature, including those reported in this special issue, we believe the scope of SOR and the Science of Teaching Reading should be expanded in two ways. First, the discussion should recognize the need for inclusion of and greater attention to writing (S. Graham, 2020; Kim, 2020; Kim & Zagata, 2024). Writing is a crucial component of communication, on par with reading. While the body of research on writing, including both basic science and classroom teaching, is substantial, discussions of the SOR have primarily focused on reading. In instances where writing is mentioned, it is often discussed in relation to reading. This imbalance is also evident in classroom contexts (e.g., Coker et al., 2016; Puranik et al., 2014) and has been noted historically (e.g., writing is often referred to as the "forgotten R"). We argue that both research and practice should move beyond a narrow focus on the Science of Reading. Instead, they should more explicitly and actively embrace the Science of Writing and the SOR and Writing, all of which explicitly include the Science of *Teaching* Reading and Writing.

Second, at the core of the SOR discussion is the importance of serving *all* students from diverse linguistic, economic, racial/ethnic, cultural, and ability/disability backgrounds. There is a

substantial body of literature on each of these aspects, and they are directly relevant to the Science of Teaching Reading and Writing. We recognize that the work of the four papers in this special issue only begins to address the full range of diversity that needs to be represented in the field. Furthermore, explicit discussions on the SOR in publications and media have often been limited to specific aspects or groups, with variations depending on context (e.g., dyslexia legislation in some US states, synthetic phonics debates in the UK). We advocate for greater explicit attention to understanding factors related to diversity and equity within these discussions. This includes principled and systematic examinations of factors that influence the development and teaching of literacy skills across various contexts and conditions, such as linguistic, economic, racial/ethnic, cultural, and ability/disability backgrounds. For example, theoretical models of reading or writing should account for language-general and language-specific aspects, and across skills spectrums and individuals from diverse demographic backgrounds, geographic, and linguistic backgrounds as well as reading and writing in L1 and L2. For example, there has been increased attention to literacy instruction in low- and middle-income countries in the last decade (e.g., J. Graham & Kelly, 2019; Kim et al., 2020 meta-analysis); and work from this context should be more explicitly considered in the discussion. General discussion points and practices outlined in the equity standard in education research (National Center for Education Research, 2022) are pertinent to this discourse.

Conclusion

In conclusion, these studies represent a first step in presenting a more integrated and inclusive approach to the Science of Teaching Reading and Writing, but more work acknowledging the varied factors that affect literacy acquisition and instruction is needed. By addressing these complexities, we can work towards more effective and equitable literacy

education for all students. We hope this special issue establishes a foundation for future research that continues to push the field forward and broadens our understanding of literacy science.

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