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The Primacy of Science in Communicating Advances in the Science of Reading

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ABSTRACT

A recent article in this journal claims that the simple view of reading represents a long-outdated account of what underlies the ability to read. Its authors argue that if teachers are to be better informed about what is known about reading then the simple view must be replaced by a more current model, one that captures the substantial progress that has been made in our understanding through the science of reading. In this comment on that article, we discuss the authors' perspective on the simple view and the three advances in research they claim invalidate it, clarifying misconceptions and critically reviewing presented evidence. We argue that the SVR, centered on the proximal causes of reading capacity under a large grain-size perspective, has garnered strong empirical support, has achieved an important level of consensus within the field regarding its validity, and has shown utility in helping education professionals understand and maintain focus on the most important cognitive capacities underlying reading success. We also argue that the proposed replacement represents a weaker, unproven model that could lead education professionals astray if applied in practice.

Duke and Cartwright (2021) argue that the simple view of reading (SVR) be replaced so that education professionals can gain an up-to-date picture from the science of reading about what reading requires and where instruction must be focused: "Given the enormous popularity of the SVR as the guiding framework for the current 'science of reading' movement, many practitioners have not yet been offered other models that can more productively guide their practice" (p. 15). Without these, the authors claim, education professionals will not be able to avoid the misleading (and presumably harmful) guidance stemming from a dated SVR, for example, through its failing to show that "reading difficulties can have causes beyond word recognition and language comprehension . . ." (p. 4).

While we concur that there has been substantial progress made in understanding reading over the last 35 years, we reject the claims that the SVR has been disproven by this progress and that it no longer provides a useful, theoretically sound, and empirically supported model of reading. Furthermore, we reject the claims that the proposed alternative to the SVR offered by Duke and Cartwright (2021) is superior (either theoretically or empirically), and that it represents an advancement in pedagogical utility. In this comment on Duke and Cartwright's (2021) central claims, we discuss (1) the authors' view of the SVR (addressing issues about what it models, the distinctions it embodies between proximal and distal factors, and its utility for practitioners); (2) the authors' claims that three advances in

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reading research invalidate the SVR (namely, the causes of reading difficulty within and beyond the SVR's two factors of word recognition and language comprehension,[1] the overlap between measures of these two factors and the bridge skills claimed to be supported on the basis of such overlap, and the role of active self-regulation in reading); and (3) the authors' summary conclusion that the SVR, and any other expanded models of reading based on it, must be rejected because of these advances.

Views of the Simple View of Reading

Before discussing interpretations of the SVR, we briefly describe it and some of its key features. Originally proposed by Gough and Tunmer (1986), then further detailed and tested by Hoover and Gough (1990), the SVR holds that reading comprehension is the product of word recognition and language comprehension. Its constructs can be defined as follows (Hoover & Tunmer, 2018):

- Reading comprehension is the ability to extract and construct literal and inferred meaning from linguistic discourse represented in print.
- Language comprehension is the ability to extract and construct literal and inferred meaning from linguistic discourse represented in speech.
- Word recognition is the ability to recognize printed words accurately and quickly to efficiently gain access to the appropriate word meanings contained in the internal mental lexicon.

Hoover and Tunmer (2018, 2020a) have pointed out several features of the SVR that are important to note when considering its empirical evidence and its application in practice:

- It represents only the proximal capacities that underlie reading (namely, word recognition and language comprehension) and ignores the distal ones that impact reading through them. It does not deny that reading is complex, it simply restricts that complexity to the two component capacities.
- It is a static model of reading, not a developmental one, requiring concurrent assessments to properly test its viability.
- By defining reading as the product rather than the sum of its two component capacities, it claims that both components are necessary, neither sufficient, for reading success. In advancing reading, skill in one component cannot compensate for any limitations in the other.
- It invokes parallel definitions of reading comprehension and language comprehension, minimally requiring parallel materials and tasks be used in properly assessing each. As an example, assessing language comprehension via an oral vocabulary measure but reading comprehension via responses to questions about previously read narrative material would violate this stipulation.
- In the original SVR formulation, the ability to recognize words in print was labeled *decoding*, but it is better represented by the broader term *word recognition*, thereby retaining neutrality about how it is achieved (e.g., indirectly through grapheme–phoneme correspondences or more directly through orthographic mapping).

As Duke and Cartwright (2021) recognize, word recognition and language comprehension are distinct constructs within the SVR and they both can be defined and measured independently of each other. But their claims that the SVR represents a "mechanism" for the interaction of "processes" operating "independently" and "sequentially" (pp. 2-4) represents a view of the SVR that runs counter to its original aims. The SVR was not intended as a process model of reading, although we note that the alternative model proposed by Duke and Cartwright (2021) leans much more heavily in this direction.

Types of Reading Models

The SVR is best viewed as a model of the cognitive *capacities* needed for reading and not one of the cognitive *processes* by which reading is accomplished. Castles, Rastle, and Nation (2018) viewed this distinction as one between reading frameworks and models, arguing that the SVR "... is not a model: It does not tell us how decoding and linguistic comprehension operate or how they develop" and further, that "To fully understand reading development, we need more precise models that detail the cognitive processes operating within the decoding and linguistic comprehension components of the Simple View" (p. 27). Nation (2019) argued that the SVR components denoted "... complex constructs rather than explaining a particular cognitive process" (p. 51). We generally agree, although we do not think that modeling is restricted to processes, as capacities and their relationships can also be modeled (as expressed in the SVR's mathematical formulation). Capacities represent abilities (or competencies) while processes represent operations (or performances). Within a domain like reading, capacities describe the accomplishments achieved by processes. The definition of word recognition given earlier (namely, the ability to recognize printed words accurately and quickly to efficiently gain access to the appropriate word meanings contained in the mental lexicon) is an example of a capacity so stated. In contrast, a process definition would describe the cognitive operations used to achieve word recognition, for example, by delineating the mechanisms for converting reflected light patterns that reach the eye from a page of print into a sequence of

letter patterns, then into phonological representations, and finally into linkages to entries in the mental lexicon. Gough (1972) proposed just such a model of the reading process, one he subsequently recognized to be wanting (Gough, 1991). But the SVR later proposed in Gough and Tunmer (1986) was not a second attempt at such a description. Rather it was an account of the broad capacities, or abilities and associated inabilities, that underlie reading skill: "According to the simple view, reading ability can result only from the combination of decoding and comprehension. But reading disability could result in three different ways: from an inability to decode, an inability to comprehend, or both" (p. 7). This describes reading in terms of abilities rather than the processes underlying them.

While cognitive models of capacity and process are distinct, a relationship exits between these different views of cognition: An empirically supported model of a system's capacities entails that any viable model of that system's operations must allow those capacities to be evidenced. If models of both capacity and process are found to have strong empirical support, then those accounts should converge. If they do not, then something is amiss in one (or both) of the accounts.

Given the current state of our knowledge of reading, a model of the processes underlying reading accomplishment must allow for the two distinct capacities of word recognition and language comprehension. If it does not, then it will be inconsistent with our understanding of what is arguably the most substantial body of evidence we have about reading—that the combined abilities to understand a language and quickly and accurately identify its printed words accounts almost completely for the ability to read that language. This conclusion is supported in some 150 studies, involving individuals ranging from beginning reader to expert, from child to adult, and across poverty level and minority status (Hoover & Tunmer, 2020a; Kilpatrick, 2020). This conclusion is also supported in studies conducted on reading in several different languages (Dolean, Lervåg, Visu-Petra, & Melby-Lervåg, 2021). In short, based on what we currently know, the SVR, through the weight of the evidence supporting it, is a valid account of reading capacity that must be accommodated in models of how that accomplishment is achieved.

Construct Independence

For those who doubt the SVR's conception of reading, there are straight-forward demonstrations of its applicability. You can go to any paragraph in this article and successfully read its words in reverse order, a clear example of (fast and accurate) word recognition without the involvement of language comprehension. And you can also ask someone to read any of these paragraphs aloud to you, which you will understand as well as if you had read them yourself, without having to recognize a single printed word.

Given that word recognition and language comprehension can be shown to operate independently, let us pursue the links between capacity and process a bit further. If there is a process model of reading whose operations require that identifying words quickly and accurately can *only* be accomplished through reliance on language comprehension, then that model will run counter to the SVR claim that word recognition is a capacity that can be exhibited independently of language comprehension. However, if that model holds that word recognition can be accomplished independently of language comprehension but that it can also be accomplished through interactions with language comprehension (e.g., in disambiguating homographic words in selected contexts, such as *read* as used in the last paragraph, or by bringing morphological awareness to bear on reading *knowledge*), then that model will not run counter to the SVR.

The question then becomes, what is the balance between the independence and interdependence of word recognition and language comprehension in accounting for reading competence? Given that word recognition is typically measured as speed and accuracy in recognizing words (or nonwords) in isolation, the strong empirical support for the SVR favors mastery of an independent capacity.

Turning to the development of reading, it is clearly the case that in learning to recognize printed words, having those words in one's oral vocabulary is helpful. For words that are only partially recognized through known orthographic–phonologic relationships, completing recognition based on a match to known words benefits word recognition skill development. This includes helping children adopt a *set for variability* in which partially correct pronunciations of target words are used to generate alternative pronunciations until one is produced that matches a word in their vocabulary and is appropriate to the sentence context (Tunmer & Chapman, 2012a, 2012b). But the influence of language comprehension on the development of word recognition skill does not invalidate the SVR claim that what is most important in such development is the mastery of word recognition skills when applied to isolated words. Again, the strong empirical support for the SVR backs this claim.

Grain Size

Concerning the big picture of reading, the SVR is about the "forest" of reading and not its "trees" (Hoover & Tunmer, 2020b). More specifically, it is about the major, large grain size, proximal factors in reading—those broadly encompassing variables of closest origin that directly impact reading comprehension. It is not about the distal factors—those variables that impact reading comprehension, but which do so through their impacts on the proximal factors of word recognition and language comprehension.

Duke and Cartwright (2021) disregard this property of the SVR, stating that one of the reasons it should be replaced is because of its failure to identify other significant factors that impact reading comprehension. But, as we will discuss further below, they fail to adequately show that any of the other variables they discuss impact reading comprehension directly rather than indirectly through word recognition or language comprehension. And evidence of additional variables operating through the proximal factors of word recognition and language comprehension does not invalidate the SVR.

Pedagogical Uses

Duke and Cartwright (2021) state that the SVR is still widely cited and used in teacher training and professional development "partly because of lack of awareness of some model-building and model testing development in research and partly because various statistical models are perceived to be too complex to be readily applied in practice" (pp. 1-2). We suggest it is more likely due to the SVR's clarity about the big picture of reading and its wide support in research. We concur with Savage (2020):

> "The simple view of reading will continue to thrive if for no other reason than for its *translational* value—it is clear and sensible enough to reflect the key science, drive national policy (e.g., Rose, 2006), allow researchers to share findings with teachers, and allow teachers to share details about the key elements of reading with parents and perhaps even children themselves. The simple view of reading can thereby help support effective and differentiated reading instruction and practice for readers around the globe." (p. 44)

Beyond the arguments above, we believe that the continuing utility of the SVR lies in its ability to clearly depict the two main requirements for reading success, with details about the capacities underlying these (e.g., vocabulary knowledge as a part of language comprehension) left to other models (e.g., the framework we discuss below proposed by Hoover and Tunmer, 2020a). Keeping the primary factors of word recognition and language comprehension top of mind helps teachers maintain a focus on what is most central to the development of reading (from novice to expert) and why those two capacities are important (Moats, 2020). In addition, the SVR can also help teachers use assessment procedures and instructional strategies to address the different literacy learning needs of readers they encounter in their classrooms (Arrow, Chapman, & Greaney, 2015).

Three Advances in Reading Research Claimed to Invalidate the SVR

Duke and Cartwright (2021) argue that three advances have been made in the science of reading since the introduction of the SVR that support it being replaced by an alternative model of reading. We discuss each of the advances they raise in turn, concluding that none of them invalidate the SVR.

First Advance: Causes of Reading Difficulties

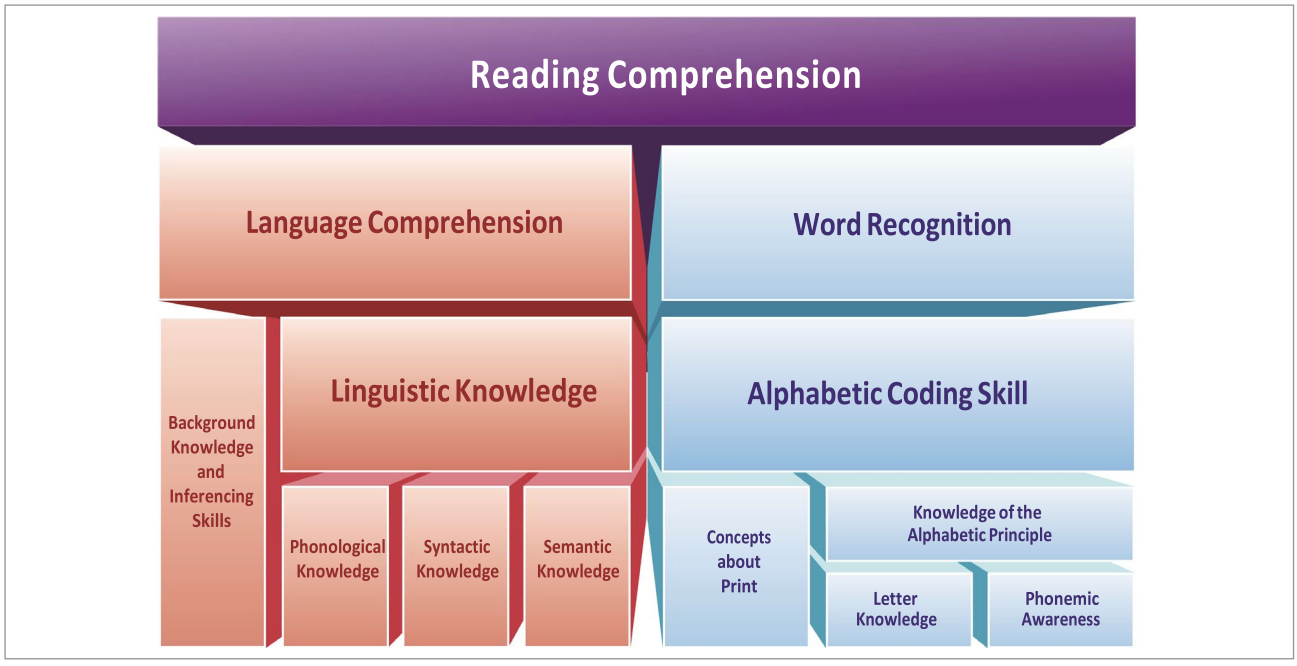
As Duke and Cartwright (2021) state, the SVR holds there are but three broad types of reading difficulties—those due to difficulties in word recognition, in language comprehension, or in both. Duke and Cartwright (2021) cite several studies they claim show that "reading difficulties can have causes beyond word recognition and language comprehension" (p. 4). Such findings, if based on strong evidence, would indeed counter the claims of the SVR, but the cited studies do not provide strong evidence. We discuss two sets of findings as instructive examples.

As one example from a cited study, Catts et al., 2003) reported that in a sample of 183 poor readers, 13.4% had composite scores in word recognition and language comprehension that were above the cutoff points defining poor performance (which was one standard deviation below sample average). But as they reported, the scores of this subset of children were all close to those cutoff points: ". . . few poor readers exceeded or even approached the average score (i.e., z score = 0) for their age on either measure" (p. 6). And discounting the measurement error these authors acknowledge likely contributed to this finding, they show in Figure 1 of their paper that none of the poor readers were above the average score for their age on both measures. Thus, it is difficult to see how Duke and Cartwright (2021) conclude from such data that this study is one that has "identified students with decoding and listening comprehension at grade-appropriate levels who nevertheless exhibit reading difficulties" (p. 3).

As a second example, the authors cite a study by Hock et al. (2009) that looked at 202 adolescent struggling readers (late eighth and early ninth graders). This study reported that while all were below cutoff points that defined poor reading comprehension, 27 (13.3%) were above the similarly defined cutoff points for poor performance in word recognition and language comprehension. The study used composite measures of language comprehension and reading comprehension based on standardized measures that tapped sentence comprehension and vocabulary knowledge for the former, but passage comprehension for the latter. As pointed out by Hoover and Tunmer (2018), strong refutations of the SVR must meet strong evidence requirements, one of which is ensuring parallel comprehension measures for language

FIGURE 1
The Cognitive Foundations Framework, where each cognitive component represents an independent, but not necessarily elemental, knowledge-skill set that is an essential, hierarchically positioned, building block in reading and learning to read. In the hierarchy, some level of skill (but not necessarily full development) is required in all lower-level elements before progress can be made on any connected upper-level elements. Components are defined as follows:

- ***Reading comprehension*: The ability to extract and construct literal and inferred meaning from linguistic discourse represented in printed text**
- ***Language comprehension*: The ability to extract and construct literal and inferred meaning from linguistic discourse represented in speech**
  - ***Background knowledge and inferencing skills*: Knowledge of relevant content, the preceding linguistic discourse, and the situational context, and the ability to use them to derive logical conclusions that go beyond the literal meaning of linguistic discourse**
  - ***Linguistic knowledge*: The unconscious knowledge of a language's grammar (including its phonology, syntax, and semantics), which defines the sound-to-meaning (listening) and meaning-to-sound (speaking) relationships the language allows**
    - ***Phonological knowledge*: Linguistic knowledge about the definition, organization, and combination of speech sounds**
    - ***Syntactic knowledge*: Linguistic knowledge about the definition and combination of phrases, clauses, and sentences**
    - ***Semantic knowledge*: Linguistic knowledge about the meaning bearing units of language at the word and sub-word levels and their use in building meaning at the sentence and discourse levels**
- ***Word recognition*: The ability to recognize printed words accurately and quickly to efficiently gain access to the appropriate word meanings contained in the mental lexicon**
  - ***Alphabetic coding skill*: The ability to map letters and letter patterns onto phonological forms at the level of phonemes**
    - ***Concepts about print:* Basic knowledge about how print works in representing linguistic discourse**
    - ***Knowledge of the alphabetic principle*: The conscious awareness that letters and letter combinations in alphabetic writing systems are used to represent the phonemes underlying spoken words**
      - ***Letter knowledge*: The ability to recognize and manipulate the letters of the alphabet used in print**
      - ***Phonemic awareness*: The ability to consciously recognize and manipulate the phonemic units underlying spoken words**



Note. The color figure can be viewed in the online version of this article at http://ila.onlinelibrary.wiley.com.
Source: Hoover and Tunmer (2020a)

comprehension and reading comprehension. The measures used in the Hock et al. (2009) study clearly are not parallel—and it is not at all surprising that language comprehension based on vocabulary and sentence-level understanding might be high relative to reading comprehension based on passage comprehension.

In further pursuing their first claim, Duke and Cartwright (2021) argue that the SVR constructs may conceal important causes of reading disability:

> "Unpacking the range of contributors to reading may be especially important when it draws attention to a construct that may otherwise be missed in identifying causes of reading difficulty or targets for instruction. One such construct is cultural and other content knowledge. The broad label of language comprehension, under which cultural and other content knowledge falls, is not likely to trigger attention to content knowledge." (p. 3)

But this does not align with their claim that the SVR fails to capture the causes of reading failure. To show that cultural and other content knowledge can serve as a cause of reading difficulty beyond those posited by the SVR, one must demonstrate that such knowledge impacts reading comprehension but neither word recognition nor language comprehension. While Duke and Cartwright (2021) recognize this is not the case concerning cultural knowledge, they seem to overlook it as a counter to their argument: "Indeed, knowledge from one's cultural experiences affects listening and reading comprehension . . ." (p. 4). To validate their claim against the SVR, they would need to show that such knowledge impacts the latter but not the former.

In summary, Duke and Cartwright (2021) have not shown that the SVR claims about reading ability and disability are inaccurate. We have yet to see any set of high-quality, replicated studies revealing successful reading comprehension coupled with unsuccessful word recognition or language comprehension, or unsuccessful reading comprehension coupled with successful word recognition and language comprehension.

Second Advance: Dependence and Bridge Skills

Duke and Cartwright (2021) claim that word recognition and language comprehension are dependent reading skills and that bridge skills explain the significant overlap between them. Failing to show this dependence is another reason behind their argument that the SVR should be replaced: ". . . presenting practitioners with models that depict word recognition and language comprehension as entirely separate is inconsistent with research, which has documented considerable shared variance between these constructs in the prediction of reading" (p. 6). There are several points to address in this claim.

First, the finding of shared variance between word recognition and language comprehension in explaining reading comprehension is not contrary to the SVR. Indeed, Gough and Tunmer (1986) pointed out in the original SVR proposal that word recognition and language comprehension were known to be correlated in the general population. But more to the point, the SVR is neutral about such shared variance, making no prediction about it.

Shared variance between two variables simply indicates that they vary together, and in the context of multivariate statistical procedures for partitioning variance, it means they vary with each other in their impacts on an outcome variable. However, Duke and Cartwright (2021) hold that such shared variance in this context indicates a shared process:

> "A second feature of the active view of reading model is that it depicts word recognition and language comprehension as overlapping and explicitly identifies processes that bridge these constructs. This feature of the model reflects the shared variance (i.e., the overlap) that many studies have found between word recognition and language comprehension . . ." (p. 8)

But shared variance does not entail shared process and using a finding of shared variance to establish a shared process is misguided. As we show below, much stronger evidence is needed.

Second, the principle of parsimony in science, the view that the simplest interpretation of a finding is preferred when the evidence for a more complicated one is lacking, applies in this case. As we have argued previously (Hoover & Tunmer, 2018, 2020a; Tunmer & Hoover, 2019), rather than invoking a new variable (or combination of variables) to understand any shared variance between word recognition and language comprehension impacting reading comprehension, one simpler explanation is that this variance arises from Matthew effects, which have long been reported to operate in learning to read (Stanovich, 1986). Under this proposed account, word recognition and language comprehension vary together with reading comprehension over time because those variables are similarly impacted through important aspects of the environment in which they develop, namely, exposure to print. The more one reads, the stronger one's word recognition and language comprehension skills become, and the stronger these become, the stronger reading comprehension becomes. In this proposal, reading comprehension is seen to develop in a reciprocal fashion with its two proximal causes, and no additional variable is needed to explain the finding of shared variance.

Foorman and colleagues (Foorman & Petscher, 2018; Foorman, Wu, Quinn, & Petscher, 2020), cited by Duke and Cartwright (2021), have found that word recognition and language comprehension make both

independent as well as shared contributions to reading comprehension, but that these contributions reveal different patterns from elementary school to high school. Their interpretation, which also does not require the inclusion of additional variables, is that word recognition and language comprehension have a synergistic relationship with reading comprehension, where the two proximal factors have a dynamic influence on reading comprehension beyond any influences each one may exert individually. We believe that Matthew effects, representing reciprocal causation, could be viewed as a form of such synergy.

Lonigan, Burgess, and Schatschneider (2018), in a study also described by Duke and Cartwright (2021), made the claim that such shared variance could be due to a distal factor impacting both word recognition and language comprehension, which would not require introduction of another proximal factor into the SVR. They proposed, consistent with the principle of parsimony, that "a general linguistic or cognitive ability" (p. 271) could be driving both word recognition and language comprehension, causing them to vary together and impacting reading comprehension through them. Their overall conclusion is one with which we concur: "To date, there is no substantial evidence indicating that the SVR needs to be made more complex by adding additional components or processes" (p. 271).

But if shared variance is insufficient to show the need for an additional proximal variable in the SVR (whether it is a distinct or hybrid variable), just what would be required? First, a competing theory must postulate an additional construct and detail what it explains beyond what the SVR is able to explain. Second, the construct must yield additional variables that can be clearly defined and measured distinctly from word recognition and language comprehension. Third, variation in such measures must make both unique and substantial contributions to reading comprehension beyond the contributions of word recognition and language comprehension.

Meeting these three requirements in high-quality studies would yield an improvement in our understanding of reading.[2] But currently there is neither strong nor converging evidence of this sort supporting the bridge variables Duke and Cartwright (2021) have proposed. Rather than serving as proximal bridge variables, some of these may serve as distal variables impacting reading comprehension through word recognition (e.g., reading fluency) or language comprehension (e.g., vocabulary and morphological awareness), and focusing instruction on them may be helpful. But others the authors propose (e.g., executive function skills, as described below) lack consistent empirical support as either proximal or distal variables specifically impacting reading comprehension.

Third Advance: Active Self-regulation and Other Unnamed Variables

Duke and Cartwright (2021) state that active self-regulation and executive function (EF) skills are critical components of reading, ones that are not a part of the SVR, which is another argument they make for its replacement: ". . . there is no place in the original SVR for EF skills . . . [and] models consistent with the science of reading must include a role for EF skills" (p. 7). They state that "EFs include three core skills—cognitive flexibility, working memory, and inhibitory control—and skills such as attention and planning . . ." (p. 6). Given the prominence the authors place on EF skills, we focus our comments on these rather than on the others they also raise, namely, motivation and engagement, and strategy use.

Duke and Cartwright (2021) hold that EF skills have direct impacts on reading comprehension: "Several EF skills contribute directly to reading . . ." (p. 6). But they also state that these operate indirectly through other factors: "EF skills also contribute to reading ability indirectly, through both word recognition and language comprehension processes . . . and thus also help explain the shared variance between word recognition and language comprehension" (p. 7). As noted above, variables claimed to impact the proximal causes of reading would not invalidate the SVR, but variables proposed as additional proximal causes would. We have already detailed what would be required to support claims of adding proximal variables to the SVR account and will not repeat that here. We will simply state that the evidence Duke and Cartwright (2021) cite in support of EF skills serving in proximal roles does not meet the requirements discussed.

But let us consider a recent example of a strong test of this view of EF skills as proximal factors, one that employed multiple measures for each of the critical constructs that were then used to derive latent indices of those constructs. Based on longitudinal data from 184 Romanian children spanning second grade, Dolean, Lervåg, Visu-Petra, and Melby-Lervåg (2021) reported that in their structural equation models, the latent variables of word recognition and language comprehension made significant contributions to reading comprehension, accounting for 92% of its variance, while that for latent EF skills made no additional contribution. They also reported that once word recognition was mastered (which is achieved relatively quickly in the transparent Romanian orthography), language comprehension showed a strong effect on reading comprehension while word recognition and EF skills did not. This study at least begs the question whether EF skills can stand as a proximal factor impacting reading comprehension beyond word recognition and language comprehension. Furthermore, as the authors argued, the study suggests that instruction that pursues the development of language comprehension skills over EF skills once word recognition

is mastered will likely be best for advancing reading comprehension (at least in this sample). Without further considering the evidence for EF skills that Duke and Cartwright (2021) cite, the general point here is this: Asking teachers to focus their instruction on something that *at best* has inconsistent support under strong assessment *over* skills research unequivocally identifies as important, like word recognition and language comprehension, is of great concern as it could have detrimental impacts on children.

Further to their third claim, Duke and Cartwright (2021) re-state that the SVR fails to name many variables that have been shown to impact reading comprehension: ". . . there are many contributors to reading not named in the simple view . . . that play a substantial role in reading" (p. 1). As stated earlier, this fails to recognize that the SVR only describes the major (cognitive) proximal causes underlying reading comprehension. We have proposed a model of the cognitive capacities needed to master the SVR's two proximal causes, defining each of the distal constructs and showing their developmental interrelationships. The model is shown in Figure 1 along with the definitions of all component capacities. Duke and Cartwright (2021), in discussing this model, reject it because it is based on the SVR's claim of independent proximal constructs:

> "Some more complex depictions of reading that share intellectual roots with the SVR, discussed later, also do not allow for a construct to be included in, or affect both, word recognition and language comprehension; each construct is placed into either the word recognition or the language comprehension strand, not in both." (p. 4)

But, as pointed out earlier, their claim for the interdependence of processes representing these constructs within the SVR based on findings of their shared variance is misguided and fails to recognize the considerable evidence that supports the notion that the processes underlying these capacities *can* operate independently with substantial, distinct impacts.

In addition, the EF skills defined by Duke and Cartwright (2021) would apply to cognitive capacities that go far beyond those specifically related to reading (e.g., working memory would be important in learning any cognitive task, such as acquiring mathematical skills). This raises issues around the *assumption of specificity* (Stanovich, 1991)—the notion that any claimed cause of reading difficulties needs to be reasonably specific to the task of reading. The SVR proximal factors are clearly specific to reading, as are those cognitive capacities underlying them as depicted in our proposed framework. In this way the SVR and the proposed framework are describing capacities specific to reading (e.g., word recognition and the underlying capacities of alphabetic coding skill and phonemic awareness; language comprehension and the underlying capacities of phonological knowledge and linguistic inferencing), where difficulties in any one capacity could lead to specific reading difficulties. The Duke and Cartwright (2021) proposed alternative seems to go well beyond reading, extending to learning difficulties in general, which begs the question of its utility in specifically understanding reading and reading disability.

Regarding reading disability, Duke and Cartwright (2021) state that EF skills may account for reading disability when both word recognition and language comprehension skills show no signs of disability: "EF is so important to reading that there is reason to believe that for some students, limited EF skills are the primary cause of reading difficulty" (p. 7). But again, the authors have not provided strong evidence of such—they have not shown that EF skills can impact reading comprehension beyond word recognition and language comprehension, nor have they presented high-quality studies showing children exhibiting difficulties with EF skills and reading comprehension in the context of strong word recognition and language comprehension skills.

Finally, Duke and Cartwright (2021) argue that all the constructs proposed in their model can be improved through instruction. Of course, this is an important aspect of any model of reading, including the SVR, but it is not a feature critical for establishing scientific worthiness.

Upholding the Role of Science in Communicating about Science

Stanovich (1993) describes three scientific criteria for evaluating knowledge claims: Publication of relevant findings in peer reviewed journals, replication of those findings by other disinterested investigators, and a consensus within the field based on converging findings from a critical mass of studies. The SVR has met all three of these, while the alternative model proposed by Duke and Cartwright (2021) as a replacement for the SVR has not, which the authors recognize: "A third limitation of our active view of reading model is that it has not been tested as a whole in research" (p. 14). In summary, the SVR, with a focus on the proximal causes of reading capacity under a large grain-size perspective, has strong empirical support and has achieved an important level of consensus within the field. In addition, it has shown utility in helping education professionals attend to the most important cognitive capacities underlying reading success.

Given these circumstances, it is difficult to make sense of the main claim made by Duke and Cartwright (2021):

> "That said, our aim in this article is more modest: to offer an alternative to the dominant model presented to practitioners, the SVR, that conveys key advances from scientific research on reading not captured in the SVR. What our model lacks in simplicity, it makes up in actionability, pointing to many specific

> contributors to reading, and their relations, that practitioners can impact through instruction." (p. 15)

To hold that the SVR must be replaced by an alternative because of its failure to capture what science has revealed about reading over the last 35 years, is unsupportable. Quite to the contrary, the SVR has gained substantial empirical support during this time, with recent evidence confirming, for instance, that in high-quality latent variable studies across elementary grade students, word recognition and language comprehension capture almost all the variance in reading comprehension (Hjetland et al., 2019; Language and Reading Research Consortium & Chiu, 2018; Lervåg, Hulme, & Melby-Lervåg, 2018; Lonigan, Burgess, & Schatschneider, 2018; Nation, 2019).

The SVR may be *augmented* by other models that reveal additional understandings of what lies underneath its main cognitive capacities, and as noted above, several have been proposed, including one we have offered. Models that consider the development of reading are critical, including those that may challenge the validity of the SVR representation across time (Foorman & Petscher, 2018; Foorman, Wu, Quinn, & Petscher, 2020). Models that expand understanding beyond the SVR to address non-cognitive factors, such as motivation and engagement, are also needed. But at present, the SVR's replacement is unfounded based on both the available evidence and its known utility in practice. Still, Duke and Cartwright (2021) continue this reasoning in their closing statements:

> "Developments in our understanding of reading, particularly contributors to reading that are amenable to instruction, require updating and enhancing initial and continuing professional development of teachers, literacy specialists, instructional coaches, speech and language pathologists, and others who interface with U.S. reading education. There is no shame in the need for revision; in fact, it is a sign of embracing science over ideology, progress over nostalgia." (p. 15)

We agree that we all must strive to learn more and to communicate those learnings where they can best be used. But we are concerned with advocating disregard for what science strongly supports and replacing it with something having so little support, especially under a false claim of progress. In the interests of those education professionals who we all urge through our translational communications to rely on science for guidance in their work with children, we must ensure that we consistently put science first, and evidence, no matter its age, over any unsubstantiated novelty of newness. If we do not, educators will learn, and justifiably so, to turn away from science, not toward it.

NOTES

[1] In this comment we use the terms word recognition and language comprehension when referencing the two components of the SVR, although in quoted material we leave the terms that are often used in their stead, decoding and listening or linguistic comprehension, respectively.

[2] Note that if the added construct is not malleable then the skills it represents, while benefiting our understanding, would not aid our ability to support improvements in reading.

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