

Report of the SUNY Science of Reading Technical Advisory Group

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Abstract

This report details the work of the State University of New York (SUNY) Science of Reading Technical Advisory Group (TAG) over the course of the 2023-2024 academic year. The report has four objectives: (1) to provide an analysis of the current reading science literature; (2) to identify what teacher candidates should know and be able to do as it relates to the teaching of reading to all students and aligned with the science of reading; (3) to conduct a landscape analysis to determine how current pedagogical practices across SUNY educator preparation programs relate to reading science principles; and (4) to identify translational research gaps, especially as related to teaching reading to diverse groups of students, for potential focus of study by faculty at SUNY campuses. To fulfill the first, second, and fourth objectives, the TAG reviewed systematic literature reviews, meta-analyses, and individual studies of reading instruction in six areas: (1) foundational skills (phonemic awareness, phonics, fluency), (2) oral language and vocabulary, (3) reading comprehension and motivation, (4) writing and reading, (5) response to intervention for reading, and (6) multilingual learners and reading. To fulfill the third objective, the TAG conducted a statewide survey of SUNY faculty to determine the alignment between the coursework and field experiences in educator preparation programs and the science of reading instruction. In this report, we present in-depth, nuanced summaries of evidence-based practices for teaching reading that are aligned with 70 recommendations for what teacher candidates should know and be able to do and 40 recommendations for future research. We also present a snapshot of the content of SUNY educator preparation programs, finding that a majority of programs report teaching students how to implement evidence-based practices aligned with the science of reading but that there are inconsistencies across programs. We conclude with recommendations for the improvement of educator preparation programs.

Introduction

The State University of New York (SUNY) convened the SUNY Science of Reading Technical Advisory Group (TAG) during the 2023-2024 academic year to produce a white paper on the science of reading and educator preparation. SUNY administration provided TAG with the following charge:

1. Provide an analysis of the current reading science literature.
2. Based on an analysis of the reading science literature, identify what teacher candidates should know and be able to do as it relates to the teaching of reading to all students and aligned with the science of reading.
3. Conduct a landscape analysis to determine how current pedagogical practices across SUNY educator preparation programs relate to reading science principles.
4. Identify translational research gaps, especially as related to teaching reading to diverse groups of students, for potential focus of study by faculty at SUNY campuses.

The SUNY Science of Reading TAG included faculty representing a range of expertise and institutions from across the SUNY system. The TAG co-chairs were Dr. John Strong, Assistant Professor at University at Buffalo, and Dr. Virginia Goatley, Dean of the School of Education and Professor at University at Albany. Members included (in alphabetical order): Dr. Erica Barnes, Associate Professor at University at Albany; Dr. Nicole Fenty, Associate Professor at Binghamton University; Dr. Keli Garas-York, Professor at Buffalo State University; Dr. Kathleen Lord, Associate Professor at SUNY New Paltz; Dr. Doreen Mazzye, Assistant Professor at SUNY Oswego; Dr. Mary McVee, Professor at University at Buffalo; Dr. Elizabeth Yanoff, Department Chair of Education and Social Sciences at Hudson Valley Community College; Dr. Bogum Yoon, Professor at Binghamton University; and Dr. Thea Yurkewecz-

Stellato, Associate Professor at SUNY Geneseo. Dr. Angela Pagano, Senior Assistant Provost for Educator Preparation and Partnerships at SUNY System Administration, served as a staff member.

In this report, we (the members of the SUNY Science of Reading TAG) describe our work to fulfill to this charge from August 2023 through May 2024. The full group met monthly during this time, via Zoom, with smaller groups meeting to complete assignments and writing more frequently. This report begins with an analysis of the reading science literature and follows with a listing of what teacher candidates should know and be able to do as it relates to the teaching of reading. Next, for the landscape analysis, we describe a statewide survey conducted to determine the extent to which SUNY educator preparation programs relate to reading science principles and summarize data from the state-wide multi-subjects teacher certification exam. Finally, we conclude with directions for future research in the science of reading.

First, however, we provide an operational definition of the science of reading. Professional organizations in the field of reading and literacy education that publish influential research and practitioner journals have similarly sought to define this oft-misunderstood term. The International Literacy Association, in an executive summary of a special issue of *Reading Research Quarterly*, defined the science of reading as “a corpus of objective investigation and accumulation of reliable evidence about how humans learn to read and how reading should be taught” (Goodwin & Jiménez, 2020, p. 3). The Reading League (2022), which is based in New York State, proposed a common definition of the term:

The science of reading is a vast, interdisciplinary body of *scientifically-based* research about reading and issues related to reading and writing. This research has been conducted over the last five decades across the world, and it is derived from thousands of studies

conducted in multiple languages. The science of reading has culminated in a preponderance of evidence to inform how proficient reading and writing develop; why some have difficulty; and how we can most effectively assess and teach and, therefore, improve student outcomes through prevention of and intervention for reading difficulties (p. 6).

The New York State Literacy Initiative (2024) published a series of seven Literacy Briefs to support educators in the implementation of science of reading. In Brief 1, the authors note,

The Science of Reading refers to a body of research—50+ years of interdisciplinary research that documents and describes how children develop reading and writing skills and competencies. This research also features the principles and practices for research-based instructional design and opportunities to learn. The Science of Reading is not a single approach or entity—the term refers to a large, diverse body of evidence that should be used to inform curriculum and pedagogy (Lesaux & Carr, 2024, p. 1).

Common among these definitions is that a scientific body of research exists upon which the teaching of reading should be based.

In the special issue of *Reading Research Quarterly*, Shanahan (2020) argued that pedagogical decisions should be made based on the science of reading *instruction*, or the body of research comprised of instructional experiments demonstrating the effectiveness of particular instructional approaches. The SUNY Science of Reading Technical Advisory Group focused on summarizing this “science of reading instruction” (Shanahan, 2020, p. S236) to determine what teacher candidates should know and be able to do when teaching reading. This body of research includes not only individual high-quality experimental and quasi-experimental studies but also meta-analyses, qualitative syntheses, and systematic literature reviews.

The United States Department of Education, through the Institute of Education Sciences and the What Works Clearinghouse, provides a clear definition and recommendations for implementing evidence-based instructional practices. The Every Student Succeeds Act delineates four tiers of evidence for instructional practices and interventions: (1) Tier 1, or strong evidence, includes at least one well-designed and implemented experimental study with randomization to treatment and control groups; (2) Tier 2, or moderate evidence, includes at least one well-designed and implemented quasi-experimental study such as a matched group comparison or interrupted time series; (3) Tier 3, or promising evidence, includes at least one well-designed and implemented correlational study with statistical controls for selection bias; and (4) Tier 4, or demonstrates a rationale, includes a well-defined logic model based on rigorous research. The What Works Clearinghouse has published eight practice guides with recommendations for literacy instruction based on studies aligned with these tiers of evidence (see Table 1).

Table 1

<i>Recommendations and Tiers of Evidence from What Works Clearinghouse Practice Guides</i>		
Practice Guide	Recommendations	Evidence
<i>Improving Adolescent Literacy: Effective Classroom and Intervention Practices</i> (Kamil et al., 2008)	1. Provide explicit vocabulary instruction.	Tier 3: Promising
	2. Provide direct and explicit comprehension strategy instruction.	Tier 3: Promising
	3. Provide opportunities for extended discussion of text meaning and interpretation.	Tier 3: Promising
	4. Increase student motivation and engagement in literacy learning.	Tier 3: Promising
	5. Make available intensive and individualized interventions for struggling readers that can be provided by trained specialists.	Tier 3: Promising

<p><i>Assisting Students Struggling with Reading: Response to Intervention (RtI) and Multi-Tier Intervention in the Primary Grades</i> (Gersten et al., 2009)</p>	1. Screen all students for potential reading problems at the beginning of the year and again in the middle of the year.	Tier 3: Promising
	2. Provide time for differentiated reading instruction for all students based on assessments of students' current reading level.	Tier 4: Has Rationale
	3. Provide intensive, systematic instruction on up to three foundational reading skills in small groups to students who score below the benchmark score on universal screening.	Tier 3: Promising
	4. Monitor the progress of tier 2 students at least once a month.	Tier 4: Has Rationale
	5. Provide intensive instruction on a daily basis that promotes the development of the various components of reading proficiency to students who show minimal progress after reasonable time in tier 2 small group instruction (tier 3).	Tier 4: Has Rationale
<p><i>Improving Reading Comprehension in Kindergarten Through 3rd Grade</i> (Shanahan et al., 2010)</p>	1. Teach students how to use reading comprehension strategies.	Tier 3: Promising
	2. Teach students to identify and use the text's organizational structure to comprehend, learn, and remember content.	Tier 3: Promising
	3. Guide students through focused, high-quality discussion on the meaning of text.	Tier 4: Has Rationale
	4. Select texts purposefully to support comprehension development.	Tier 4: Has Rationale
	5. Establish an engaging and motivating context in which to teach reading comprehension.	Tier 3: Promising
<p><i>Teaching Elementary School Students to Be Effective Writers</i> (Graham et al., 2012)</p>	1. Provide daily time for students to write.	Tier 4: Has Rationale

	2. Teach students to use the writing process for a variety of purposes.	Tier 1: Strong
	3. Teach students to become fluent with handwriting, spelling, sentence construction, typing, and word processing.	Tier 2: Moderate
	4. Create an engaged community of writers.	Tier 4: Has Rationale
<i>Teaching Academic Content and Literacy to English Learners in Elementary and Middle School</i> (Baker et al., 2014)	1. Teach a set of academic vocabulary words intensively across several days using a variety of instructional activities.	Tier 1: Strong
	2. Integrate oral and written English language instruction into content-area teaching.	Tier 1: Strong
	3. Provide regular, structured opportunities to develop written language skills.	Tier 4: Has Rationale
	4. Provide small-group instructional intervention to students struggling in areas of literacy and English language development.	Tier 2: Moderate
<i>Foundational Skills to Support Reading for Understanding in Kindergarten Through 3rd Grade</i> (Foorman et al., 2016)	1. Teach students academic language skills, including the use of inferential and narrative language, and vocabulary knowledge.	Tier 4: Has Rationale
	2. Develop awareness of the segments of sounds in speech and how they link to letters.	Tier 1: Strong
	3. Teach students to decode words, analyze word parts, and write and recognize words.	Tier 1: Strong
	4. Ensure that each student reads connected text every day to support reading accuracy, fluency, and comprehension.	Tier 2: Moderate
<i>Teaching Secondary Students to Write Effectively</i> (Graham et al., 2016)	1. Explicitly teach appropriate writing strategies using a Model-Practice-Reflect instructional cycle.	Tier 1: Strong

	2. Integrate writing and reading to emphasize key writing features.	Tier 2: Moderate
	3. Use assessments of student writing to inform instruction and feedback.	Tier 4: Has Rationale
<i>Providing Reading Interventions for Students in Grades 4-9</i> (Vaughn et al., 2022)	1. Build students' decoding skills so they can read complex multisyllabic words.	Tier 1: Strong
	2. Provide purposeful fluency-building activities to help students read effortlessly.	Tier 1: Strong
	3. Routinely use a set of comprehension-building practices to help students make sense of the text.	Tier 1: Strong
	4. Provide students with opportunities to practice making sense of stretch text (i.e., challenging text) that will expose them to complex ideas and information.	Tier 4: Has Rationale

As shown in Table 1, the What Works Clearinghouse practice guides offer many recommendations for what teachers should know and be able to do as it relates to the teaching of reading, writing, and literacy in elementary and secondary grades. These practice guides address the following areas:

- instructional practices for adolescent literacy (grades 4-12),
- Response to Intervention (RTI) in primary grades (K-3),
- reading comprehension in primary grades (K-3),
- elementary writing (grades K-5),
- English learners in elementary and middle school (grades K-8),
- foundational skills in primary grades (K-3),
- secondary writing (grades 6-12), and
- reading interventions in upper-elementary and middle grades (grades 4-9).

While not seeking to duplicate these efforts, the SUNY Science of Reading TAG organized into five subgroups, each tasked with reading, summarizing, and providing recommendations for what preservice teachers should know and be able to do in a particular area aligned with the practice guides. The five subgroups reviewed: (1) Foundational Skills (Phonemic Awareness, Phonics, and Fluency), (2) Vocabulary and Oral Language, (3) Reading Comprehension and Motivation, (4) Writing and Reading, (5) Response to Intervention for Reading, and (6) Multilingual Learners and Reading. These six areas are also aligned with the five essential components of effective reading instruction identified by the National Reading Panel (2000) – phonemic awareness, phonics, fluency, vocabulary, and comprehension, as well as oral language, a sixth component identified by the New York State Literacy Initiative (2024). We also address the science of writing instruction, consistent with arguments for the integration of writing with the science of reading (Graham, 2020; New York State Literacy Initiative, 2024). Finally, we address considerations for the teaching of special populations of learners, including students with reading difficulties (or disabilities) who receive additional interventions and/or special education services outside of the general education setting and multilingual learners.

In the sections that follow, we present an analysis of the research and recommendations for what teacher candidates should know and be able to do as it relates to the teaching of reading in each of these areas. We based the literature analysis primarily on meta-analyses, qualitative syntheses, systematic literature reviews, and individual high-quality experimental and quasi-experimental studies. Then, we describe a landscape analysis conducted to determine the extent to which SUNY educator preparation programs aligned with reading science principles consistent with our review of the research. Finally, we conclude with a summary of translational research gaps in each of these areas and directions for future research in the science of reading.

Analysis of the Current Reading Science Literature

Foundational Skills: Phonemic Awareness, Phonics, and Fluency

Foundational literacy skills including phonological awareness, phonics, and fluency are required for reading comprehension (Foorman et al., 2016). Theoretical models of reading, such as the Simple View of Reading (SVR; Hoover & Gough, 1990; Hoover & Tunmer, 2018), posit that reading comprehension is the product of two main underlying constructs: decoding (D) and language comprehension (LC) as depicted by the equation $D \times LC = RC$. To achieve proficiency in reading comprehension, a reader must be able to recognize the words in connected text through automatic recognition by sight or through decoding (Ehri, 2005; Share, 1995) while simultaneously constructing meaning from those words (Perfetti & Stafura, 2014). Accuracy and automaticity in word recognition are central components of reading fluency (along with prosody, or expression), which is necessary for reading comprehension to occur (LaBerge & Samuels, 1974). Theoretical models that expand upon SVR, such as Scarborough's (2001) rope model of reading and Duke and Cartwright's (2021) Active View of Reading highlight the multifaceted nature of these underlying constructs and the significant cognitive development required of readers. Decoding, or word recognition, as a construct is dependent upon at least three sets of foundational skills: phonological awareness, phonics, and fluency (Foorman et al., 2016).

Phonemic Awareness

Phonological awareness involves the ability to recognize and manipulate the sounds of spoken language, which is essential for understanding the relationship between letters and sounds (Rehfeld et al., 2022). A continuum of meta-linguistic skills is linked as a critical precursor to reading and includes broad phonological units at the sentence, word, syllable, and phoneme levels of language (Brown et al., 2021; Suggate, 2016). Research supports the

instructional focus on smaller phonemic skills (e.g. segmenting, blending, addition, deletion, and substitution) as a stronger predictor of long-term reading achievement (Ehri et al., 2001b; Rice et al., 2022; Savage et al., 2006). Phonemic awareness, specifically, is the ability to identify and manipulate individual speech sounds (phonemes) with automaticity. Recent meta-analyses confirm phonemic awareness instruction can be effective at varying ages but is strongest in kindergarten and first grade (Rehfeld et al., 2022) and at an optimal dosage of 16 hours of instruction (Erbeli et al., 2024). Further, instruction is effective when incorporating methods of segmenting, blending, and deleting individual sounds and is enhanced when graphemes are mapped to the phonemes, or when phonological awareness instruction is combined with phonics (Rehfeld et al., 2022; Stalega et al., 2024). Support for phonemic awareness as a strong predictor of individual differences in reading development is identified in a systematic meta-analytic review (Melby-Lervåg et al., 2012) where phonemic awareness was the strongest correlate of individual differences in word reading ability. This effect remained reliable after controlling for variations in both verbal short-term memory and rime awareness.

Phonics

Phonics instruction should apply systematic (progressing from simple to complex concepts) and explicit teaching (clear explanation with examples, practice, and teacher feedback) of phoneme-grapheme correspondences, according to the meta-analysis included in the National Reading Panel's (2000) report (Ehri et al., 2001a). Phonics instruction requires multiple opportunities to practice and cumulatively review phoneme-grapheme correspondences while reading phonetically aligned texts and spelling these same skills (Blachman et al., 2014; Savage et al., 2018). Phoneme-grapheme correspondences should be taught to the level of automaticity (Ehri et al., 2001a). Individual phonemes should be linked to graphemes during explicit

instruction on how to spell the various sounds in the language, and opportunities to practice applying the spellings and decoding of words promotes word storage in long-term memory for effortless and automatic recall (Ehri, 2020). As systematic instruction progresses, morphemes, or larger units of meaning, and syllable patterns should be taught to promote effortless word recognition (Blachman et al., 2014; Bowers et al., 2010; Ehri, 2014). Spelling should be taught explicitly and in conjunction with phonics skills, syllables, and morpheme units (Gersten et al. 2020; Wanzek et al., 2006). This method of instruction is highly effective for both native and nonnative speakers of English (Yeung & Savage, 2020).

Ehri's (2005) model of phases in the development of sight word reading highlights the centrality of a process known as *orthographic mapping* that leads to the automatic, or instantaneous, recognition of words by sight. During four overlapping phases of development, there is an improvement in lexical quality (Perfetti, 2007) and word-learning from the first phase, pre-alphabetic, to partial alphabetic, full alphabetic, and consolidated alphabetic phases (Ehri, 2005). Orthographic mapping is enabled by phonemic awareness and grapheme phoneme (letter-sound) knowledge (Ehri, 2014, 2020). According to Ehri (2014), "an important consequence of orthographic mapping is that the spellings of words enter memory and influence vocabulary learning, the processing of phonological constituents in words, and phonological memory" (p. 6).

Fluency

For novice readers, most of the skills related to decoding ability are in development and cannot be drawn upon readily to support reading comprehension. Novice readers must devote considerable cognitive energy to the various facets of reading (LaBerge & Samuels, 1974). Pikulski and Chard (2005) state, "If developing readers cannot instantly identify these words, they are unlikely to become fluent" (p. 117). Oral reading fluency (ORF) is in many ways

the application and behavioral outcome of the interaction of decoding ability and the bridge to reading comprehension (Berninger et al., 2006; Kuhn & Stahl, 2003). ORF is the ability to read a text aloud accurately, automatically, and with prosody (Puranik et al, 2008; Rasinski et al., 2009; Samuels, 1997). It has been posited that comprehension difficulties are a result of challenges in oral reading fluency (DiSalle & Rasinski, 2017). There is evidence that microprocessing of instruction at the word and phrase levels supports fluency development (Kuhn & Stahl, 2003). Further, integrated instruction aimed at both phonological decoding that leads to word recognition and reading comprehension skills significantly improved text reading fluency (Berninger et al., 2006). Berninger et al. (2006) conclude from their studies that there are steppingstones toward fluent reading based on accurate and automatic: alphabetic knowledge, phoneme-spelling correspondence, phonological decoding, word reading, oral reading of text.

Fluency instruction is successful in improving the reading achievement of children, though the greatest benefits are with students with some entering knowledge about words but who are not so fluent that they cannot demonstrate improvements (Kuhn & Stahl, 2003). Syntheses of fluency interventions of students with reading difficulties affirm the use of repeated reading of connected text with teacher modeling to build ORF and comprehension (Hudson et al, 2020; Therrien, 2004). However, recent studies have also shown no differences between repeated reading and non-repetitive reading fluency interventions to increase rate, word recognition, and comprehension, especially with adolescents (Wexler, et al., 2008; Zimmerman et al., 2021). Thus, repeated, wide, and independent reading are likely to improve fluency.

Vocabulary and Oral Language

Reading is grounded in language, as reading is the act of decoding printed symbols into oral language. At the heart of language are words (vocabulary), syntax (grammar), and discourse

features that allow for meaningful communication. Research across the grade bands reveals the development of these skills relates to stronger reading comprehension, particularly when students are learning and using meaningful words taught and repeated within rich contexts.

Pre-Kindergarten and Kindergarten

Children learn language through engagements with proficient speakers in which they hear models of complex language and are encouraged to use language to display understanding. Research supports the inclusion of rich and diverse vocabulary and syntactically-complex speech provided in conceptually rich instruction that builds knowledge (e.g., Hadley et al., 2023). Interventions providing vocabulary instruction demonstrate positive overall effects (Effect Size [ES]= .88; Marulis & Neuman, 2010), but less so for children who display risk factors such as coming from low-income homes or marginalized racial groups, English Language Learners (ELLs), and students with disabilities (Marulis & Neuman, 2013). Interventions that explicitly taught word meanings had higher gains than those promoting incidental exposure, while those that combined incidental exposure and explicit instruction were more effective than either explicit or incidental alone (Marulis & Neuman, 2013). A recent systematic review (Hadley et al., 2023) and meta-analysis (Hadley et al., 2022) reveal teachers vary their use of supportive language by instructional setting, and that the eleven identified effective teacher language practices loaded onto two factors relating to children's language growth: an emerging academic register (e.g., inclusion of academic vocabulary, complex syntax, and conceptually-rich, content-area talk), and a bridging register (e.g., scaffolding, eliciting talk).

Elementary Grades

Decades of research support the explicit instruction of vocabulary, yet current work provides a more nuanced look into how language may be developed through more

comprehensive and integrated instruction that builds knowledge across the disciplines (Cervetti et al., 2023; Hwang et al., 2022). A recent meta-analysis (Cervetti et al., 2023) found no positive overall effects for interventions targeting explicit teaching of academic vocabulary meanings or those teaching strategies for determining word meanings through contextual analysis (e.g., morphology, context clues, metalinguistic knowledge). In contrast, integrated literacy and content area instruction (e.g., developing word and linguistic knowledge through social studies and science instruction) was significantly and positively related to vocabulary growth of children in kindergarten through fifth grade ($ES = .91$; Hwang et al., 2022). Engaging with content area texts that systematically build conceptual knowledge promotes the development of word knowledge through frequent and repeated exposure to academic vocabulary in reading and writing (e.g., Hwang et al., 2023). Additionally, a meta-analysis investigating listening comprehension interventions reported positive effects on custom measures of vocabulary ($ES = 0.85$), morphology ($ES = 1.14$), and academic language ($ES = 0.08$; Silverman et al., 2020).

Secondary Grades

Language-focused instruction at the secondary level focuses on academic language, with an emphasis on students with learning difficulties and ELLs as skilled readers tend to acquire vocabulary and advanced language structures through reading widely (Sternberg, 1987). A review of instructional methods for secondary learners with learning disabilities found four effective methods for vocabulary instruction: mnemonics, morphemic analysis, direct instruction, and multimedia instruction (Kuder, 2017). Emerging evidence of academic language-focused interventions shows promise for promoting vocabulary and language growth in linguistically-diverse populations (Kieffer & Lesaux, 2012; Lesaux et al., 2010; Lesaux et al., 2014).

Reading Comprehension and Motivation

Reading comprehension is a complex process, described by the RAND Reading Study Group (Snow, 2002) as “the process of simultaneously extracting and constructing meaning” (p. 11), dependent on a reader, text, and activity. While scholars have proposed numerous models of reading comprehension and the role of motivation in reading comprehension (e.g., Guthrie & Wigfield, 1999, 2000), two models of reading comprehension are especially useful for educators: the Construction-Integration Model (Kintsch, 1988; Zwaan, 2016) and the Layered Model of Effective Comprehension (Duke et al., 2021). Kintsch’s (1988) model helps teachers know that students must construct a mental representation of what the text says (text base) and integrate this text information with background knowledge to determine what the text means (situation model). Duke and colleagues’ (2021) layered model helps teachers understand how to layer effective general classroom instruction to support students’ comprehension. This summary of comprehension research is organized around five of these layers: (1) knowledge building and activating, (2) teaching about text, (3) teaching about comprehending, (4) engagement with text, and (5) motivating literacy.

Knowledge Building and Activating

Background knowledge grounds learning – it is needed for students to construct a *situation model* (Kintsch, 1988; Zwaan, 2016). The impact of background knowledge is well-documented. Meta-analyses have shown stronger comprehension when teachers help students build background knowledge (Filderman et al., 2022; O’Reilly et al., 2019; Peng et al., 2023; Smith et al., 2021). Also, integrated literacy and content-area instruction can improve comprehension in elementary grades (Hwang et al., 2022, 2023; Kim et al., 2021a, 2021b; Swanson et al., 2014). Children and adults with background knowledge about a topic have better

comprehension than those with little knowledge (Chiesi et al., 1979; Pearson et al.1979; Schneider et al., 1989). Students retain more information because background knowledge serves as a framework for new information, so students do not need to remember every detail – it increases processing speed and reduces cognitive load (Sweller, 1994). Knowledge focuses students’ attention, which helps students discern relevant information from irrelevant information, locate new information accurately and rapidly, and make a more deliberate use of knowledge (National Academies of Sciences, Engineering, and Medicine [NAS], 2018). Students with adequate knowledge extend their knowledge by generating inferences because they make logical connections between pieces of information (NAS, 2018; Rice & Wijekumar, 2024). Readers use background knowledge to apply what they have learned to new information – transfer (Chi & VanLehn, 2012).

Hattan and colleagues (2023) reviewed the literature that examined instructional practices designed to activate prior knowledge to facilitate students’ comprehension. They found that activating prior knowledge before reading supports comprehension, but it is also beneficial during and after reading. Instructional practices include open-ended prompts (e.g., discussions about what students know about a topic), procedural or strategic supports during reading (e.g., perspective taking), visual representations (e.g., concept maps), analogical reasoning (e.g., compare/contrast prior knowledge with text concepts), text alteration (e.g., problem-oriented tasks connected to text), augmented activation (e.g., alerting students’ to misconceptions), extratextual activities (e.g., demonstrations), and spontaneous activation (e.g., student think alouds). Most of these practices show promise but require additional research.

Teaching About Text

Teachers require knowledge about text complexity to select texts that support comprehension development (Shanahan et al., 2010). Text complexity involves interactions among the text, the reader, and the task. This includes the readability of the text (e.g., word difficulty, text cohesion), the characteristics of reader (e.g., prior knowledge), and how teachers support the reading task to facilitate students' successful reading comprehension. Simply increasing the complexity of text leads to a decline in reading outcomes. Therefore, students may need instructional supports to assist them as they read challenging texts, and teachers may require professional development to learn what makes a text complex. Further research is needed on instructional supports for reading complex texts (Amendum et al., 2018; Strong et al., 2018).

Students require knowledge about texts and text structure (Shanahan et al., 2010). This knowledge supports students in constructing a *text-based representation* required for comprehension. For example, explicit instruction in narrative and expository text structure across various grade levels and ability levels supports reading comprehension (Bogaerds-Hazenburg et al., 2021; Hebert et al., 2016; Pyle et al., 2017; Strong, 2020). Teaching students how to determine main ideas in informational texts (Stevens et al., 2019) and literary themes in narrative texts (Wilder & Williams, 2001; Williams et al., 2002) have also shown to be effective in increasing reading comprehension outcomes. Providing inference instruction also has moderate effects on students' inferencing skills and general comprehension (Rice & Wijekumar, 2024).

Teaching About Comprehending

Teaching reading comprehension strategies benefits students' comprehension (Shanahan et al., 2010). Peng and colleagues (2023) found that while background knowledge and strategy instruction did benefit students, "there is no 'the most important' or 'active ingredient' reading

comprehension strategy. Instead, different reading comprehension strategies are conceptually related and interact with one another to produce different effects based on different combinations" (p. 29). This research indicates that students in grade 3-12 with reading difficulties benefit from learning multi-strategy approaches produce maximum interaction effects on comprehension. The three most effective strategies and strategy combinations were (1) main idea, text structure, and retell; (2) main idea, text structure, self-monitoring, and graphic organizers, and (3) main idea. Integrating too many strategies (i.e., above five) shows smaller effects on comprehension. One key finding is that background knowledge instruction is important, because without it, the effects of reading comprehension strategies decrease.

Engagement with Text

Talking about text in teacher- and student-led discussions can improve reading comprehension (Shanahan et al., 2010). Murphy et al. (2009) conducted a meta-analysis to examine the effects of using group discussions as a tool for promoting students' high-level, critical, reflective thinking about text. Many of the approaches analyzed were highly effective at promoting students' literal and inferential comprehension. There is some evidence of a few approaches promoting students' critical thinking, reasoning, and argumentation about and around text, but more research is needed. Most approaches effectively increased student talk and decreased teacher talk. Student talk, however, did not necessarily result in increases in students' comprehension. Critical-analytic discussions may be effective for promoting comprehension.

Motivating Literacy

Promoting motivation and engagement also improves reading comprehension (Shanahan et al., 2010). Motivation is energization and direction of human behavior, including goal orientation (e.g., intentions, mastery goals), beliefs (e.g., self-efficacy, expectancy, value) and

disposition (e.g., attitudes, interest; Toste et al., 2020). Motivational processes relate to reading performance, which has important implications for developing effective instructional practices and fostering students' active engagement in reading (Cho et al., 2023; Guthrie et al., 2004, 2007; McBreen & Savage, 2020; van der Sande et al., 2023). Toste et al., (2020) report that "intrinsic motivation is positively associated with reading in samples from preschool through high school grades" (p. 442). The constructs of beliefs and disposition both have significantly stronger relations to reading achievement than goal orientation. Further, "the relations between motivation and (foundational) skills are precursors to proficient reading and may influence later associations between motivation and reading comprehension" (Toste et al., 2020, p. 444), but more research is recommended. For instance, motivational interventions designed to engage primary-grade students' individual interests and/or trigger students' situational interests have significant effects on reading motivation and reading comprehension (van der Sande et al., 2023). Interventions such as Concept-Oriented Reading Instruction that have explicitly targeted students' intrinsic motivation, perceived autonomy, self-efficacy, social interaction, and mastery goals through motivations supports (e.g., relevance, choice, collaboration, self-efficacy support, thematic units) have led to improvements in motivational and comprehension outcomes (Guthrie et al., 2007).

Writing and Reading

Writing and reading are sets of skills that are reciprocally related and mutually beneficial (Graham, 2020). Theorists have suggested for many years the important role writing instruction plays in cognitive development and higher mental processes (e.g., Bereiter & Scardamalia, 1987). In preschool through twelfth grades, writing and writing instruction improve children's reading ability (Graham & Hebert, 2011), reading instruction improves writing ability (Graham

et al., 2018), and instruction that combines reading and writing improves both reading and writing (Graham et al., 2017). Further, writing is improved by teaching students read and re-read exemplary texts as models for writing (Graham et al., 2016). Thus, the science of reading is incomplete without consideration of the science of writing (Graham, 2020). Like the simple view of reading, which highlights the contributions of code-based skills (i.e., decoding) and meaning-based skills (i.e., language comprehension) to reading comprehension ability (Gough & Tunmer, 1986), the simple view of writing contends that writing ability is the outcome of transcription skills (e.g., handwriting, typing, spelling), text generation, and self-regulation to guide the composing process in working memory (Berninger et al., 2002). In the following sections, we summarize the results of systematic and meta-analyses on the impact of writing instruction focused on transcription and text generation for general education students in elementary and secondary grades. In addition, we summarize the results of systematic reviews and meta-analyses focused on instruction for students with learning disabilities.

Transcription

Teaching transcription skills, or transcribing ideas into written phrases and sentences through handwriting, spelling, and/or keyboarding/typing, is an essential and effective component of writing instruction in elementary and secondary grades, with positive effects on handwriting, spelling, and typing outcomes (Graham et al., 2012, 2023). Teaching handwriting in grades K-12 via individualized or technology approaches improves not only handwriting legibility and fluency but also writing quality, length, and fluency (Santangelo & Graham, 2016), suggesting that automaticity in transcription skills allows for more attention to be devoted to idea generation. Notably, with regard to translation of ideas into phrases or sentences, the most recent research suggests that sentence instruction and grammar instruction are both effective

approaches for improving sentence writing outcomes in secondary grades (6-12; Graham et al., 2023a). However, several studies have shown that teaching sentence combining (i.e., combining two or simple sentences into compound or complex sentences), as well as similar approaches like sentence expanding, is a more effective approach to improving grammar and syntax in writing than traditional grammar instruction (Andrews et al., 2006; Graham et al., 2012; Graham & Perin, 2007a; Saddler & Graham, 2005).

Text Generation

There are many effective approaches to improving students' text generation knowledge and skills in elementary and secondary grades. This instruction includes comprehensive writing programs with and without the following components: strategy instruction (e.g., planning, drafting, and/or revising) with and without self-regulation (using the self-regulated strategy development model of writing instruction), text structure instruction (e.g., narrative, persuasive/argumentative, and expository structures), prewriting activities (e.g., brainstorming), process writing (i.e., extended opportunities for writing in cycles of planning, drafting, revising, editing, and publishing), peer assistance when writing, setting product goals, word processing/computer-assisted instruction/digital writing tools, using exemplary texts as models, assessment of writing with feedback (Graham et al., 2012, 2020b, 2023; Graham & Perin, 2007a; Morphy & Graham, 2012). Additional approaches that are effective for students in elementary grades include creativity/imagery instruction and providing extra time for writing (Graham et al., 2012), while additional effective approaches that are effective in secondary grades (6-12) include teaching summarization, inquiry, and teaching critical/creative thinking skills (Graham & Perin, 2007a; Graham et al., 2023a). Notably, process writing has shown positive effects for students in general education on writing quality but not for students with writing difficulties (Graham &

Sandmel, 2011), suggesting that teachers' writing instruction should not rely on a writing process or writer's workshop approach alone. In addition, assessment of writing with feedback has been shown to be effective, but popular approaches such as the 6+1 Trait model do not moderate effects (Graham et al., 2015).

Additionally, a review of qualitative studies of writing instruction provides ten recommendations for a comprehensive approach to writing instruction. They include: (1) dedicating time to writing and writing instruction daily; (2) involving students in various forms of writing over time; (3) treating writing as a process; (4) keeping students engaged and on-task by involving them in thoughtful activities; (5) teaching writing often to the whole class, in small groups, and with individual students; (6) modeling, explaining, and providing guided assistance when teaching writing; (7) providing enough support so that students can make progress or carry out writing tasks and processes; (8) being enthusiastic about writing and creating a positive environment for writing; (9) setting high expectations for their students' writing, and (10) adapting writing assignments and instruction to better meet the needs of individual students (Graham & Perin, 2007b).

Writing for Students with Disabilities

Many instructional practices that are effective for students in general education settings are also effective for students with disabilities. Specifically, effective instruction for students with learning disabilities (LD) includes (1) teaching strategies for planning, writing, revising, and/or editing; (2) process writing instruction focused on planning, drafting, revising, editing, and publishing writing over extended periods of time and for authentic audiences and purposes, (3) setting goals for writing, and (4) dictation to a recording device (e.g., speech-to-text) or a scribe (Gillespie & Graham, 2014). These instructional practices aim to promote self-regulation

skills or minimize the impact of transcription difficulties on text generation skills. Similar approaches to writing intervention are likely to be effective for students with attention deficit hyperactivity disorder (Graham et al., 2016), students with speech language impairment (Graham et al., 2020a), students with reading difficulties (Graham et al., 2021), and students identified with LD, who experience greater difficulty than their typically achieving peers on assessments of writing quality, organization, vocabulary, sentence fluency, conventions (i.e., spelling, grammar, handwriting), genre elements, output, and motivation (Graham et al., 2017). For students identified as having dyslexia, who also often experience difficulties with writing, interventions in spelling, transcription, executive function, and working memory can improve transcription skills, as well as overall writing quality when combined with approaches such as text structure instruction, sentence combining, and self-regulated strategy development (Hebert et al., 2018).

Response to Intervention for Reading

Response to Intervention (RTI), more recently an academic component of Multi-tiered Systems of Support (MTSS), is a model developed to promote the data-based decision-making process for instruction (Zhang et al., 2023). The model is intended to identify students at risk for disabilities in reading, including dyslexia, and provide interventions to prevent or remediate reading difficulties. The RTI model involves the regular use of assessment data to determine the instruction and intervention needs of students as well as their placement within a three-tiered system (Fuchs & Fuchs, 2017). At Tier 1, all students receive universal screening assessment(s) to inform the instructional decisions made in general education settings. Specifically, educators use universal screening assessments to measure how students are performing in comparison to benchmark expectations, the efficacy of core instruction, and to structure instructional groupings. Universal screeners also help determine which students are at risk and need further diagnostic

assessments. Diagnostic assessments help identify students' strengths and areas of need and guide the decisions surrounding increases in time and intensity that accompany small-group, targeted interventions at Tier 2 and individualized, intensive interventions at Tier 3. With ongoing instruction and interventions across tiers, the use of regular progress monitoring assessments and data analyses are also necessary to determine how and when to make adjustments for students. It is essential for educators to base instructional decisions on data analysis from multiple measures, rather than composite scores alone, to provide an accurate picture of learning needs and strengths.

The RTI model has been shown to be effective when instructional interventions are evidence-based and implemented systematically and explicitly (Al Otaiba et al., 2023). Specifically, students with reading disabilities and students receiving special education services, including students with or at risk for dyslexia, often experience difficulties with phonological awareness, phonics, and spelling skills and, therefore, may need explicit instruction in Tier 2 or Tier 3 interventions to support improvement in these areas (Shanahan, 2023). Further, there is evidence to support the benefits for students with or at risk for dyslexia of instruction that is data based, includes clear goals, and involves consistent opportunities to respond (Shanahan, 2023).

A well-implemented RTI or MTSS model that includes universal screening, evidence-based Tier 1 instruction, preventative intervention, ongoing progress monitoring for at-risk students, and structures to intensify intervention with increased dosage and practice at Tier 2 and Tier 3 can be used for the identification and treatment of students with reading disabilities, including dyslexia (Hall et al., 2023; Shanahan, 2023). Several conclusions can be drawn from the convergence of evidence across multiple meta-analyses on reading instruction for students with reading disabilities, including dyslexia (Al Otaiba et al., 2023; Hall et al., 2023; Shanahan,

2023). In the following sections, we summarize the findings of meta-analyses of whole class instruction delivered at Tier 1, supplemental interventions delivered at Tier 2, and intensive interventions delivered at Tier 3. Due to developmental differences in the goals and focus of reading instruction in primary grades and in upper-elementary and secondary grades (Al Otaiba et al., 2023; Shanahan, 2023), we summarize the research on these grade bands separately.

Primary Grades (K-3)

Tier 1 Instruction. The focus of Tier 1 (whole class) instruction in kindergarten through third grade varies in the type and amount of instruction in each reading component due to developmental differences among students. However, in general, effective Tier 1 instruction includes explicit, systematic instruction in four components: (1) alphabets (i.e., phonemic awareness, phonics, and spelling), (2) oral reading fluency (i.e., oral reading practice with feedback and repetition), (3) reading comprehension strategies (e.g., summarization, self-questioning, visualizing, seeking main ideas, inferencing), and (4) instruction in oral and written language comprehension (e.g., vocabulary, morphology, syntax, cohesion, and text structure; Shanahan, 2023). Comprehension strategy instruction is most effective when combined with knowledge-building approaches to instruction and integration with content literacy in science and social studies (e.g., Swanson et al., 2014). At minimum, teacher candidates should be prepared to deliver explicit instruction (e.g., clear learning goals, instructional modeling and ongoing review), differentiated instruction (small-group instruction targeting specific needs), intense lessons aimed at the needs of students with reading difficulties (e.g., modifying instruction and providing extra instruction, practice, and review), well-designed lessons (e.g., guided and independent practice), and well-implemented lessons (e.g., high-level student-teacher interaction) in these components (Shanahan, 2023). Depending on grade, Tier 1 instruction also

includes explicit instruction in foundational skills; language development; additional aspects of comprehension instruction, such as knowledge building and motivation support; writing instruction, including transcription and text generation (described above); and differentiation and instructional supports for special populations such as multilingual learners (described below).

Tier 2 Interventions. Less extensive interventions of fewer than 100 sessions for students with or at-risk for developing reading difficulties in the primary grades (K-3) can effectively improve foundational skills (e.g., phonological awareness, phonics, and word recognition), language, and reading comprehension outcomes regardless of intervention type (i.e., foundational skills or multicomponent), instructional group size (one-to-one, groups of 2-3 students, or groups of 4-5 students), grade level, implementer, or duration (Elbaum et al., 2000; Wanzek et al., 2016). There are statistically significant impacts of reading interventions in grades 1-3 on word reading, reading fluency, and comprehension, though, importantly, focusing on decoding, encoding, and writing is more effective for improving foundational skills than phonological awareness training once students have learned to decode (Gersten et al., 2020). Further, Tier 2 interventions should likely be provided in small groups of no more than 2-5 students (Gersten et al., 2020; Neitzel et al., 2022). Research indicates that optimal time for small-group interventions should not extend beyond approximately 40 hours in total (Roberts et al., 2022).

Tier 3 Interventions. More extensive, or intensive, interventions of 100 or more sessions for students with reading difficulties or disabilities in the primary grades (K-3) can effectively improve phonological awareness (e.g., syllable segmentation, phoneme identification and manipulation), phonics and word recognition (e.g., letter-name and letter-sound correspondence, blending and segmenting the sounds in words, reading decodable words and high-frequency

words), and fluency (e.g., reading, rereading, and shared reading of decodable texts (Austin et al., 2017; Wanzek & Vaughn, 2007; Wanzek et al., 2018). There have been fewer investigations of the effects of Tier 3 interventions on vocabulary and comprehension outcomes (Wanzek et al., 2018). Additionally, Tier 3 interventions should be provided early, as there are larger effects for grade 1 than for 2-3 (Wanzek & Vaughn, 2007). Tier 3 interventions should follow standardized procedures whether implemented by teachers or tutors, and effects are larger when provided one-to-one rather than in small groups of two or more students (Gersten et al., 2020; Neitzel et al., 2022; Wanzek & Vaughn, 2007; Wanzek et al., 2018). Research indicates that optimal time spent on one-on-one interventions may increase indefinitely beyond approximately 17 hours of instruction (Roberts et al., 2022), with most Tier 3 interventions providing between 25 and 63 hours of instruction (Wanzek et al., 2018).

Upper-Elementary and Secondary Grades (4-12)

Tier 1 Instruction. General classroom instruction (Tier 1 in an RTI model) focused on reading comprehension and vocabulary instruction can significantly improve reading comprehension (e.g., content knowledge) and vocabulary (e.g., word knowledge) outcomes for students with reading difficulties in upper-elementary, middle, and high school grades (4-12). Strategy instruction follows an explicit, gradual release model of instruction incorporating multiple opportunities to practice with various texts. However, there is limited research on the effects of Tier 1 instruction on phonics/word recognition and fluency outcomes as well as studies in grades 9-12 (Swanson et al., 2017). Instruction was not significantly moderated by grade level or duration, meaning Tier 1 instruction is similarly effective in grades 4-5 and grades 6-8 and for shorter or longer durations. Though limited to one meta-analysis (Swanson et al., 2017), findings suggest that Tier 1 instruction in grades 4-12 should prioritize evidence-based instruction for

vocabulary and comprehension, with students needing additional instruction in foundational skills (e.g., phonics/word recognition, fluency) receiving more intensive interventions beyond Tier 1. Tier 1 instruction in grades 4-12 also includes instruction in additional aspects of oral language, reading comprehension, and writing, and considerations for special populations such as multilingual learners (described below).

Tier 2 Interventions. Tier 2 interventions that target foundational reading skills, reading comprehension, and multiple components are effective for improving outcomes for students with reading difficulties in grades 4-12. In the upper-elementary grades (4-5), interventions that target foundational reading skills (i.e., phonemic awareness, phonics [e.g., multisyllabic decoding], spelling, fluency), reading comprehension strategies (e.g., main idea, summarization), and multicomponent interventions (e.g., fluency, vocabulary, and comprehension instruction) produce small, positive effects for students with reading difficulties (Donegan & Wanzek, 2021; Wanzek et al., 2010). Given the relatively limited number of studies focusing on vocabulary or fluency alone and the smaller effects of word study interventions than comprehension or multicomponent interventions on comprehension outcomes, it is likely that most interventions for students with reading difficulties in grades 4-5 should address multiple components (Wanzek et al., 2010). Further, interventions with smaller groups and longer durations produce larger effects (Donegan & Wanzek, 2021). In middle and high school (grades 6-12), interventions that explicitly model and provide practice with reading comprehension strategies (e.g., reciprocal teaching, text structure, graphic organizers, main idea, story themes) and multicomponent interventions (e.g., word study and fluency, fluency and comprehension) produce large effects on comprehension, while word study interventions (e.g., phonemic awareness, phonics) produce small-to-moderate effects on comprehension (Edmonds et al., 2009). Of note, reading

comprehension interventions produce significantly higher effects on reading comprehension in grades 4-12 than fluency interventions (Scammacca et al., 2015), suggesting that meaning should be a focus of Tier 2 intervention.

Tier 3 Interventions. In the upper-elementary, middle, and high school grades, interventions for students with reading disabilities should include evidence-based practices for some combination of these five components based on need: (1) advanced word study (e.g., multisyllabic decoding and morphology instruction), (2) fluency (e.g., repeated reading, wide reading), (3) vocabulary (e.g., direct instruction in academic and discipline-specific vocabulary, context clues, and root words and affixes), (4) comprehension (e.g., activating prior knowledge, graphic organizers, comprehension-monitoring strategies, summarizing) and (5) motivation (providing interesting content goals for reading, supporting student autonomy, providing interesting texts, and increasing social interactions among students (Roberts et al., 2008). There is strong evidence to suggest that extensive interventions in grades 4-12 targeting some combination of these five components have significant positive effects on reading comprehension, reading fluency, word reading, word reading fluency, and spelling outcomes, regardless of group size, duration, or grade level, suggestions similar effects in grades 4-5, 6-8, or 9-12 (Wanzek et al., 2013).

Multilingual Learners and Reading

In this section, we synthesize research on reading in relation to multilingual learners (MLLs) who are in the process of learning English as a new and additional language in the United States. In education, the term MLLs has been interchangeably used as emergent bilingual learners, English language learners, or English as a second language (ESL) students. Classroom

teachers with and without certification in teaching English to Speakers of Other Languages should be familiar with implementing research-based instruction for MLLs.

Reading interventions have positive effects on MLLs' reading skills such as accuracy, fluency, and comprehension across K-12 grades and MLLs with reading difficulties. Instruction aligned with the key pillars of phonemic awareness, phonics, fluency, vocabulary, and comprehension identified by the National Reading Panel (2000) work equally well for MLLs. Because reading interventions have positive effects on MLLs' reading skills, there is no need to delay intervention until MLLs reach particular levels of oral proficiency (Ludwig et al., 2019; Solari et al., 2022). Quality reading instruction integrates multiple aspects of reading. For example, vocabulary and reading comprehension together have more positive effects than a focus on a single aspect of reading (e.g., a focus on only vocabulary). Common literacy practices such as shared book reading are also effective for young MLLs (Fritton et al., 2018).

Bilingual programs have greater positive effects on reading progress than English-only immersion programs for MLLs. Reading instruction in a child's home language can help act as a bridge to English. General comprehension strategies, phonemic awareness, decoding, and blending of sounds can transfer, particularly among languages that use phonetic orthographies such as Spanish and English (Graham et al., 2023b; Slavin & Cheung, 2005). Students may benefit as well from lessons tailored to language differences, for example, sounds that exist in English but do not occur in the student's first language (Giambo & McKinny, 2004).

Reading instruction for MLLs need not be limited to English language arts (ELA) classrooms. For example, middle grades reading interventions in content areas such as math, science, and social studies can be equally effective as intervention in ELA classrooms (Hall et

al., 2017). Furthermore, reading interventions are effective for adolescents, although care should be taken in selecting developmentally appropriate interventions (Huddle et al., 2017).

What Should Teacher Candidates Know and Be Able to Do?

In this section, we identify what teacher candidates should know and be able to do as it relates to the teaching of reading (and writing) to all students based on the science of reading. Research reveals a complicated relationship between teachers' knowledge of reading instruction, the quality of instruction they provide, and their students' reading achievement (e.g., Hudson, 2023; Kehoe & McGinty, 2024; Risko et al., 2008). Nevertheless, there have been numerous attempts to better understand teachers' knowledge of reading instruction and its relationship to their preparation and experience (e.g., Davis et al., 2022; Lacina & Block, 2011). Recent systematic reviews of the research on teacher preparation for reading instruction show that, in general, teacher preparation can effectively improve teacher candidates' knowledge of reading instruction, especially when they have opportunities to apply their knowledge under the guidance and supervision of experts such as in field experiences (Hudson et al., 2021; Tortorelli et al., 2021). However, both reviews concluded that more research is needed to understand, specifically, what teacher candidates need to learn and do during their preparation in order to effectively improve student achievement once in the classroom. For example, one promising area of research that merits further investigation is the use of mixed-reality teaching simulations that provide teacher candidates with opportunities to practice what they learn in coursework in simulated field experiences (e.g., Allen & Stecker, 2023; Ely et al., 2018).

Despite limitations in this body of research on the effects of teacher preparation on student achievement, research-based guidance on the content and structure of effective programs is available. For example, an analysis conducted by the International Literacy Association and

National Council of Teachers of English (2017) found that effective literacy teacher preparation programs exhibit the following characteristics: (1) coursework to promote development of content and pedagogical knowledge; (2) an emphasis on preparing to teach diverse groups of students; (3) multiple opportunities for authentic practice that are coherent with coursework and include explicit mentoring; (4) engagement in self-critique and professional learning communities; and (5) ongoing assessment of teacher candidates (Risko & Reid, 2019). Similarly, Hindman and colleagues (2020) posit that teacher preparation for reading instruction should be (1) *learner centered* (e.g., individualized instruction based on what teacher candidates know and can do), (2) *knowledge centered* (e.g., content has clear relevance for real classrooms and curricula), (3) *assessment centered* (e.g., multiple, ongoing, authentic field experiences to practice, be observed, and receive feedback) and (4) *community centered* (e.g., extended time for peer support and mentorship). Along with our specific recommendations that follow, we suggest that teacher preparation programs attend to each of these characteristics.

With our analysis of the reading science literature concentrated on identifying effective instructional practices, our recommendations are focused on the content and pedagogical knowledge teacher candidates should develop in coursework and field experiences to learn and apply these practices. Our recommendations are not meant to be an exclusive or exhaustive list of the *only* content teacher candidates should develop. Much guidance based in the science of reading already exists for what teachers should know as it relates to the teaching of reading, including foundational skills such as phonological awareness, phonics, and fluency (e.g., Ehri, 2022; Mesmer & Kambach, 2022; Piasta & Hudson, 2022); vocabulary (e.g., Manyak et al., 2018; Zucker et al., 2021); reading comprehension (e.g., Cervetti & Hiebert, 2019; Duke et al., 2021; Kambach & Mesmer, 2024); writing and reading (e.g., Kim & Zagata, 2024); assessment

and reading disabilities (Truckenmiller, 2024; Truckenmiller et al., 2024); and instruction for multilingual learners (e.g., Ascenzi-Moreno, 2024). Not seeking to duplicate this guidance, we provide recommendations for what we expect teacher candidates should know and be able to do to implement effective instruction in foundational skills, vocabulary and oral language, reading comprehension, writing, response to intervention, and instruction for multilingual learners. It is important to note that within a response to intervention (RTI) model, classroom teachers should know and be able to implement Tier 1 instruction, while specialists (e.g, literacy specialists, special educators) should know and be able to implement Tier 2 and Tier 3 interventions.

Foundational Skills: Phonemic Awareness, Phonics, and Fluency

Phonemic Awareness

- Assess and provide explicit instruction in phonological and phonemic awareness.
- Demonstrate understanding that phonemic awareness is a strong predictor of individual differences in reading development.
- Demonstrate understanding that phonemic awareness instruction can be effective at varying ages with the strongest effects in kindergarten and first grade.
- Identify phonological units produced orally at the word, syllable, and phoneme levels of language, and implement evidence-based instructional practices on phonemic awareness skills (e.g. segmenting, blending, addition, deletion, and substitution).
- Provide explicit instruction in segmenting, blending, and deleting individual sounds and assisting students in mapping phonemes to graphemes.

Phonics

- Implement evidence-based approaches to phonics instruction (e.g., synthetic, analytic) that is explicit and systematic (i.e., follows a clear scope and sequence).

- Demonstrate understanding of the phases of word reading and an appropriate developmental progression of phonics skills.
- Explicitly teach students to decode single-syllable words using the relationship between letters (and letter combinations) and sounds (i.e., grapheme-phoneme correspondences).
- Explicitly teach students to decode multisyllabic words through syllabic and morphemic analysis (e.g., word roots, prefixes, suffixes).
- Explicitly teach students to spell words in conjunction with phonemic awareness and phonics skills, syllables, and larger morpheme units (e.g., word roots, prefixes, suffixes).
- Implement evidence-based instructional practices to promote orthographic mapping of words, including high-frequency words.
- Identify and implement appropriate practice opportunities for students to read phonetically aligned (i.e., decodable) texts with an appropriate lesson-to-text-match.
- Demonstrate understanding that multilingual learners benefit from explicit and systematic phoneme and phonics instruction.

Fluency

- Define and assess oral reading fluency, including accuracy, automaticity, and prosody, and use the results of screening assessments as a basis for making instructional decisions.
- Demonstrate understanding of the relationship between word recognition, oral reading fluency, and reading comprehension.
- Develop students' oral reading fluency through repeated reading of grade-level text with teacher modeling and feedback.
- Develop students' oral reading fluency through non-repetitive approaches such as choral and echo reading, partner reading, wide reading, and reader's theater.

Vocabulary and Oral Language

Pre-Kindergarten and Kindergarten

- Provide both incidental and explicit (intentional) vocabulary instruction, including modeling the use of rich vocabulary and complex syntax through conceptually-rich instruction.
- Incorporate rich and diverse language across instructional settings and encourage students to use language to demonstrate understanding.
- Utilize an academic register that includes academic vocabulary, complex syntax, and conceptually-rich, content-area talk along with a bridging register that includes scaffolding and eliciting talk that is consistent with the instructional setting and students' needs.

Elementary Grades

- Integrate literacy and content area instruction (e.g., social studies and science) to promote linguistic development.
- Build conceptual knowledge that promotes the development of word knowledge through frequent and repeated exposure to academic vocabulary in reading and writing.
- Further develop listening comprehension to promote the growth of vocabulary, morphology, background knowledge, and academic language.

Secondary Grades

- Assist students with acquiring vocabulary and advanced language structures through reading widely.
- Provide mnemonics, morphemic analysis, direct instruction, and multimedia resources for vocabulary instruction, particularly with students with learning difficulties.

- Emphasize language-focused instruction for promoting vocabulary and language growth in linguistically-diverse populations.
- Continue to promote knowledge development through conceptually-rich instruction.

Reading Comprehension and Motivation

Knowledge Building and Activating

- Determine knowledge needed to support comprehension and learning by activating prior knowledge or building background knowledge.
- Demonstrate understanding of cognitive load and its impact on comprehension and learning of new content.
- Implement integrated content-area instruction and literacy instruction.
- Implement evidence-based practices for prior knowledge activation (e.g., discussion, perspective taking, concept maps, demonstrations, student think-alouds).
- Recognize how to support transfer of learning.

Teaching About Text

- Demonstrate understanding of the factors that contribute to text complexity (i.e., text, reader, and task).
- Explicitly teach students to identify and use expository text structures (e.g., cause/effect, problem/solution, description, sequence, compare/contrast) to support comprehension.
- Implement evidence-based practices to help students determine main ideas and summarize informational text.
- Explicitly teach students to recognize and use the structure of narratives with basic story maps for young children and more complex story maps for older students.
- Explicitly teach students to determine themes within literary text.

- Implement evidence-based practices to help students make various types of inferences while reading informational and literary texts.

Teaching About Comprehending

- Introduce and explicitly teach multiple comprehension strategies guided by the text, the reader, and the context, including:
 - Activating prior knowledge;
 - Determining main idea and retelling;
 - Identifying the text structure and retelling;
 - Incorporating graphic organizers;
 - Self-monitoring, clarifying, or fix-up strategies; and
 - Teaching inferences.

Engagement with Text

- Engage students in small- and whole-group discussions to promote comprehension.

Motivating Literacy

- Build intrinsic motivation for reading through evidence-based practices such as relevance, choice, collaboration, interest, self-efficacy support, and thematic units to positively influence reading motivation, engagement, and comprehension.

Writing and Reading

Transcription

- Explicitly teach transcription skills (i.e., transcribing ideas into written phrases and sentences through handwriting, spelling, and keyboarding or typing).
- Implementing evidence-based approaches to sentence-level writing instruction (e.g., grammar instruction, sentence combining, sentence expanding).

Text Generation

- Assess students' writing (e.g., rubrics) and provide feedback to inform instruction.
- Dedicate daily time for students to write with various forms of writing over time.
- Explicitly teach students how to produce written summaries of text.
- Explicitly teach writing strategies (e.g., planning, drafting, revising, and/or editing) using a gradual release of responsibility (e.g., modeling, explaining, and providing guided assistance when teaching writing) with and without self-regulation (e.g., self-regulated strategy development model of instruction).
- Explicitly teach students how to use a process approach to writing (i.e., extended opportunities for writing in cycles of planning, drafting, revising, editing, and publishing).
- Explicitly teach students to set product goals for writing.
- Explicitly teach students how to identify and use text structure in writing, including narrative, persuasive/argumentative, and expository text structures.
- Explicitly teach students how to emulate models of writing (e.g., mentor texts).
- Explicitly teach students to use word processing, computer-assisted instruction, and/or digital writing tools.
- Implement pre-writing activities (e.g., brainstorming).
- Implement collaborative approaches to writing or peer assistance when writing.
- Provide students with opportunities to write over extended periods of time and for authentic audiences and purposes.

Writing for Students with Disabilities

- Provide adaptations or accommodations for students with learning disabilities (e.g., dictation to a recording device or a scribe).

Response to Intervention for Reading

- Collaborate with colleagues, including literacy specialists and special education teachers, to develop a well-implemented multi-tiered system of support that includes universal screening, evidence-based Tier 1 instruction, targeted (Tier 2) and intensive (Tier 3) interventions, and ongoing progress monitoring for students with reading difficulties.

Primary Grades (K-3)

- Provide Tier 1 explicit and systematic instruction in alphabets (i.e., phonemic awareness, phonics, spelling), oral reading fluency, reading comprehension, writing, and oral and written language comprehension.
- Provide Tier 2 targeted interventions to small groups of students in foundational skills (e.g., phonological awareness, phonics, word recognition) through decoding and encoding instruction; reading fluency; oral language and vocabulary; writing, and reading comprehension.

Upper-Elementary and Secondary Grades (4-12)

- Provide Tier 1 instruction in reading comprehension and vocabulary, (including morphology, syntax, knowledge of text structures and genre with instruction in phonics/word recognition and fluency as appropriate, particularly in upper-elementary grades).
- Provide Tier 2 interventions that target multiple components of reading, including foundational skills (i.e., phonemic awareness, phonics [multisyllabic decoding], spelling,

fluency), reading comprehension strategies (e.g., main idea, summarization), writing, and vocabulary.

Literacy Specialists and Special Education

- Provide intensive interventions one-on-one or in small groups for PK-3 students with reading difficulties or disabilities in phonological awareness (e.g., syllable segmentation, phoneme identification and manipulation), phonics and word recognition (e.g., letter-name and letter-sound correspondences, blending and segmenting the sounds in words, reading decodable words and high-frequency words), and fluency (e.g., reading, rereading, and shared reading of a variety of texts).
- Provide interventions for students in grades 4-12 with reading disabilities in advanced word study (e.g., multisyllabic decoding and morphology instruction), fluency (e.g., repeated and wide reading), (3) vocabulary (e.g., direct instruction and academic and discipline-specific vocabulary, context clues, root words and affixes), (4) comprehension (e.g., activating prior knowledge, graphic organizers, comprehension-monitoring strategies, summarizing), writing, and motivation (e.g., providing interesting content goals for reading, supporting student autonomy, providing interesting texts, and increasing social interactions among students)

Multilingual Learners and Reading

- Demonstrate understanding of foundations and instruction for multilingual learners (MLLs) across foundational skills (e.g., phonics, phonemic awareness, fluency), vocabulary and oral language development, comprehension, writing, and assessment.
- Demonstrate understanding that it is not necessary to wait until oral proficiency in English is reached before providing reading interventions for MLLs.

- Demonstrate awareness of multiple reading interventions for MLLs of any age or grade level who may need increased support with reading.
- Demonstrate understanding that MLLs' home languages play a crucial role in their successful learning of English, and that some languages such as Spanish can positively transfer to learning a new language.
- Implement evidence-based practices for teaching foundational reading skills (e.g., phonics instruction), vocabulary and oral language (e.g., read-alouds), and comprehension (e.g., text structures), as these are also effective for instruction of MLLs.
- Integrate components of literacy (e.g., vocabulary and comprehension) with content (e.g., science, social studies) instruction to support MLLs' language and literacy learning.
- Incorporate approaches that draw from students' own funds of knowledge about language in planning and implementing literacy instruction including promoting bilingual approaches that value multiple languages in the classroom.

Landscape Analysis of SUNY Educator Preparation Programs

Purpose

In this section, we describe a landscape analysis conducted to determine how current pedagogical practices across SUNY educator preparation programs reflect reading science principles. Consistent with prior research, we view a landscape analysis as a determination of “the strengths, resources, and needs of a particular community to ensure that any interventions or programs developed are in response to actual needs” (Brasili et al., 2023, p. 358). Specifically, we sought to determine the alignment between the pedagogical practices of SUNY educator preparation programs and pedagogical practices aligned with the science of reading instruction.

Method

We conducted two statewide surveys, one of faculty (and/or program directors) who teach in educator preparation programs (EPPs) across SUNY institutions and one of undergraduate/graduate students enrolled in educator preparation programs for first initial certification across the same SUNY institutions. Using SUNY administration protocols, the SUNY New Paltz Human Research Ethics Board approved this study (IRB ID STUDY00004711).

Due to a focus on beginning reading instruction, we invited participants to respond to these surveys who either taught in or were enrolled in a program leading to one of five initial certification areas in elementary grades:

1. Childhood Education (Grades 1-6),
2. Early Childhood Education (Birth-Grade 2),
3. Early Childhood/Childhood Education (Birth-Grade 6),
4. Special Education and Childhood Education (Grades 1-6), and
5. Special Education and Early Childhood Education (Birth-Grade 2).

SUNY institutions with registered teacher preparation programs in these five areas were invited to participate via an email distributed to the SUNY Deans and Directors of Education listserv and forwarded to EPP faculty and students. Respondents completed the surveys between March and April 2024.

In addition, we conducted a review of SUNY students' performance on two the New York State Teacher Certification Examinations (NYSTCE) required of five targeted areas indicated above for the past four academic years. As an outcome measure, student performance on these certification exams is an additional component of the landscape analysis.

SUNY Faculty Literacy Program Survey

To inform our landscape analysis, we first identified pedagogical practices considered to be aligned with the science of reading as well as pedagogical practices viewed as less aligned with the science of reading. For the former, we consulted several reputable sources, including a previous survey of teacher preparation in early reading instruction published by the Institute of Education Sciences (Salinger et al., 2010) and five What Works Clearinghouse (WWC) practice guides that address elementary reading and writing instruction (Foorman et al., 2016; Gersten et al., 2009; Graham et al., 2012; Shanahan et al., 2010; Vaughn et al., 2022). For the latter, we consulted a recent review of elementary teacher preparation programs that identified “practices contrary to the science of reading,” (Ellis et al., 2023, p. 65) including three-cueing systems, running records, miscue analysis, balanced literacy models, guided reading, reading workshop, leveled texts, and embedded/implicit phonics. The purpose of identifying these practices was to understand the extent to which faculty and students report teaching and learning about practices aligned and “misaligned” (Ellis et al., 2023, p. 11) with the science of reading.

We modeled the faculty and student surveys after the survey used in the *Pre-Service Teacher Preparation Program and Knowledge Survey* (Salinger et al., 2010), a valid and reliable survey in the public domain. Each SUNY survey had three sections: (1) Background Information, (2) Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences, and (3) Feelings of Preparedness. The items in the Background Information section were adapted from the survey conducted by Salinger and colleagues (2010) to be relevant for programs offered at SUNY institutions leading to initial teacher certification in New York State. For many items, respondents were able to select more than one response.

Similarly, items in the Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences section were adapted from the survey conducted by Salinger and colleagues (2010). We added items were added from the recommendations in the WWC practice guides and the report by Ellis and colleagues (2023) described above. For each item, respondents selected the degree of emphasis on a particular reading practice in literacy coursework and field experiences from four options: (1) None (this topic is not addressed in any of the courses), (2) Little (this topic is addressed briefly in one course), (3) Moderate (this topic is addressed over several class periods in one or two of the courses), or (4) Considerable (there is a course entirely devoted to this topic). Items reflected practices considered to be well aligned and less aligned with the science of reading for teaching foundational skills (phonological awareness, phonics, fluency), vocabulary and oral language, reading comprehension, and writing, as well as assessment practices for determining reading difficulties and making instructional decisions. We added two open-ended items to elicit additional information from respondents about their coursework and field experiences.

The items from the Feelings of Preparedness section were adapted from the survey conducted by Salinger and colleagues (2010). For each item, respondents selected the expected degree of preparedness of teacher candidates for teaching the essential components of reading (e.g., phonemic awareness, phonics, fluency vocabulary, comprehension) at different grade levels (i.e., PK-1, 2-3, 4-6) following program completion. There were four options: (1) not at all prepared (candidates in this program do not know about or do not understand these components well enough to teach students), (2) somewhat prepared (candidates in this program are not completely sure how to teach these components with students in all grades and at all reading levels), (3) mostly prepared (candidates in this program understand how to teach these

components well with some students but still need to deepen their understanding of the components), or (4) definitely prepared (candidates completely understand how to teach these components with students at all grades and at all reading levels). We added two open-ended items to elicit additional information from respondents.

New York State Teacher Certification Examinations

New York State requires certification exams for teachers for initial certification. There are four Multi-Subject exams that assess the relevant grades levels associated with the certification area: Early Childhood, Childhood, Middle, and Secondary. For this landscape analysis, we considered only the two following exams: Multi-Subject: Teachers of Early Childhood (Birth – Grade 2) and Multi-Subject: Teachers of Childhood (Grade 1 – Grade 6). NYSED developed the Multi-Subject exams via a reliability and validity process, including content based on relevant professional standards:

- *New York State Next Generation English Language Arts Learning Standards*. (2017). New York State Education Department.
- *New York State Teaching Standards*. (2011). New York State Education Department.
- *Guidelines for the Preparation of Teachers of English Language Arts*. (2006). National Council of Teachers of English.
- *Standards for Reading Professionals*. (Revised 2010). International Reading Association.
- *Knowledge and Practice Standards for Teachers of Reading*. (2010). International Dyslexia Association.

Each of the Multi-Subject exams has three parts, assessing knowledge of Literacy and English Language Arts, Mathematics, and Arts and Sciences. Within each exam, Part One assesses Literacy and English Language Arts. The four subareas within this section are:

1. Knowledge of Literacy & Language Arts
2. Instruction in Foundational Literacy Skills
3. Instruction in English Language Arts
4. Analysis, Synthesis, and Application

Within each of these competencies, there are a series of performance expectations and performance indicators. For example, within the Childhood Level exam for “Instruction in Foundational Literacy Skills,” there are four performance expectations: (a) Instruction in Print Concepts and Phonological Awareness; (b) Instruction in Phonics, Word Recognition, and Fluency; (c) Instruction in Language Knowledge and Vocabulary; and (d) Text Complexity and Instruction in Text Comprehension. Many of these performance indicators in the assessment align with the body of research referred to as the science of reading. While it was beyond the charge of the SUNY TAG to conduct a detailed evaluation of the assessment framework, the exam is a key assessment for all candidates across New York State (NYS) and an assessment in which NYS has heavily invested resources to ensure validity and reliability of the exam.

Subarea information is reported as a performance index from 1 to 4:

- 4 - Performance on the skills and knowledge is well above the level represented by the minimum passing score.
- 3 - Performance on the skills and knowledge is just at or above the level represented by the minimum passing score.
- 2 - Performance on the skills and knowledge is just below the level represented by the minimum passing score.
- 1 - Performance on the skills and knowledge is well below the level represented by the minimum passing score.

The reporting process provides each individual SUNY institution with data on how their students perform, along with comparative data for SUNY Institutions and all New York State candidates. Many institutions use these exam data as part of the accreditation process, with comparisons to their own students. EPPs are also required to have 80% of candidate pass the exam for program registration purposes. In this landscape analysis, we report the performance data for all SUNY institutions for the Early Childhood and Childhood Multi-Subjects exams.

Results

SUNY Faculty Literacy Program Survey

In this section, we describe results for the SUNY Faculty Literacy Program Survey only. We provide descriptive statistics (i.e., counts, frequencies) for all closed-ended items, which were computed by the first author. A small group of TAG members analyzed the open-ended items qualitatively (e.g., coding themes), which we report at the thematic level for each item. The SUNY Pre-Service Teacher Literacy Program Survey received only 93 responses from students enrolled in one of the targeted SUNY educator preparation programs across all institutions. Further, over 70% of respondents were from two institutions. Due to these limitations, the results were not considered to be representative of SUNY institutions and are not reported below.

Results from the Background Information section are displayed in Table 2. In total, there were 29 responses, each reflecting a different program. Respondents were mostly literacy faculty (82.8%), a program administrator/director (20.7%), and/or a committee of program representatives (17.2%). Responses were completed across all SUNY institutions with registered programs in the five targeted areas. Respondents from six institutions completed more than one survey response, each for a different program/certification area: Binghamton University (2), Buffalo State University (5), SUNY Cortland (4), SUNY Fredonia (3), SUNY Oneonta (4), and

SUNY Potsdam (2). Over two thirds of responses were for programs at the undergraduate level (69.0%), while nearly a third were at the graduate level (31%). The graduate level programs led to initial certification, the focus of the study, though they also provided completers with New York State professional certification. Responses reflected the range of targeted program areas, including 27.6% of responses for Childhood Education (Grades 1-6), 6.9% for Early Childhood Education (Birth-Grade 2), 34.5% for Early Childhood/Childhood Education (Birth-Grade 6), 24.1% for Special Education and Childhood Education (Grades 1-6), and 6.9% for Special Education and Early Childhood Education (Birth-Grade 2).

The surveys also collected background information on faculty reports of program requirements. Most programs required 3-6 credits of literacy coursework (55.2%) or 7-9 credits of literacy coursework (24.1%). Most programs required either two (48.3%) or one (24.1%) course in “methods for teaching reading” or “foundations of reading development” (or a similar title). Most programs required a course in “teaching early reading, emergent literacy, teaching reading in grades PreK-3 or K-3” (89.7%), though somewhat fewer required a course in “teaching reading in the middle grades, teaching intermediate reading, teaching reading in grades 3-6” (69%). This difference is likely reflective of the fact that 13.8% of responses were for initial certification in Birth-Grade 2. All other course listings were required by at least 50% of programs except “remediation of children’s reading problems” (44.8%), “foundations of oral language, oral language development, linguistics” (48.3%), and “teaching reading to English language learners” (41.4%). All programs were reported to have field experiences in at least two classes, though not necessarily specific to reading content, with a majority indicating that field experiences were included in four or more classes (55.2%).

Table 2***SUNY Faculty Literacy Program Survey Results: Background Information***

Question	N	%
1. For the person completing this survey, what is your role?		
a. Literacy Faculty Member	24	82.8
b. Program Administrator/Director	6	20.7
c. Dean/Associate Dean	0	0.0
d. Committee of Program Representatives	5	17.2
e. Other	1	3.4
2. What is your SUNY Institution?		
a. Albany	1	3.4
b. Binghamton	2	6.9
c. Brockport	1	3.4
d. Buffalo State	5	17.2
e. Buffalo	1	3.4
f. Cortland	4	13.8
g. Empire	1	3.4
h. Fredonia	3	10.3
i. Geneseo	1	3.4
j. New Paltz	1	3.4
k. Old Westbury	1	3.4
l. Oneonta	4	13.8
m. Oswego	1	3.4
n. Plattsburgh	1	3.4
o. Potsdam	2	6.9
3. Select the program for this survey.		
a. Undergraduate (e.g., BA, BS, BSEd)	20	69.0
b. Graduate (e.g., MA, MS, MEd)	9	31.0
c. Advanced Certificate or Transition Pathway	0	0.0
4. Does the program accept literacy coursework for transfer credit from other institutions?		
a. Yes	21	72.4
b. No	6	20.7
c. Don't Know	2	6.9
5. Select the degree or major/concentration area addressed by this survey.		
a. Childhood Education (Grades 1-6)	8	27.6
b. Early Childhood Education (Birth-Grade 2)	2	6.9
c. Early Childhood/Childhood Education (Birth-Grade 6)	10	34.5
d. Special Education and Childhood Education (Grades 1-6)	7	24.1
e. Special Education and Early Childhood Education (Birth-Grade 2)	2	6.9

6. How many credits of literacy related coursework does the program require by graduation for the candidates?		
a. 0 – 2	0	0.0
b. 3 – 6	16	55.2
c. 7 – 9	7	24.1
d. 10 – 12	3	10.3
e. 13 – 15	0	0.0
f. 16 or more	3	10.3
7. Of your literacy coursework, how many “methods for teaching reading” and/or “foundations of reading development” courses are included in the program? Do not count courses such as children’s literature or teaching language arts.		
a. 0	0	0.0
a. 1	7	24.1
b. 2	14	48.3
c. 3	4	13.8
d. 4 or more	4	13.8
8. Does the program have courses with the following topics? Mark all that apply.		
a. Teaching early reading, emergent literacy, teaching reading in grades PreK-3 or K-3	26	89.7
a. Teaching reading in the middle grades, teaching intermediate reading, teaching reading in grades 3-6	20	69.0
b. Teaching reading in grades K-6 or 1-6	19	65.5
c. Teaching reading in the content areas	18	62.1
d. Children’s literature	16	55.2
e. Assessment, diagnosis, and/or evaluation of children’s reading	19	65.5
f. Remediation of children’s reading problems	13	44.8
g. Teaching reading using technology or media literacy	15	51.7
h. Language acquisition	16	55.2
i. Foundations of oral language, oral language development, linguistics	14	48.3
j. Teaching language arts	15	51.7
k. Teaching writing	16	55.2
l. Teaching reading to English language learners	12	41.4
9. In how many courses do the candidates have assignments that they complete in a PK-6 classroom (e.g., observing a class, teaching a lesson, leading a small group activity, etc.)? Include all courses they need to complete for your program.		
a. 0	0	0.0
b. 1	0	0.0
c. 2	7	24.1
d. 3	6	20.7
e. 4 or more	16	55.2

Results from the Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences section are displayed in Table 3. For ease of interpretation, levels of emphasis will be reported in this section as “none-to-little” or “moderate-to-considerable,” though the full breakdown for each item is displayed in Table 3. A majority of responses indicated that practices aligned with the science of reading received moderate-to-considerable levels of emphasis in literacy coursework and field experiences. For example, the first five items indicate that faculty reported moderate-to-considerable emphasis in a majority of programs on teaching phonemic awareness (93.1%), phonics (93.1%), fluency (89.6%), vocabulary (93.1%), and comprehension (89.6%). Faculty reported that 75% or more of programs placed moderate-to-considerable emphasis on all practices aligned with the science of reading for teaching phonemic awareness, phonics, fluency, vocabulary, and comprehension (items 6-37) except for item 11 (making instructional decisions based on evaluations of children’s oral reading fluency; 72.4%); item 32 (teaching students to become fluent with handwriting, typing, and word processing; 34.5%); item 33 (teaching students to spell words correctly; 72.4%); item 34 (teaching students to construct sentences for fluency, meaning, and style; 62.1%); item 35 (creating an engaged community of writers; 62.1%); and item 36 (screening all students for potential reading problems at the beginning of the year and again in the middle of the year, and regularly monitoring the progress of students who are at elevated risk for developing reading disabilities; 51.7%).

Exposure to and emphasis on practices considered to be “misaligned” (Ellis et al., 2023, p. 11) with the science of reading was also collected to determine the extent to which these practices are taught in SUNY educator preparation programs as reported in a recent review of elementary teacher preparation programs. A majority of faculty indicated that programs placed “moderate-to-considerable” emphasis on the following practices considered to be *not* aligned

with the science of reading: item 38 (assessing children’s reading using *running records*; 75.9%); item 39 (assessing children’s reading using *miscue analysis*; 65.5%); item 43 (teaching children to read using *guided reading*; 79.3%); and item 44 (teaching children to read using *balanced literacy*; 62.1%). However, faculty reported that a minority of programs placed “moderate-to-considerable” emphasis on four practices considered to be *not* aligned with the science of reading: item 47 (teaching children to read using *reader’s workshop*; 31%); item 48 (teaching children to read using *leveled texts*; 48.2%); item 53 (teaching children to read reading using *three-cueing systems*; 37.9%); and item 54 (teaching children to read words using *embedded/implicit phonics*; 48.3%).

When constructing this survey, we intentionally contrasted these items with counterparts considered to be more aligned with the science of reading. A majority of faculty indicated that programs placed “moderate-to-considerable” emphasis on all of the following practices considered to be more aligned with the science of reading: item 40 (assessing children’s reading using standardized *screening measures*; 72.4%); item 41 (assessing children’s reading using standardized *diagnostic measures*; 69%); item 42 (assessing children’s reading using standardized *progress-monitoring measures*; 86.2%); item 45 (teaching children to read using *structured literacy*; 79.3%); item 46 (teaching children to read using *comprehensive literacy*; 72.4%); item 49 (teaching children to read using *decodable texts*; 86.2%); item 50 (teaching children to read using *authentic texts*; 89.6%); item 51 (teaching children to read using *literature*; 93.1%); item 52 (teaching children to read using *informational text*; 93.1%); and item 55 (teaching children to read words using *explicit/systematic phonics*; 96.6%). There were no items aligned with the science of reading for which faculty members indicated that a minority of programs placed “moderate-to-considerable” emphasis, except for item 32 as noted above.

Table 3***SUNY Faculty Literacy Program Survey Results: Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences***

Question	None		Little		Moderate		Considerable	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
1. Learning what elementary students must <i>know and be able to do</i> in order to identify and manipulate phonemes in spoken words?	0	0.0	2	6.9	16	55.2	11	37.9
2. Learning what elementary students must <i>know and be able to do</i> in order to associate letters and the sounds they make to identify words?	0	0.0	2	6.9	16	55.2	11	37.9
3. Learning what elementary students must <i>know and be able to do</i> in order to read orally with appropriate speed, accuracy, and expression?	0	0.0	3	10.3	17	58.6	9	31.0
4. Learning what elementary students must <i>know and be able to do</i> in order to understand the meanings of words and learn new words?	0	0.0	2	6.9	18	62.1	9	31.0
5. Learning what elementary students must <i>know and be able to do</i> in order to understand what they read?	0	0.0	3	10.3	13	44.8	13	44.8
6. Teaching children how to isolate, identify, separate, and blend sounds in spoken words.	0	0.0	3	10.3	15	51.7	11	37.9
7. Teaching children to use phonics skills to figure out how to pronounce unfamiliar words.	0	0.0	2	6.9	17	58.6	10	34.5
8. Teaching children to monitor how well they understand what they read and to correct problems as they occur.	0	0.0	4	13.8	13	44.8	12	41.4
9. Using a variety of methods to teach children the meanings of words, including direct and indirect (conversational)	0	0.0	2	6.9	18	62.1	9	31.0

instruction, and multiple exposures and repetition.

10. Identifying the words in a text that children do not know and using their background knowledge to help them figure out the words' meanings.	0	0.0	3	10.3	20	69.0	6	20.7
11. Making instructional decisions based on evaluations of children's oral reading fluency.	0	0.0	8	27.6	12	41.4	9	31.0
12. Teaching children a variety of strategies for understanding the text they read, such as using graphic organizers, making predictions, asking questions, and identifying the main ideas.	0	0.0	1	3.4	16	55.2	12	41.4
13. Teaching phonics to children in a systematic way, with a series of skills and activities.	0	0.0	3	10.3	17	58.6	9	31.0
14. Teaching children to recognize and name letters.	0	0.0	5	17.2	13	44.8	11	37.9
15. Having children repeatedly read the same text aloud to improve their speed, accuracy, and expression.	1	3.4	2	6.9	18	62.1	8	27.6
16. Teaching reading with <i>both</i> fiction and nonfiction reading materials.	1	3.4	0	0.0	16	55.2	12	41.4
17. Relationships between elements of reading and oral language.	0	0.0	4	13.8	16	55.2	9	31.0
18. Relationships among elements of reading or different types of reading skills.	0	0.0	4	13.8	14	48.3	11	37.9
19. Teaching students academic language skills, including the use of inferential and narrative language, and vocabulary knowledge.	0	0.0	3	10.3	19	65.5	7	24.1

20. Developing students' awareness of the segments of sounds in speech and how they link to letters.	0	0.0	3	10.3	16	55.2	10	34.5
21. Teaching students to decode words, analyze word parts, and write and recognize words.	0	0.0	2	6.9	18	62.1	9	31.0
22. Ensuring that each student reads connected text every day to support reading accuracy, fluency, and comprehension.	0	0.0	4	13.8	18	62.1	7	24.1
23. Building students' decoding skills so they can read complex multisyllabic words.	0	0.0	2	6.9	20	69.0	7	24.1
24. Teaching students how to use reading comprehension strategies.	0	0.0	2	6.9	15	51.7	12	41.4
25. Teaching students to identify and use the text's organizational structure to comprehend, learn, and remember content.	0	0.0	4	13.8	17	58.6	8	27.6
26. Guiding students through focused, high-quality discussion on the meaning of text.	0	0.0	3	10.3	14	48.3	12	41.4
27. Selecting texts purposefully to support comprehension development.	0	0.0	2	7.1	12	42.9	14	50.0
28. Establishing an engaging and motivating context in which to teach reading comprehension.	0	0.0	4	13.8	12	41.4	13	44.8
29. Building students' world and word knowledge so they can make sense of the text.	0	0.0	2	6.9	18	62.1	9	31.0
30. Providing daily time for students to write.	0	0.0	5	17.2	18	65.5	5	17.2
31. Teaching students to use the writing process for a variety of purposes.	0	0.0	8	27.6	14	48.3	7	24.1

32. Teaching students to become fluent with handwriting, typing, and word processing.	1	3.4	18	62.1	6	20.7	4	13.8
33. Teaching students to spell words correctly.	0	0.0	8	27.6	17	58.6	4	13.8
34. Teaching students to construct sentences for fluency, meaning, and style.	0	0.0	11	37.9	12	41.4	6	20.7
35. Creating an engaged community of writers.	1	3.4	10	34.5	12	41.4	6	20.7
36. Screening all students for potential reading problems at the beginning of the year and again in the middle of the year, and regularly monitoring the progress of students who are at elevated risk for developing reading disabilities.	0	0.0	14	48.3	7	24.1	8	27.6
37. Providing differentiated reading instruction for all students based on assessments of students' current reading skills.	0	0.0	2	6.9	18	62.1	9	31.0
38. Assessing children's reading using <i>running records</i> .	3	10.3	4	13.8	14	48.3	8	27.6
39. Assessing children's reading using <i>miscue analysis</i> .	3	10.3	7	24.1	12	41.4	7	24.1
40. Assessing children's reading using standardized <i>screening measures</i> .	0	0.0	8	27.6	12	41.4	9	31.0
41. Assessing children's reading using standardized <i>diagnostic measures</i> .	0	0.0	9	31.0	10	34.5	10	34.5
42. Assessing children's reading using standardized <i>progress-monitoring measures</i> .	0	0.0	4	13.8	17	58.6	8	27.6
43. Teaching children to read using <i>guided reading</i> .	2	6.9	4	13.8	16	55.2	7	24.1
44. Teaching children to read using <i>balanced literacy</i> .	3	10.3	8	27.6	14	48.3	4	13.8

45. Teaching children to read using <i>structured literacy</i> .	1	3.4	5	17.2	17	58.6	6	20.7
46. Teaching children to read using <i>comprehensive literacy</i> .	3	10.3	5	17.2	11	37.9	10	34.5
47. Teaching children to read using <i>reader's workshop</i> .	4	13.8	16	55.2	6	20.7	3	10.3
48. Teaching children to read using <i>leveled texts</i> .	2	6.9	13	44.8	7	24.1	7	24.1
49. Teaching children to read using <i>decodable texts</i> .	0	0.0	4	13.8	17	58.6	8	27.6
50. Teaching children to read using <i>authentic texts</i> .	0	0.0	3	10.3	13	44.8	13	44.8
51. Teaching children to read using <i>literature</i> .	0	0.0	2	6.9	14	48.3	13	44.8
52. Teaching children to read using <i>informational text</i> .	0	0.0	2	6.9	14	48.3	13	44.8
53. Teaching children to read reading using <i>three-cueing systems</i> .	10	34.5	8	27.6	9	31.0	2	6.9
54. Teaching children to read words using <i>embedded/implicit phonics</i> .	8	27.6	7	24.1	12	41.4	2	6.9
55. Teaching children to read words using <i>explicit/systematic phonics</i> .	0	0.0	1	3.4	20	69.0	8	27.6

Table 4 displays the results from our analysis of the two open-ended questions from the Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences section. Overall, a majority of responses references courses (40%) as the primary focus on the five components of reading, followed by more specific areas such as specific components (20%), specific teaching techniques (12%), fieldwork experiences (14%), and assignments (8%).

Further, a majority of responses indicated that programs placed moderate or considerable emphasis in elementary reading coursework and fieldwork experiences on other specific topics (e.g., engagement/motivation, writing instruction, culturally response teaching), followed by embedded literacy fieldwork (19.4%), NYS literacy briefs (3.2%), and assignments (3.2%).

Table 4

SUNY Faculty Literacy Program Survey Open-Ended Question Results: Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences

Question and Responses	N	%
56. Please briefly describe how the program emphasizes the five components of reading (i.e., phonemic awareness, phonics, fluency, vocabulary, comprehension) in coursework.		
Course(s) focusing on the five components of reading	20	40
Assignments (e.g. lesson plans) based on the five components of reading.	4	8
Specific components (e.g., phonemic awareness) within certain courses	10	20
How the five components of reading are taught in courses	6	12
Fieldwork experiences connected to five components	7	14
NYS Literacy Briefs	1	2
Course processes/approach (e.g., small group, individual)	1	2
Not Applicable	1	2
57. On what additional strategies/components does the program place moderate or considerable emphasis in your elementary reading courses and fieldwork experiences?		
Literacy embedded fieldwork placement/opportunities	6	19.4
Significant project on assessment/intervention	1	3.2
NYS Literacy Briefs	1	3.2
Specific topics (e.g., engagement, writing, culturally responsive)	23	74.2

Table 5 displays the results from the Feelings of Preparedness section. Overall, a majority of responses indicated that faculty felt that teacher candidates were mostly prepared or definitely prepared to teach the essential components of reading to students in grades PK-1 (75%), grades 2-3 (92.9%), and grades 4-6 (85.7%). Possible reasons for these differences by grade band are discussed in our conclusions below.

Table 5***SUNY Faculty Literacy Program Survey Results: Feelings of Preparedness***

Question	Not at all prepared		Somewhat prepared		Mostly prepared		Definitely prepared	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
58. How prepared are your candidates to teach students in grades PK-1 the essential components of reading?	0	0.0	7	25.0	14	50.0	7	25.0
59. How prepared are your candidates to teach students in grades 2-3 the essential components of reading?	0	0.0	2	7.1	18	64.3	8	28.6
60. How prepared are your candidates to teach students in grades 4-6 the essential components of reading?	2	7.1	2	7.1	17	60.7	7	25.0

Table 6 displays the results from our analysis of the two open-ended questions from the Feelings of Preparedness section, which sought additional information about reading coursework and candidates' opportunities to apply components of reading during field experiences. The responses generated a great deal of information about specific course content (29.2%), overall preparedness of graduates (16.7%), fieldwork experiences (12.5%), professional learning for faculty (12.5%), and other program-specific initiatives. Further, the responses focused on rigorous or extended field work experiences (41.9%), match between coursework and fieldwork experiences (22.6%) or mismatch/limitation of fieldwork site placements (6.5%), professional learning for faculty (9.7%), and passing scores on the NYSTCE assessments (12.9%).

Table 6***SUNY Faculty Literacy Program Survey Open-Ended Question Results: Exposure to and Emphasis on Early Reading Concepts in Coursework and Field Experiences***

Question and Responses	N	%
61. What additional information do you wish to provide about your reading coursework?		
Well-prepared and reflective graduates	4	16.7
Ongoing professional learning for EPP faculty	3	12.5
Additional literacy courses for certification	7	29.2
Extra courses on middle grades and students with disabilities	1	4.2
Focused content in field work experiences	3	12.5
Research-based reading methods content	1	4.2
History of literacy education transformation content	1	4.2
Not Applicable/None	4	16.7
62. What additional information do you wish to provide about your candidates' opportunities to apply the essential components of reading during field experiences?		
Rigorous and/or extensive field work experiences	13	41.9
Shared PDS site EPP and K-12 educators profession learning	3	9.7
Limitations of fieldwork site placements	2	6.5
Passing Test scores on Multi-Subject ELA exam	4	12.9
Match between coursework and field experience	7	22.6
Not Applicable	1	4.2

New York State Teacher Certification Examinations

Table 7 shows the mean score on the Multi-Subject: Teachers of Childhood assessment in each of the four ELA subareas across a four-year period.

Table 7**Multi-Subject: Teachers of Childhood ELA Results for All SUNY Institutions**

Year	Subarea	#Takers		Mean
		SUNY	NYS	
2022-23	01	1600	5279	3.0
	02	1600	5279	3.2
	03	1600	5279	3.1
	04	1600	5279	2.8
2021-22	01	1548	5243	3.0
	02	1548	5243	3.2
	03	1548	5243	3.1
	04	1548	5243	2.8
2020-21	01	1554	5542	3.0

	02	1554	3.3	5542	3.2
	03	1554	3.2	5542	3.2
	04	1554	2.9	5542	2.9
2019-20	01	889	3.1	3420	3.0
	02	889	3.3	3420	3.2
	03	889	3.2	3420	3.1
	04	889	2.9	3420	2.8

Notes: Subareas: 01 = Knowledge of Literacy & Language Arts; 02 = Instruction in Foundational Literacy Skills; 03 = Instruction in English Language Arts; 04 = Analysis, Synthesis, and Application.

Table 8 shows the mean score on the Multi-Subject: Teachers of Early Childhood assessment in each of the four ELA subareas across a four-year period.

Table 8

Multi-Subject: Teachers of Early Childhood ELA Results for All SUNY Institutions

Year	Subarea	#Takers		#Takers	
		SUNY	Mean	NYS	Mean
2022-23	01	929	3.1	3643	3.0
	02	929	3.4	3643	3.2
	03	929	3.2	3643	3.0
	04	929	2.9	3643	2.8
2021-22	01	949	3.2	3358	3.1
	02	949	3.3	3358	3.2
	03	949	3.1	3358	3.0
	04	949	2.8	3358	2.8
2020-21	01	969	3.2	3429	3.0
	02	969	3.4	3429	3.2
	03	969	3.1	3429	3.0
	04	969	2.9	3429	2.8
2019-20	01	512	3.2	2202	3.0
	02	512	3.4	2202	3.2
	03	512	3.2	2202	3.0
	04	512	2.9	2202	2.8

Notes: Subareas: 01 = Knowledge of Literacy & Language Arts; 02 = Instruction in Foundational Literacy Skills; 03 = Instruction in English Language Arts; 04 = Analysis, Synthesis, and Application.

Both tables indicate SUNY teacher candidates routinely meet or exceed the ELA subarea scores in comparison to NYS as a whole and meet the level at or above the passing score. The

subarea 4, where candidates had the lowest average score, required an extended written response rather than multiple choice. Given the focus of items on the science of reading instruction on the Multi-Subjects assessment, especially in subareas 1 and 2, individual institutions that do not meet the average minimal score for all test takers may benefit from reviewing curriculum and instruction to ensure alignment with the science of reading to improve assessment outcomes.

Conclusions and Limitations

While there are several conclusions that can be drawn from this landscape analysis, the results should also be considered alongside its limitations. The SUNY Faculty Literacy Program Survey revealed that the percentage of programs reporting moderate-to-considerable levels of emphasis for most of the practices aligned with the science of reading was high. However, there was a clear pattern in the results that there was somewhat less emphasis (though still relatively high) in coursework and field experiences on evidence-based practices for teaching writing such as transcription (e.g., handwriting), spelling, and sentence construction skills (see Graham et al., 2012). This finding is not particularly surprising, as research consistently reveals elementary teachers report receiving minimal preparation for teaching writing (Cutler & Graham, 2008; Gilbert & Graham, 2010). The SUNY Faculty Literacy Program Survey also suggested somewhat less emphasis (though still relatively high) on teaching students to conduct screening assessments and make instructional decisions based on measures of oral reading fluency, which are practices aligned with evidence-based practices for response to intervention for reading (see Gersten et al., 2009; Salinger et al., 2010). Prior research reveals that teacher educators have reported varying emphasis on teaching preservice teachers about practices for response to intervention, such as data-based decision making (Vollmer et al., 2019). Thus, we encourage

SUNY educator preparation programs to consider the level of emphasis in coursework and field experiences on evidence-based practices for teaching writing and for response to intervention.

We also asked respondents to indicate the level of emphasis in coursework and field experiences on specific practices considered to be less and more aligned with the science of reading. It is important to note that the evidence for many of the practices often considered to be misaligned with the science of reading (Ellis et al., 2023), such as three-cueing systems, running records, miscue analysis, balanced literacy models, guided reading, reading workshop, leveled texts, and embedded/implicit phonics, has been a source of debate among literacy researchers for some time. The SUNY Faculty Literacy Program Survey revealed that a majority of faculty reported moderate-to-considerable emphasis on all of these practices in their program's coursework and field experiences with four exceptions: reader's workshop, three-cueing systems, leveled texts, and embedded/implicit phonics. While a full review of the research on each of these practices is beyond the scope of this landscape analysis, we encourage stakeholders to consider recent reviews of these practices (e.g., Davis et al., 2021; DeJulio et al., 2024; Goldberg & Goldenberg, 2022; Stouffer, 2021; Young, 2023). Also, while there is little dispute about the degree of alignment between the body of research referred to as the science of reading and many of the practices in our survey, such as explicit/systematic phonics instruction (e.g., Ehri, 2020; Kearns & Cooper Borgenhagen, 2024), the support for some practices, such as decodable texts and leveled texts, remains a matter of debate (e.g., Pugh et al., 2023). Nevertheless, we consider the results of this survey to suggest that the emphasis on practices aligned and not aligned with the science of reading is somewhat inconsistent across programs.

The SUNY Faculty Literacy Program Survey revealed that faculty reported relatively higher percentage of feelings of preparedness among teacher candidates for teaching grades 2-3

than for teaching other grade bands. This finding might simply be due to the fact that all initial teacher certification programs lead to licensure in second grade (though this would also apply to first grade), while Early Childhood Education (Birth-Grade 2) programs would not lead to licensure in grades 4-6 and Childhood Education (Grades 1-6) programs would not lead to licensure in grades PK-K. Alternatively, it is possible that faculty consider the level of preparation required for teaching the essential components of reading in grades PK-1 and 4-6 to be higher or more demanding than for teaching reading to students in grades 2-3. Future research might investigate whether there are differences in the level of preparation needed to teach the essential components of reading in the early primary, later primary, or upper elementary grades.

Finally, there are several limitations to consider when interpreting these results. First, the SUNY Faculty Literacy Program Survey is based on self-report data, which may be influenced by perception bias. Faculty might be more likely to report their programs positively. Second, programs from all SUNY institutions were represented in the SUNY Faculty Literacy Program Survey, though there was a higher number of responses from institutions with more of the targeted programs. Thus, we caution readers not to interpret the results of this survey to be indicative of all programs at all SUNY institutions. What the results do provide is a snapshot from which trends can be inferred, namely that overall alignment of programs with the science of reading seems high but that there might be inconsistencies between programs, including relatively less emphasis on teaching writing and relatively more emphasis on practices that are considered to be less aligned with the science of reading in some programs. We encourage faculty and administrators who work in SUNY educator preparation programs to consider these results in future program reviews and revisions to literacy coursework and field experiences.

Translational Research Gaps: Directions for Future Research

In this section, we identify translational research gaps, especially as related to teaching reading to diverse groups of students, for potential focus of study by faculty at SUNY campuses. Many researchers have suggested that there is a robust body of basic research on how students learn to read, but there is a need for more translational research on how to provide research-based reading instruction to diverse groups of students in real classrooms (e.g., Seidenberg et al., 2020; Solari et al., 2020). Consistent with our analysis of the reading science literature, our recommendations for what teacher candidates should know and be able to do as it relates to the teaching of reading, and our landscape analysis of SUNY educator preparation programs, the directions for future research we have identified are grounded in the science of reading *instruction* (Shanahan, 2020). Our recommendations are not meant to be an exclusive or exhaustive list of the *only* areas of translational research that are required. Rather, we identified the directions for future research in the meta-analyses and systematic literature reviews that formed the basis of our analysis of the reading science literature. In this section, we summarize directions for future research that were consistently reported in the literature on foundational skills (phonemic awareness, phonics, and fluency), vocabulary and oral language, reading comprehension, writing, response to intervention, and instruction for multilingual learners.

Foundational Skills: Phonemic Awareness, Phonics, and Fluency

Phonemic Awareness

1. Explore practices to support families' understanding of phonological awareness in order to enhance the skills of early learners (Rice et al., 2022).
2. Examine the impact of phonological awareness instructional practices with multilingual learners' (Rice et al., 2022).

3. Address phonemic awareness instruction with and without letters at multiple grade levels, especially in pre-kindergarten (Stalega et al., 2024).

Phonics

4. Investigate how phonics instruction beyond kindergarten and first grade impacts reading and language comprehension outcomes (Wanzek et al., 2016).
5. Explore the interaction between fidelity of implementation, and teacher qualifications, and the effectiveness of phonics instruction on student outcomes (Suggate, 2016).

Fluency

6. Engage in longitudinal research on the long-term impact of repeated reading instruction on reading comprehension and oral reading fluency outcomes, including prosody (Hudson et al., 2020; Therrien, 2004).
7. Study non-repetitive fluency interventions for students with reading difficulties, including the addition of decoding instruction in fluency interventions and practices such as choral and echo reading or readers' theater (Hudson et al., 2021; Zimmerman et al., 2021).

Vocabulary and Oral Language

Vocabulary

8. Investigate if reading more extensively, which should enhance reading comprehension, relates to vocabulary growth to better understand if building knowledge through reading is more effective than a direct emphasis on explicit instruction of word meanings (Cervetti et al., 2023; Hadley et al., 2022). What is the role of world knowledge in vocabulary development/acquisition?
9. Investigate if taught strategies are generalizable to vocabulary learning at large or only for the taught words presented in the classroom context (Kuder, 2017; Marulis &

Neuman, 2010; Silverman et al., 2020). How effective is peer-based support for vocabulary acquisition? What is the role of technology in vocabulary instruction?

10. Study whether vocabulary interventions exacerbate differences in word learning for children from different SES-levels? Additionally, future studies should seek to identify the appropriate context and mix of language instruction that will yield the greatest outcomes for students at different developmental levels (Cervetti et al., 2023; Hadley et al., 2022; Hadley et al., 2023; Kuder, 2017; Marulis & Neuman, 2010; Silverman et al., 2020). Are there differences in the type of vocabulary instruction provided in general education compared with intervention settings?

Oral Language

11. Evaluate the effectiveness of longer interventions in relation to instructional duration as well as longitudinal studies that demonstrate potential effects over extended periods of time (Cervetti et al., 2023; Marulis & Neuman, 2010; Silverman et al., 2020).
12. Expand studies at the upper elementary and secondary levels, particularly for learners with diverse needs and backgrounds (e.g., varying levels of SES, language backgrounds, learning disabilities) and across the academic disciplines (Cervetti et al., 2023; Hadley et al., 2022; Hadley et al., 2023; Kuder, 2017; Lesaux et al., 2010; Silverman et al., 2020).
13. Determine which words to teach and the duration and frequency of instruction (Hadley et al., 2022; Hadley et al., 2023; Marulis & Neuman, 2010; Silverman et al., 2020). Is there a relationship between the difficulty of the word, the learner's present level of performance, and instruction?

14. Address language in general rather than vocabulary specifically, and especially addressing academic language, syntax, discourse-level features (Cervetti et al., 2023; Hadley et al., 2022; Hadley et al., 2023; Lesaux et al., 2010; Silverman et al., 2020).
15. Address how teachers can leverage students' home language practices in their classroom instruction (Hadley et al., 2022; Hadley et al., 2023; Lesaux et al., 2010).
16. Examine more closely the effects of participant characteristics, group size, and instructional setting, including looking at a variety of settings across the school day beyond shared book reading or English language arts instruction (Cervetti et al., 2023; Hadley et al., 2022; Hadley et al., 2023; Lesaux et al., 2010; Marulis & Neuman, 2010; Silverman et al., 2020).
17. Address how teacher characteristics shape classroom language. Presently, there is inconsistent reporting on teacher demographics and related features such as culture, race/ethnicity, linguistic/language practices, educational-attainment (Hadley et al., 2022; Hadley et al., 2023; Silverman et al., 2020).

Reading Comprehension and Motivation

Knowledge Building and Activating

18. Determine whether students benefit from exposure to background knowledge in a specific, explicit and sequenced way or “knowledge rich” curriculum (Smith et al., 2021).
19. Determine whether relevant prior knowledge allows new knowledge to be better retained over a long period of time and, if so, determine how a knowledge base is developed in typical classrooms (Smith et al., 2021).

20. Investigate the effects of integrated literacy and content-area instruction on vocabulary and comprehension for students and the long-term or cumulative impacts on vocabulary and comprehension (Hwang et al., 2022).

Teaching About Text

21. Understand the professional development needed for teachers to provide instructional support in classrooms when teaching with complex texts (Amendum et al., 2018).
22. Investigate text structure instruction with different student populations, text structure types and sequences, and instructional practices to increase the generalizability of prior research (Bogaerds-Hazenburg et al., 2021; Hebert et al, 2016; Pyle et al., 2017)
23. Development and implementation of instructional practices that guide students to determine central ideas, including main ideas in expository texts (Stevens et al., 2019) and themes in narrative texts (Wilder & Williams, 2001; Williams et al., 2002).
24. Understand which aspects of narrative text lead to an advantage over expository text in order to improve inferential comprehension of expository texts (Clinton et al., 2020).

Teaching About Comprehending

25. Understand specific instructional interventions and combinations of strategies that support reading comprehension for diverse groups of students with and without reading difficulties (Peng et al., 2023).

Engagement with Text

26. Study the role and amount of teacher and student talk needed in various approaches to classroom instruction, as well as the impact on literal or inferential comprehension *and* critical thinking, argumentation, and reasoning about text (Murphy et al., 2009).

Motivating Literacy

27. Compare the effects of different motivational practices and combinations (e.g., self-regulatory instruction, interest-based practices, attribution training, autonomy-supportive practices) on both reading achievement and motivation (McBreen & Savage, 2020).
28. Examine the impact of motivational interventions on multiple aspects of reading beyond comprehension (e.g., phonological awareness, phonics, fluency) to help how motivational instruction may contribute to reading development (McBreen & Savage, 2020).
29. Determine constructs that can be generalized to broaden motivation theory, as well as understand the interactive and moderating effects of these factors and individual differences (i.e., student-level characteristics) on the development of students' reading achievement and motivation within a longitudinal framework (Toste et al., 2020).

Writing and Reading

30. Examine the impact of specific practices on handwriting skills, including teaching motor skills, using self-evaluation, teaching individual letters through motion models, and copying letters from models and memory (Santangelo & Graham, 2016).
31. Examine the impact of implementing specific instructional practices on writing quality and writing motivation, as well as comparing or combining different approaches. Some of the less-studies approaches include but are not limited to self-monitoring, direct instruction, behavioral reinforcement, grammar instruction, process writing, computer feedback, revision instruction, enhancing motivation to write, awareness of audience and purpose via experimental and single-subject design research (Graham & Perin, 2007b; Graham & Sandmel, 2011; Graham et al., 2015, 2023; Hebert et al., 2013).

32. Study the relational effects of reading instruction on writing outcomes and of writing instruction on reading outcomes, such as the effects of spelling on phonological awareness and phonics or writing about text on reading comprehension, and vice versa (Graham & Hebert, 2011; Graham et al., 2018).
33. Address needs for improvement in the quality of experimental and single-subject design studies of writing instruction, including random assignment, treatment fidelity, social validity, eliminating ceiling/floor effects, and multiple teachers in treatment and control groups (Graham & Hebert, 2011; Graham et al., 2012, 2018; Rogers & Graham, 2008).
34. Extend research beyond practices for typically-developing students to study the effects of different writing practices for students with learning disabilities, multilingual learners, students of color, and students who experience poverty (Graham & Hebert, 2011; Graham & Perin, 2007b; Graham et al., 2012, 2018, 2020a, 2021; Kent & Wanzek, 2016).

Response to Intervention for Reading

35. Study the relationship between instructional variables (e.g., group size, duration, or dosage) and student-level variables (e.g. gender, race/ethnicity, socioeconomic status) and the effectiveness of interventions in order to determine not only what works but for whom and under what conditions (Al Otaiba et al., 2023; Austin et al., 2017; Donegan & Wanzek, 2021; Edmonds et al., 2009; Gersten et al., 2020; Roberts et al., 2022; Swanson et al., 2017; Wanzek & Vaughn, 2007; Wanzek et al., 2010, 2013, 2016).
36. Investigate whether standardized or individualized interventions are more effective, the effects of intensive interventions for older students with reading difficulties beyond the primary grades (including vocabulary and comprehension interventions), the maintenance

of intervention effects over time, and observations of intensive interventions to determine what is being implemented in practice (Al Otaiba et al., 2023; Austin et al., 2017; Donegan & Wanzek, 2021; Edmonds et al., 2009; Gersten et al., 2020; Roberts et al., 2022; Swanson et al., 2017; Wanzek & Vaughn, 2007; Wanzek et al., 2010, 2013, 2016).

37. Engage in rigorous research on the effects of Tier 1 instruction as well as multisensory interventions at Tier 2 and Tier 3 for students with a range of learning difficulties, including dyslexia (Al Otaiba et al., 2023; Shanahan, 2023; Stevens et al., 2021).

Multilingual Learners and Reading

38. Extend research on the effectiveness of reading interventions for MLLs on students' reading skills (e.g., Fritton et al., 2018; Ludwig et al., 2019; Solari et al., 2022) to address the lack of thorough investigations on teacher intervention and implementation (Aukerman & Chambers Schuldt, 2021; Compton-Lilly et al., 2020). This gap points to opportunities for researchers to further examine the process of teacher interventions related to reading and to provide specific intervention strategies for teacher candidates.
39. Employ more diverse research methods beyond experimental designs in investigations of MLLs' reading and writing. Language and literacy learning is complex for MLLs and involves many factors, including their identities and primary language backgrounds (Giambo & McKinney, 2004; Graham et al., 2023b; Slavin & Cheung, 2005; Yoon & Pratt, 2023). More diverse methods, including qualitative and mixed methods, case studies, and design-based research approaches, would be helpful in examining the complexities of MLLs' language and literacy learning (Tierney & Pearson, 2024).
40. Expand studies on reading interventions beyond English language arts classrooms. Given that reading and writing are crucial in content areas such as math and science for MLLs'

content knowledge (Lee et al., 2019), more studies outside of English language arts could provide a fuller picture of complex MLLs' reading and writing practices in the disciplines (Hall et al., 2017; Huddle et al., 2017). Such studies may also reveal specific disciplinary supports effective for MLLs and pedagogical practices useful for teachers.

Conclusion

The science of reading is a large body of research that is more complex than the simplified version commonly repeated in legislation, professional development, and reform movements (Seidenberg et al., 2020). Conducting an analysis of the entire body of research and delineating everything that teacher candidates should know and be able to do as it relates to the teaching of reading would be an insurmountable task. A goal with this research review was to focus on meta-analyses and systematic literature reviews, along with qualitative syntheses and selective research conducted via individual high-quality experimental and quasi-experimental studies. With this focus, the group concentrated on key research findings rather than media, legislative, or political influences on the topic. Doing so also allowed us the opportunity to recommend future research that could better inform next steps in terms of what teachers need to know and be able to do in order to teach all students how to read. With continued research and related insights in practical instructional applications, especially representing the diversity of the PK-12 population, the field could move closer the ideal of few to no PK-12 students who experience reading difficulties.

SUNY invited the faculty who served on the SUNY Science of Reading TAG based on a range of expertise and geographical location. It is unlikely that every member of the TAG agrees with every word of this report. The group worked to keep within the framework of the four charges, and at times needed to pull back from pathways that while potentially important, veered

away from the main goals. To leverage the expertise of each member of this group, we organized the TAG into smaller groups to summarize and provide recommendations for the improvement of SUNY educator preparation programs. Overall, what this report presents is a summary of rigorous, empirical research on practices for teaching reading to PK-12 students as well as a set of 70 recommendations for what we believe teacher candidates should learn and be able to do in order to provide effective reading instruction once they enter the classroom. With the New York State expectations for teaching experience, continued professional learning, and mentoring, these teacher candidates will continue to learn and grow in these proficiencies throughout their careers in education. To that end, there is still much research to be done on how to translate the science of reading instruction to effective classroom instruction. This report provides 40 such recommendations for future research that could be taken up by SUNY faculty based on our reading and understanding of the research literature.

Thus, a goal of this report is that SUNY administrators, faculty, staff, students, and other relevant stakeholders gain a more complete understanding of the science of reading as it is understood by a group of experts who were invited to serve on the TAG. It is our hope that the research summaries, recommendations, and results found within this report will be useful as the SUNY system works to better support SUNY institutions in providing coursework and field experiences aligned with the science of reading to teacher candidates who will become certified teachers. We look forward to continued efforts across the SUNY system to improve the quality of reading instruction and reading achievement for PK-12 students across New York State.

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