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Sentences Are Key: Helping School-Age Children and Adolescents Build Sentence Skills Needed for Real Language

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ABSTRACT

Purpose: In this article, we present key concepts pointing to the importance of targeting complex sentences for school-age children and adolescents with developmental language disorders (DLD). Drawing on current treatment research, we argue that the sentence is a crucial but often neglected piece of the puzzle when it comes to understanding relationships between DLD and academic outcomes. We provide detailed suggestions for how clinicians can focus on complex sentence structures in natural academic contexts to bridge this gap.
Method: Background information on sentence complexity is presented, along with a rationale for targeting complex sentences with school-age children and adolescents with DLD. Intervention methods from a variety of studies targeting multiclausal sentences are discussed in relation to current accounts of language learning and language processing models. We provide a robust catalog of suggested strategies for targeting sentence complexity in a manner that is aligned with research findings to date and integrated into real academic contexts.
Conclusions: Complex sentence structures are a key challenge for students with DLD as they tackle discipline-specific language and academic tasks. Sentence complexity treatment programs employ one or more treatment methods including priming, modeling, recasting, contextualization, metalinguistic instruction, and sentence combining. While studies have consistently shown a measurable improvement in complex sentence production on proximal outcomes regardless of treatment approach, evidence of durable, functional changes for students with DLD remains sparse. We encourage new treatments that target comprehension and production of complex sentences in real-life academic contexts in clinical practice and research.
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A substantial number of children (7.4%) begin formal schooling with developmental language disorders (DLD; Tomblin et al., 1997), placing them at considerable risk for learning difficulties in an academic language environment (Ziegenfusz et al., 2022). Some children may not be identified as having DLD at school entry, but general language comprehension problems impact reading comprehension later in mid-elementary grades when confronted with more complex language found in school texts (Catts et al., 2005, 2006). DLD is persistent and there can be lifelong repercussions in education, employment, social relationships, and independent living (Dubois et al., 2020; McGregor, 2022; Young et al., 2002). Of particular concern is the fact that many students with DLD may not be identified by school personnel as needing any kind of special assistance. In a recent study of community-identified elementary children meeting a research definition of DLD,

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only a small minority (15%) were receiving supplemental services (Duff et al., 2022). The need for improved identification and innovative treatments in this large population of individuals with persistent language disorder is great.

Over the years, researchers have identified syntax difficulties as a core feature of DLD with an emphasis on morphosyntactic systems that include verb tense/agreement/aspect, number, pronoun case/gender, and articles (Rice et al., 1995; Tager-Flusberg & Cooper, 1999). Likewise, morphosyntactic targets have dominated the intervention literature, not only for younger preschool children but continuing through elementary school years (Ebbels, 2014). We note that morphosyntactic difficulties, often omissions of common grammatical markers, are noticeable even by untrained listeners. However, as researchers expanded their studies to older school age children, adolescents, and even young adults with DLD and/or learning disabilities, it was soon obvious that a wider syntactic lens is required to describe language difficulties. With age, morphosyntax errors often decrease or resolve (Rice et al., 1998), but complex syntax can be problematic. Examples of complex syntax include passive voice and clausal subordination (e.g., adverbial, object complement, and relative clauses).

The intervention literature began to reflect this wider syntactic lens as clinical researchers designed programs to target sentences with more complex argument structure (Ebbels, et al., 2007) and subordinate clauses of various types (Balthazar & Scott, 2018). Even so, it is not easy to determine whether complex sentences should be targeted for treatment. Older school children and adolescents with DLD often show weaknesses across language components/levels (word, sentence, text) and modalities (listening, speaking, reading, and writing). Due to its inherent complexity, dividing language into components, modalities, and even genres (conversational, narrative, expository) is helpful to interventionists but also raises nontrivial questions about which targets to prioritize during limited intervention time.

To help determine whether sentence complexity is a good fit for intervention, Section 1 provides background information on the variety of syntactic structures that make sentences more complex and discusses why these types of sentences are important to target.[1] In Section 2, we review methods and outcome measures used in intervention programs targeting sentence complexity published to date and discuss these programs within current accounts of language learning and language processing models. As shown, evidence that gains in these programs have an impact on academic performance is limited. In Section 3, we conclude by suggesting ways to bridge this gap by targeting sentence complexity in a manner more integrated with language learning models in real academic contexts.

Section 1: The Importance of Complex Sentences for Children and Adolescents

What Makes Sentences Complex

In this article, we treat sentence complexity as a broad construct that includes a variety of structures. In previous work, we have provided examples of structures that can create comprehension and production problems in spoken and written language modalities for school-age children (Balthazar & Scott, 2017, 2018; Scott, 2009; Scott & Balthazar, 2010, 2013). Studies of naturalistic language production in children with DLD have often measured syntactic complexity in global terms of (a) sentence length (the average number of morphemes or words in a sentence) and/or (b) the average number of clauses (main and subordinate) per sentence—a measure labeled as clause density, or synonymously, the subordination index (Lenhart et al., 2022; Nippold et al., 2008, 2009; Scott & Windsor, 2000). The first measure, average sentence length, would include complexity features within clauses, as well as across clauses; the second measure, clause density, is restricted to the extent of clausal subordination. A smaller number of studies have tallied occurrences of particular structures (e.g., occurrences of adverbial clauses or relative clauses or noun phrase modification; Marinellie, 2004; Scott & Lane, 2008). Researchers interested in sentence comprehension abilities of children with DLD have included a variety of sentence types predicted to challenge comprehension including those with an increasing number of obligatory arguments, passive voice, postmodified subject, and/or object nouns, object relative clauses, and *wh*-questions, among others (Leonard et al., 2013; Montgomery et al., 2018).

One way to think of sentence complexity is to define it as any structure that adds to, interrupts, or changes the subject–verb–object (SVO) order within a clause or adds clauses within a sentence and can be reasonably predicted to increase the processing "load" of the sentence. English sentences follow a pattern where the grammatical subject (the agent) precedes the verb (the action or state), which is followed by the object (the patient)—the SVO order. Examples enumerated below all add complexity to SVO sentences. Note that some structures occur within a clause (and, therefore, could occur within a one-clause sentence

[1]We use the terms *syntactic complexity* and *sentence complexity* as synonyms. The sentence is the "domain" of syntactic complexity and is the grammatical unit that clinicians and students will attend to and manipulate during assessment and intervention activities.

(nos. 1, 2, and 3) and others add a subordinate clause to a main clauses (a multiclausal sentence).[2]

1. Increases in the number of clause elements: Adding obligatory arguments (e.g., an indirect object as in *John gave Mary the book*) or optional elements (adverbials) as in *On Wednesday after school we will pick apples at the U-Pick farm in Fennville*.
2. Noncanonical word order: Passive voice (*The dog was washed by the boy*) where the grammatical subject *dog* is not the thematic agent *boy*. Reversible passives are particularly difficult (e.g., *The cat was chased by the dog*).
3. Adding noun phrase modification, particularly postmodification, after the head noun: (*Many colonists in the northern and middle colonies and in larger towns did not support the war effort*). The underlined postmodification interrupts the subject noun *colonists* and verb *support* by a span of 10 words.
4. Increases in the number of clauses per sentence: Adding coordinated or subordinated clauses to the main clause. Major types of subordinate clauses include (a) adverbial (*After hearing about the Boston Tea Party, Parliament punished the colony of Massachusetts*), (b) relative (*Harold who was king of England made many tactical errors fighting William the Conqueror*), and (c) object complement (*The voters hoped the new administration could break the deadlock in Congress*). The object complement[3] clause functions as a direct object of the preceding verb.
5. Long-distance (nonlocal) dependencies (gaps): Object relative clauses (*The dog that$_i$ the boy chose ~~the dog~~$_i$ at the shelter wagged its tail and barked*). The relative pronoun *that* refers to the trace grammatical object *dog*.
6. Anything that makes it harder to discern the main clause–subordinate clause relationship: These include (a) left-branching (preposed) adverbial clauses or prepositional phrases that add processing load in front of the main clause, (b) increased depth of subordination where a subordinate clause contains its own subordinate clause, (c) structures that interrupt the main clause subject and verb (e.g., noun postmodifying structures including prepositional phrases, appositives, and center-embedded relative clauses), and (d) combinations of these (e.g., *Although the teacher that the school hired mid-year tried his best, student math scores kept dropping*). The example contains a left-branching adverbial clause where the subject *teacher* and verb *tried* are interrupted by an object relative clause.

It is helpful to picture a phrase structure diagram of a sentence with its governing nodes, branches, and levels illustrating grammatical relationships between elements of the sentence (its linear and hierarchical [tree] structure). Diagrams of the italicized sentences above would show several nodes, branches, and levels. This visual picture of grammatical complexity reminds us of the complicated syntactic representations that must be learned and held in long-term linguistic memory by a competent language user and why children with DLD might struggle comprehending and producing such sentences (Montgomery et al., 2021).

Why Target Sentence Complexity

We draw on several types of evidence as support for prioritizing interventions that build sentence complexity in school-age children, adolescents, and young adults with DLD. At the most basic level, these structures are needed to communicate more complicated ideas and relationships among ideas (Beers & Nagy, 2009; Nippold & Marr, 2022). Although simple sentences are used selectively by speakers and writers as a stylistic device, complex ideas would be difficult to communicate without complex sentences. It follows then that sentence complexity structures constitute important targets from a developmental perspective as children's social and academic worlds expand and become more complex. Beginning with school-based studies by Hunt (1965, 1970) and Loban (1963, 1976) in the 1960s and 1970s, a great many studies analyzing naturalistic language samples document slow but steady increases of complex syntax in both spoken and written output—increases that continue through adolescence and on into young adulthood. For example, Hunt (1965) showed that complexity growth as reflected in average written sentence length increased from 13 to 16, 17, and 25 words across Grades 4, 8, 12, and adult levels, respectively. Nippold et al. (2005) documented complexity growth for children, adolescents, and adults in both conversational and expository discourse where sentence length, number of relative clauses, and number of

[2]Sentence complexity is a construct that different clinicians and researchers may operationalize in different ways. Some restrict use of the term "complex sentence" to multiclausal sentences (those with two or more clauses), which are then contrasted with "simple sentences" (one clause). In the list of complexity features here, we have chosen a broader view. Research has shown that several syntactic features that operate *within* a clause add processing load for children with DLD (e.g., active vs. passive voice; Montgomery et al., 2018). Depending on the particular structures, a one-clause sentence might be more difficult to process than a multiclausal sentence.

[3]This usage of the term "object complement" from Quirk et al. (1985) is different from some frameworks (e.g., the Cambridge Grammar of English; Carter and McCarthy, 2006).

sentences (volume) showed substantial change. Nippold (2016), Perera (1984), and Scott (1988) can be consulted for details of specific complex syntax structures characteristic of older school children and adolescents.

In addition to developmental relevance, a second reason for targeting complex sentences is that they are harder than simple sentences to comprehend and produce. Syntactic complexity carries a processing cost for *all* communicators in *all* modalities—listening and reading, as well as speaking and writing. The literature is replete with studies showing that sentences with the types of complexity features listed above impact comprehension. Wingfield et al. (2003) provided a good example using the contrast of center-embedded subject relatives (easier) versus object relatives (harder) in a listening task with adults. Both young and older adults were less accurate answering questions of the "who did what to whom" variety for sentences with object relatives (characterized by long-distance dependencies). Further, when sentence rate was increased via speech compression, the syntactic complexity effect was exacerbated, particularly for older adults. Although fewer in number, studies of production also show a processing cost of complexity. When college students and adults were asked to produce sentences with object relative clauses and questions (which, like object relatives, contain long-distance dependencies), these sentences took longer to begin (formulate), longer to actually produce (say), and had more disfluencies when compared with easier subject-extracted versions (Scontras et al., 2015).

Sentence complexity has an even greater impact on individuals with DLD when compared to same-age peers. On the comprehension side, numerous studies have reported difficulty processing sentences with noncanonical order (e.g., passives; Montgomery & Evans, 2009; Norbury et al., 2002; van der Lely, 1998) and long-distance dependencies (e.g., object relatives; Friedmann & Novogrodsky, 2004, 2007). Montgomery et al. (2018) went the next step to investigate how comprehension performance for the canonical and noncanonical contrast in active/passive is associated with cognitive variables that included working memory, language knowledge in long-term memory, controlled attention, and fluid reasoning. Studying a large group of children with DLD and propensity-matched controls between the ages of 7 and 11 years and using structural equation modeling, the researchers tested different models of best fit between cognitive variables and sentence comprehension. The best model was one in which working memory mediated the relationship between the other cognitive variables and comprehension, with group differences for the influence of language knowledge stored in long-term memory. They argued that comprehension for both types of sentences was more automatic for children with typical language (TL) because they could draw on stored multiword chunks (structural templates). In contrast, without these stored patterns, comprehension was a more conscious (word-by-word) effort for children with DLD, particularly for noncanonical (passive) sentences.

In addition to studies of listening comprehension, there is ample evidence that children and adolescents with DLD have difficulties with reading comprehension that can be directly or indirectly traced to sentence complexity. A longitudinal study of a large epidemiological sample of kindergarten children with DLD revealed that reading comprehension in 10th grade was at a sixth-grade level (Catts et al., 2008). In the same sample at eighth grade, Nippold (2017) reported a significant relationship between tests of reading comprehension and syntax. Because reading comprehension relies on many factors besides syntax such as vocabulary, inference, and background knowledge, it can be difficult to isolate the effects of sentence-level comprehension on text comprehension. However, Poulsen and Gravgaard (2016) designed a study to test whether comprehension of complex sentences explained variance in text-level comprehension after controlling for basic sentence comprehension and other variables that included memory, vocabulary, and decoding. Testing results with fifth-grade readers led the researchers to conclude that comprehension of complex sentences explains individual differences in the ability to comprehend written texts.[4] We have provided clear examples from clinical transcripts of how the misinterpretation of individual multiclausal sentences while reading can impact comprehension (see Scott & Balthazar, 2013, p. 18; Scott & Koonce, 2014, p. 288).

On the production side, language sample analysis (LSA) studies of speaking and writing of children and teenagers with DLD reveal evidence of their struggles to produce adequate quantity, variety, and error-free versions of complex sentences needed for the communication of complex ideas across genres that include conversational, narrative, persuasive, and expository/informational. Investigations of both speaking and writing in these genres reveal reduced sentence length, fewer sentences with two or more clauses, less embedding depth, less noun phrase elaboration, and more frequent grammatical errors (Domsch et al., 2012; R. B. Gillam & Johnston, 1992; Marinellie, 2004; Nippold et al., 2008, 2009; Scott, 2020; Scott & Lane, 2008; Scott & Windsor, 2000; Windsor et al., 2000). Group differences when compared to children with TL are also found in studies using elicited tasks as opposed to LSA (see Frizelle & Fletcher, 2014, on relative clauses and Steel et al., 2016, on object complement clauses).

[4]Fifth-grade participants in this study were drawn from a general population of school children.

A third reason for targeting sentence complexity comes from the examination of oral and written academic language from mid-elementary through secondary grades. Students are expected to engage in oral discussion of topics and issues where complex ideas require complex sentences to explain, elaborate, and debate. Teacher input is complex. Textbooks increase in sentence-level complexity by grade (see Curran, 2020). The linguistic complexity of test items on required state and national tests can be challenging and has been shown to affect performance (Cawthon et al., 2012). The expectation that students can learn and perform in this linguistic environment is encoded in national standards that call for increasing complexity in texts that students read with understanding and in the written products they produce. As noted by Schleppegrell (2013), there is a tendency for educators to associate text complexity with vocabulary level, but this would be a mistake because it also involves grammar and text organization.

Educators and linguists have provided detailed descriptions of "the language of schooling" by specific content area (Fang, 2006; Schleppegrell, 2004; Scott & Balthazar, 2010). The idea is to document how different disciplines favor different syntactic mechanisms for conveying information, a pursuit labeled as disciplinary literacy (Ehren et al., 2012; Shanahan & Shanahan, 2012). For example, according to Fang (2006), science texts have (a) informational density via a greater proportion of content words packed into clauses (nouns, verbs, adjectives, and some adverbs); (b) explanation and elaboration via pre- and postmodification of nouns in the form of prepositional phrases, appositive constructions, and relative clauses (e.g., *the lush green tropical rain forest formed from the remains of once-living organisms*); (c) abstraction via nominalization that turns verbs and adjectives into abstract process nouns (e.g., *evaporation, condensation, this narrowing*...); and (d) authoritativeness via mechanisms such as passive voice that remove the agent.

In summary, there are important reasons for targeting sentence complexity in interventions designed for older school children and individuals with DLD. These include developmental appropriateness, processing costs, and the complex syntax inherent in academic language. We emphasize this information because it may not be obvious that a problem processing (producing and/or comprehending) complex sentences could be a major contributor to language related literacy difficulties. A student with sentence processing problems might function adequately in familiar, everyday, interactive language contexts. However, in less familiar contexts used for language sampling—for example, making up a story to go with picture prompts or telling how to play a favorite game, or when completing a school writing assignment—difficulties emerge. Even in the language contexts where sentence processing problems emerge, trained professionals (speech-language pathologists [SLPs]) often focus on other, nonsyntactic, features in judging language complexity. Research has shown that SLPs are inconsistent when asked to make decisions about the need for intervention based on the level of language complexity present in language samples (Bawayan & Brown, 2022). In addition, when a student fails to comprehend language input, whether listening or reading, the underlying reason can be opaque. Perusal of the reading comprehension literature shows that problems are commonly blamed on vocabulary or macrostructure (text organization) deficits rather than sentences (Scott, 2009; Shanahan, 2022). As noted in our opening remarks, many students with DLD and literacy disorders are not being identified by regular and special educators (Duff et al., 2022).

Section 2: Methods Used in Intervention Programs Targeting Sentence Complexity

Treatment studies of specific sentence features that increase complexity have targeted passives (Ebbels, 2007; Ebbels & van der Lely, 2001); *wh*-questions (Ebbels & van der Lely, 2001; Ebbels, et al., 2007); coordinating conjunctions (Ebbels, 2014); and, more recently, a variety of subordinate clauses in multiclausal sentences (Balthazar & Scott, 2018; Curran & Owen Van Horne, 2019; Levy & Friedmann, 2009; Wada et al., 2020; Zwitserlood et al., 2015). Methods used in these clinical studies have varied considerably, often in accordance with age and developmental level of participants.

As noted previously, complex sentence structure in reading and writing becomes an increasingly important area of language functioning as the school years progress, in the acquisition of literacy skills and in learning specific disciplinary content (for comprehensive reviews, see Scott & Balthazar, 2010, 2013). The written modalities and concomitant development of metalinguistic skills (Kamhi & Koenig, 1985) allow for metalinguistic teaching methods to be introduced, for the purpose of making important syntactic information overt and available for examination (Ebbels et al., 2007) or to supplement language functions presumed to be impaired (Calder et al., 2018; Ebbels, 2014). The effectiveness of metalinguistic strategies for improving morphosyntactic skills remains an area of debate (Baron & Arbel, 2022; Finestack, 2018; Finestack & Fey, 2009), a debate that is situated within an evolving understanding of the mechanisms and principles of language processing and learning (R. B. Gillam et al., 2019; Montgomery & Evans, 2009; Montgomery et al., 2018; Plante & Gomez, 2018). To date, regardless of the specific methods used, most investigations of sentence-level

interventions have resulted in improved performance on proximal outcome measures that are taken during or closely following treatment and often involve tasks similar to treatment tasks. However, there is relatively little evidence for improved performance on more distal measures that are less like treatment tasks and more likely to require comprehension or production of complex sentences in discourse, text, or naturalistic tasks. The durability of treatment effects has also been infrequently documented.

Methods of Intervention

Complex sentence interventions assume that students with DLD are capable of expanding their syntactic knowledge and skills beyond early developing morphology and syntax and that the fundamental mechanisms of learning do not differ from those of typically developing peers. The methods used for teaching sentence complexity have been applied in a variety of combinations and situated within varying linguistic and nonlinguistic contexts.[5] Here, we describe methods that have been applied to teaching complex syntactic structures to older children with DLD, and in the subsequent section, we will discuss how these methods have been applied using sentence-level or contextualized treatment stimuli.

Priming/Bombardment

Structural or syntactic priming (hereafter "priming") refers to an unconscious process in which exposure to a syntactic structure increases the likelihood of a speaker producing that syntactic structure (Leonard, 2011). Priming is the principle behind the therapeutic practice of bombardment, in which a target structure is repeated in a high concentration, with the aim of activating pattern recognition processes and increasing the likelihood that the learner will be biased to produce the target pattern (Baron & Arbel, 2022; Leonard, 2011). When priming or bombardment is implemented therapeutically, the learner's role is passive, in that no productions of the target structure are required, and the clinician does not provide corrective or other feedback on performance. It may be useful to view priming as a tool of inductive learning, within the framework of principles derived from statistical learning studies (Plante & Gomez, 2018). This method requires a high level of control over input in order to maximize inductive learning. Massed presentation of utterances containing the target structure is key, but it is also important to remove any counterexamples and to vary the nontarget features of the stimulus sets (Baron & Arbel, 2022; Plante et al., 2014). Some researchers have suggested that it may be necessary to deliberately distract the learner from any conscious awareness of the language learning task to avoid activating the explicit or deductive learning system, which is considered to be the default process that competes with inductive learning (Baron & Arbel, 2022). In his 2011 tutorial on priming, Leonard explained that while priming is generally recognized for its immediate effects on language production, it has also been shown to affect comprehension and may be important for learning language structures by strengthening connections between form and meaning. Although studies have not typically investigated priming effects on children's learning of new syntactic structures, Leonard (2011) argued that priming is a form of implicit learning and that the findings from priming research support several of the methods described below, including modeling, focused stimulation, and recasting. Nonetheless, relatively little is known about whether priming increases the long-term likelihood that target structures will be learned to the extent that they are used in functional contexts. Furthermore, the majority of treatment-relevant research on priming and statistical learning involves young children learning words or single-clause sentence structures, and it is unclear how priming applies to older individuals learning complex, multiclausal syntactic structures. There is also some limited evidence to suggest that structural priming is actually weaker in language-impaired children (Garraffa et al., 2018). See the work of Balthazar and Scott (2018) for an example of a priming step when targeting use of subordinate clauses.

Modeling/Focused Stimulation

As with priming and bombardment, modeling and focused stimulation techniques involve providing models of the target structure; however, these are delivered in a naturalistic communicative context that allows the learner to associate form with meaning (Fey, 1986; Fey et al., 2003). Central to all modeling methods is the assumption that language learning and generalization will be greatest when models relate to the subject of the learner's attention. Modeling and focused stimulation treatment methods, a mainstay of syntax intervention with young preschool children, have not been as prominent in approaches for improving the complex sentence knowledge of school-age individuals with DLD (but, see To et al., 2015, for an example when targeting relative clauses).

Recasting

The method of modeling known as recasting differs from other methods in that the key is to use the child's own utterances to provide models of a target pattern (Cleave et al., 2015). The clinician may use a recast to correct an error in the child's utterance, or to add optional information (Fey, 1986). The child is not required or even

[5]A summary table is available in Supplemental Material S1, illustrating how methods differ across studies with respect to type of manipulation of the linguistic input, required learner responses, and type of clinician feedback.

prompted to imitate the adult in the traditional recasting method, although elicitation of a target production has been built into assessments in some treatment studies (Curran & Owen Van Horne, 2019, who targeted adverbial clauses using *because* and *so*).

Contextualization

Contextualization refers to the presentation of treatment targets within communicative contexts where continuity of meaning is maintained (S. L. Gillam et al., 2012). Contextualized intervention (Ukrainetz, 2006) has been employed on the assumption that the target language knowledge will be embedded within broader conceptual schema, leading to more durable and generalized effects (S. L. Gillam et al., 2012). For the sake of our discussion, this method of presenting therapeutic stimuli stands in contrast to methods in which sentences are presented in isolation from larger units of text or discourse.

Metalinguistic Instruction

Metalinguistic strategies for teaching sentence structure fall at the explicit end of the implicit–explicit continuum, relying on deductive learning processes that are conscious and intentional (Baron & Arbel, 2022). Metalinguistic instruction refers to overt description, classification, and explanation of syntactic structures and operations, combined with feedback focused on form, the functions of forms, and the manipulation of forms (Balthazar & Scott, 2017). This kind of instruction encompasses an array of activities, including visual coding systems and sentence combining (Balthazar & Scott, 2018; Ebbels, 2007; Zwitserlood et al., 2015). Metalinguistic instruction is employed in treatment focused on sentence complexity in order to capitalize on the relative strength of the declarative memory system in children with DLD, as compared to the procedural memory system invoked with implicit methods of instruction (Ullman & Pierpont, 2005). Several approaches to teaching sentence structure involve metalinguistic methods in order to teach concepts such as word order, clausal additions, combinations, and movement, and a detailed summary of three metalinguistic approaches can be found in the work of Balthazar et al. (2020). Scaffolded support (a cue, prompt, feedback, or explanation) is commonly used when the child is unable to respond correctly independently (Wisman Weil & Schuele, 2019).

Sentence Combining

One type of metalinguistic instruction, sentence combining, has a long history and special role in teaching sentence complexity, especially in the written modality (see Graham & Perin, 2007, for a meta-analysis). Sentence combining instruction usually involves practice taking two or more simple sentences and creating one sentence that conveys the same content by using alternative syntactic strategies, such as noun- and verb-phrase expansions, pre- and postmodification of noun phrases, or clausal coordination and subordination (e.g., Saddler & Graham, 2005). For example, two simple sentences such as *Jane saw her girlfriends* and *They were walking into the store* could be combined using a relative clause into *Jane saw her girlfriends who were walking into the store.* Variations on this task may include the use of student-generated kernel sentences (Domsch et al., 2018) and focused recasting (e.g., Wada et al., 2020). Usually this method is employed in the written modality with children old enough to have acquired basic literacy and metalinguistic skills (Scott & Nelson, 2009), but it has also been used in the spoken modality with younger children using manipulatives as visual analogies for words, phrases, and clauses (Zwitserlood et al., 2015). Sentence combining was a prominent part of the methods used by Balthazar and Scott (2018) as they targeted relative and adverbial clauses.

Sentence Complexity Intervention Contexts and Outcomes

While the mechanisms of learning (e.g., inductive or deductive learning) for children and adolescents with DLD are likely broadly similar to their typically developing peers, these students may have different profiles of ability in key areas for complex sentence processing (R. B. Gillam et al. 2019; Montgomery et al., 2018). Evidence suggests that students with DLD have some knowledge of complex sentence features but that these patterns in long-term memory are less stable and usable, reducing students to a word-by-word processing strategy that is inefficient and taxing (Montgomery et al., 2018). Such factors make it especially challenging to find ways to teach complex structures to a point of fluency and automaticity that can be put to use to improve academic performance. While the impact of DLD on academic outcomes has been well documented, the success of complex sentence interventions has not often been evaluated in the context of common school outcome measures. Nonetheless, treatment studies targeting complex sentences to date provide promising clues as to how intervention methods might be deployed to achieve enduring functional impact.

These studies vary in the targeted types of sentence complexity (as described in Section 1) and in the outcome measures used to assess therapeutic impact. We were interested in whether stimuli were presented in relatively isolated sentences or within meaningful contexts or both and whether this choice seemed to be important in terms of positive outcomes. One reason for using isolated sentences (sentences without surrounding text or discourse context) is that it provides a better opportunity than discourse to present a series of sentences with the same structure to

increase stimulus frequency, which is a key principle of statistical learning (Plante & Gomez, 2018). Implicit learning from structural priming would theoretically extend and enrich language knowledge in long-term memory, and this knowledge would be available for use in communicative contexts long term. Another reason to use isolated sentences might be in metalinguistic instruction, under the belief that explicit instruction and practice might be necessary to augment or compensate for impaired implicit learning processes. Either way, presenting sentences in isolation is thought to be advantageous for highlighting the structural patterns. Teaching complex sentence structures using discourse or text is done for different reasons, stemming from the idea that language structure is learned in relation to communicative contexts where sentence complexity matters. By teaching language structure within a broader communicative context, there may be a closer alignment with performance on functional outcome measures.

Several treatment studies have utilized isolated sentences exclusively, and while all provided evidence of treatment-related improvements on proximal measures, only one study (Zwitserlood et al., 2015) documented distal outcomes in the form of a lasting treatment effect (3 months posttreatment) following metalinguistic instruction targeting relative clauses. Following sentence combining treatment targeting adverbial clauses, Domsch et al. (2018) reported weak to no treatment effects on number of complex sentences produced in a timed writing task immediately posttreatment. Telesca et al. (2020) incorporated metalinguistic sentence combining instruction targeting syntactic structures used for comparison and contrast into science lessons. At the end of the study, a writing sample was collected, but there were no significant improvements in use of target structures. Interestingly, significant improvements in filling out a graphic organizer, interpreted by the researchers as an indicator of reading comprehension of science concepts, were found even though the amount of instructional time spent on those concepts was reduced in order to teach language structure. In a Chinese language study comparing the effect of a sentence combining treatment to modeling in narratives, To et al. (2015) targeted relative clauses and clausal complements. Significant performance improvements were found following both treatment types on a grammar measure and on a measure of syntactic complexity in narratives as well. There were no significant differences between the treatment groups. Finally, in a single-session experiment to determine feasibility of using priming and focused recasting to increase production of subject- and object-focused center-embedded relative clauses, Wada et al. (2020) found that participants with DLD increased production of target structures (subject- and object-focused center-embedded relative clauses) but at a significantly lower rate requiring a significantly larger number of trials to reach criterion compared to matched participants with TL. Immediate impact of the treatment was demonstrated, but no measures were included to determine durable or generalized impact on language performance.

Other studies not only have used isolated sentences in part of the treatment but also have presented target sentences within larger units of discourse or text (Balthazar & Scott, 2018; S. L. Gillam, et al., 2012). Specifically, Balthazar and Scott (2018) and S. L. Gillam et al. (2012) used methods such as contextualization and focused recasting in addition to priming and metalinguistic instruction in order to promote generalization to distal measures; however, neither study measured durability of treatment effects over time. Balthazar and Scott (2018) targeted three types of subordination in multiclausal sentences and reported significant effects on a written sentence combining probe administered during and after intervention (a proximal measure), as well as significant increases on the Clinical Evaluation of Language Fundamentals–Fourth Edition (CELF-4; Semel et al., 2003) Formulated Sentences subtest and Core Language Quotient administered 2 to 4 weeks posttreatment (distal measures). There were no significant treatment effects for the distal measures related to sentence comprehension or reading comprehension as measured on standardized tests, or increased use of sentence complexity in narrative and expository writing. S. L. Gillam et al. (2012) targeted a variety of syntactic structures, individualized to each participant, some of which implied complex sentences (verbs that take object complements and elaborated noun phrases including relative clauses). Focused stimulation, recasting, and metalinguistic instruction were embedded in the context of stories. They reported significant increases in performance on sentence-level (proximal) measures—CELF-4 Recalling Sentences and Formulated Sentences subtests—and on discourse-level (distal) measures, including the Test of Narrative Language (TNL; R. B. Gillam & Pearson, 2004) Narrative Language Index and Narrative Comprehension score. Interestingly, students' scores increased significantly on the Monitoring Indicators of Scholarly Language (S. L. Gillam & Gillam, 2008) Microstructure score but not on the Macrostructure score.

Curran and Owen Van Horne (2019) took a highly contextualized approach, using recasting within science instructional units to teach adverbial clauses using *because* and *so*. They reported improved performance for causal adverbials containing *because* on elicited production probes but did not measure any distal outcomes. Thus, they demonstrated that instruction embedded in meaningful communicative contexts could improve production of the target structures, but the extent of generalization and maintenance was yet to be determined.

Section 3: Sentence Complexity Intervention Aligned With Academic Language

The review of interventions in Section 2 has shown that programs to date are dominated by methods that engage students with sets (lists) of unrelated sentence problems where sentences are devoid of wider context or true pragmatic intent. With a few exceptions when investigators included more distal, functional outcome measures, results have been disappointing. We might ask, then, whether sentence complexity interventions can be designed that bring about more distal changes—ones that teachers and parents would notice such as improvements in the ability to orally discuss, explain, summarize, and support a position; improved reading comprehension; higher quality writing on school assignments; higher achievement test scores; and so forth. In this section, we review several intervention programs that have embedded complex syntax targets in text-based activities that might be more characteristic of academic contexts.

Embedding Sentence Complexity Intervention in Discourse and Texts With Purpose

Communicate Plans and Reasons

In a recent article, Fahy and Browning (2021) have described a program they developed for adolescents with DLD and concomitant executive function weaknesses. The intervention centered on presenting a student with a novel science problem to solve (e.g., how to keep an ice cube from melting). The student was to produce a plan (instructions) that was clear and contained enough detail that a student partner could successfully accomplish the task. The authors reasoned that successfully constructed instructions (plans) addressing things like order of steps and reasons for doing things a certain way would require a variety of complex structures including subordinate, coordinate, and correlated conjunctions and adverbial conjuncts (*instead, otherwise*). The initial proposed steps in the plan were transcribed on a white board for examination. In most cases, the instructions needed revision/elaboration that required the use of more complex syntax and vocabulary. The clinician then provided scaffolding to assist the student with revisions. Examples of scaffolded input to the student might include, "Why is it important to do that first, and what would happen if you didn't?" Of note, the authors stated that they work individually with the students during the school year on sentence complexity at a more explicit level and the protocol described here is carried out as a summer program. The authors did not cite efficacy data in this article.

Retell and Critically Analyze Fables

In her long history of LSA research of adolescents with and without DLD, Nippold has been interested in the influence of function and meaning on form, reminding readers that complex syntax begins with complex thought (Nippold, 2010). As a platform for evoking complex thought and syntax in both spoken and written language samples, Nippold et al. (2020) have used retells and critiques of fables. Their premise is that fables, by definition, contain complex ideas as revealed in moral lessons about life. In a recent study, Nippold and Marr (2022) have provided an intervention analogue of this work titled Philosophy for Adolescents that requires adolescents to produce narratives (retell fables) and participate in oral critical analysis (discuss fables with a clinician)—all with advanced language. The program contains a set of 40 fables along with scaffolding instructions and examples for modeling and prompting the complex syntax and vocabulary needed for retells and discussion. Employing a Socratic prompting method, clinicians ask questions that encourage students to apply the moral message to real life, reflect on their own assumptions and beliefs, distinguish between fact and opinion, and provide reasons and evidence supporting their views (Nippold & Marr, 2022, p. 795). Scaffolding requires the clinician to judge the right moment, based on the content of the ongoing retell or discussion, to provide an appropriate complex sentence prompt (we might refer to this as "a teachable moment"). For example, the clinician might say, "I wonder why Tim decided to do that," hoping to prompt an object complement on the part of the student ("he believed that…"). Using a more explicit prompt, the clinician could model the beginning of the object complement and ask the student to complete the sentence. Examples of scaffolding for complex syntax during a fable retell can be found in the work of Nippold and Hayward (2018). The intervention program centered on fables exemplifies the belief that language treatment with adolescents should involve mentally stimulating tasks that "stress the system … prompting them to tap into their own cognitive and linguistic resources more fully, revealing the presence of both strengths and weaknesses in individual students" (Nippold & Marr, 2022, p. 793). To date, the authors have not published efficacy data for their approach.

Tell Good Stories

R. B. Gillam et al. (2017) detailed several narrative intervention studies culminating in SKILL (Supporting Knowledge in Language and Literacy), a program to improve comprehension and production of narratives in children with DLD between the ages of 5 and 10 years. SKILL has evolved into a highly manualized program with three phases that teach children to comprehend, retell, and compose complex stories (S. L. Gillam & Gillam, 2020). After being taught basic story macrostructural and

causal language in Phase I, children learn about linguistic structures, concepts, and vocabulary of more complex stories in Phase II. Temporal and causal relationships and conjunctions and adverbs that communicate these relations are emphasized. In Phase III, children receive multiple opportunities to practice retelling, creating, editing, and revising stories with the goal of gaining independence in competent storytelling. R. B. Gillam et al. (2019) explained how the SKILL program design is supported by the research-validated GEM (Gillam, Evans, Montgomery) model of sentence comprehension. As discussed in Section 1, this model integrates four cognitive processes that include language knowledge in long-term memory, controlled attention, fluid reasoning, and complex working memory. SKILL program strategies that strengthen patterns held in long-term memory include contextualizing the targets, modeling the target forms in functional contexts that encourage meaningful interactions, and providing contingent facilitative responses to children's utterances. The SKILL program is currently supported by promising efficacy data. To date, however, outcome measures could be described as proximal (counts of macrostructure and microstructure intervention targets), but SKILL developers report that research is underway that includes evaluation to more distal reading and writing measures (R. B. Gillam et al., 2019).

Use Better Sentences When Writing

Sentence combining exercises are a mainstay of several intervention protocols reviewed in the previous section and are often featured in programs designed to improve student writing (Saddler et al., 2008; Scott & Nelson, 2009). When compared to other writing instruction protocols, sentence combining ranked fifth out of 11 programs in a meta-analysis where the rank of each program was determined by a weighted effect size calculation (Graham & Perin, 2007). Many sentence combining programs can be described as decontextualized in that materials are isolated lists of sentence pairs or groups (two or more short sentences to be combined into one longer sentence). In contrast, Saddler (2012) provides examples of "whole discourse" sentence combining exercises, where simple (kernel) sentences are provided to be combined, but when the student has completed these in sequence from beginning to end, there is a resulting story or essay. As noted by Saddler, "often context is needed to weigh the qualitative value of one particular combination over another" (2012, p. 32). Another helpful feature of Saddler's sentence combining material is that exercises are grouped according to the syntactic target of the combining solution (e.g., relative clause, adverbial clause, appositive, object complement clause).

Reacting to research findings that traditional grammar lessons in language arts classes (e.g., learning parts of speech and diagramming sentences) did not improve writing (Hillocks, 1986), Weaver (1998) and others published suggestions for teaching grammar in the context of real writing. Weaver (1998) offered advice on what aspects of grammar are "well taught" within the context of text-level writing; these include (a) developing a sense of clause and sentence as units, (b) teaching style through manipulation of free elements (e.g., moving adverbial clauses to pre- or postsentence position), and (c) expanding syntactic sophistication and repertoire through sentence combining and reduction (Weaver, 1998, pp. 21–23). She recommends starting with the writing assignment and, then, introducing minilessons as needed. To illustrate, she observed that written answers to comprehension questions about science and social studies texts were often fragments beginning with *because*. This prompted short minilessons on what constitutes a complex sentence with both independent and dependent subordinate clauses—in other words, developing a "sentence sense" as discussed earlier. Details on this and many other sentence structure improvements can be found in her book, *The Grammar Plan Book* (Weaver, 2007). Minilessons to develop sentence complexity are also an important part of the writing lab approach developed by Nelson et al. (2004).

Read Fluently With Comprehension

Scott (2022) recently published details of an intervention protocol targeting improved reading fluency for struggling mid-elementary readers. Building a general sense of what a sentence is and noting differences between simple and complex sentences were important initial goals. Students viewed reading as an exercise in reading words accurately rather than gaining meaning from text with the result that they read texts word by word, with little or no expression or pausing at sentence boundaries—a habit that seemed to persist even as word recognition was improving. The goal was to teach that, in addition to accuracy, fluency meant reading each sentence with appropriate expression and pausing. Before reading a high-interest text, students had to mark all sentence-final periods on their copy. They counted the number of words in various sentences with the clinician teaching that some were "long and complex." In addition to length, complex sentences were defined as those with two or more verbs. The clinician modeled reading each sentence with intonation that promoted syntactic chunking. Using a method adapted from repeated reading protocols (see Lee & Yoon, 2017), when it came time for students to read, they were reminded to read with intonation and pausing. In a final step, with appropriate scaffolding, the students constructed (dictated) a short summary of the text. They saw their dictated sentences take form on a computer screen, providing another opportunity for visually reinforcing the concept of complex sentences as they occurred.

As discussed in Section 1, poor sentence comprehension may be overlooked as a contributing cause of poor reading comprehension. The inability to comprehend key sentences in a text will undermine finding the main idea, drawing conclusions, making inferences, or answering many comprehension questions. Indeed, Shanahan recently noted that "the lowly sentence gets short shrift in most programs and classrooms" (Shanahan, 2022). Clinicians and educators have suggested some ways to address complex sentences in reading. When working on reading comprehension, clinicians will encounter opportunities to teach about connections between certain types of words and clauses, for example, the role of nominalization and relative clauses in elaborating (*industrialization is a process that*...; see Nippold, 2017, p. 129, for suggestions). Schleppegrell (2013) discusses ways to target sentence complexity while working on reading comprehension with goals that include establishing agency, interpreting logical relations signaled by later-developing conjunctions and establishing a chain of reference. Tamborella and Singer (2015) developed a protocol to teach four sentence concepts with the potential to improve reading comprehension: (a) what is a sentence, (b) what is not a sentence, (c) chunking long noun phrases with pre- and postmodification, and (d) comprehending sentences with center-embedded relative clauses that interrupt the main clause subject and verb. Another approach for building sentence complexity during reading comprehension is to use a think-aloud strategy. This has the potential to reveal exactly which sentences are being misunderstood. For example, S. L. Gillam and Fargo (2009) used a think-aloud procedure to compare the accuracy and types of statements made by fourth-grade students with and without DLD. Participants followed along while the clinician read the text. After each sentence the clinician asked, "What do you know about the story now?" Answers of participants with DLD were significantly less accurate than peers with TL. Although researchers did not report on potential ties between inaccuracies and sentence syntax, this type of think-aloud procedure could be used for that purpose, revealing for example how the child had inaccurately parsed the sentence.

Discussion

Because older school-age children often have language weaknesses that can span language levels, modalities, and genres, clinicians face difficult decisions about what aspects of language to prioritize and address with limited intervention time. Communication activities are often described in terms of discourse or textual units—we have a discussion, tell a story, write an essay. The significance of the fact that these communications are made up of groups of individual sentences is easy to overlook. It follows that it is also easy to overlook the critical role that sentence processing can play in communication success or failure. For these reasons, we have devoted considerable space in this article to discuss what syntactic features make sentences complex (harder to process) and why these sentences play a central role in language and literacy proficiency. As children develop throughout the school years, they need complex sentences for their increasingly complex ideas. In Section 1, we cited research evidence pointing to the fact that children and adolescents with DLD have a harder time comprehending and producing complex sentences when compared with peers with TL. Nevertheless, syntactic structures that impact processing will occur with increasing frequency in their school textbooks with each grade. Teachers will judge their writing, in part, by the quality of their sentences.

For all these reasons, clinical researchers have developed intervention programs to address sentence complexity. We recognize that the small number of studies we reviewed in Section 2, and the wide variety of details among them—from design and participant characteristics to treatment targets and outcome measures—makes it impossible to draw definitive conclusions regarding the efficacy of the various treatment methods. Our review was intended to make some sense of the ways treatment studies focusing on complex sentence structures have or have not successfully attempted to promote improvements in longer term and relevant areas of language functioning.

The use of isolated sentences as the primary or only level of linguistic context in treatment, found in the preponderance of this research, is emerging as a supportable method for teaching the structural patterns of complex sentences. To date, positive intervention outcomes have been documented on proximal measures comprising isolated sentence tasks, and in the one study where such a measure was repeated 3 months posttreatment, improvements were maintained (Zwitserlood et al., 2015). Further investigations using distal measures involving discourse, narrative, and text-level language could shed more light. Whether sentence-level stimuli for the purpose of activating inductive learning (priming) or deductive learning (metalinguistic instruction) or a combination is used, we do not yet see definitive indicators of how best to promote long-term representations and the use of targeted patterns in appropriate contexts. Contextualized intervention methods, which include sentence- and discourse/text/narrative-level stimuli, have also proven effective on proximal, and some distal, outcome measures, though such results are sparse and mixed. It is encouraging to see that when genre-specific contextualized or metalinguistic interventions have been employed, the subject-area knowledge growth does not appear to be diminished (S. L. Gillam et al., 2012; Telesca et al., 2020). If this holds true, there

are now some data supporting the practice of teaching complex sentence structures within curriculum units and academic tasks relevant to the student's actual school experience.

The lack of evidence for distal effects for current sentence complexity interventions led us to search for programs and resources that *combine* real discourse and text (implicit language processing) with a more conscious focus on specific syntactic structures (explicit language processing). On the implicit side, there are opportunities for real language input and output as students (a) participate in oral discussions (e.g., talking with a clinician about a moral dilemma in a fable or the adequacy of instructions to carry out a plan); (b) hear or read narrative literature, fables, or informational texts; (c) retell a fable, summarize a story, or tell about a personal experience; or (d) write for any personal reason or school-assigned task, to name a few. On the explicit side, the clinician draws attention to specific complex structures called for in these contexts that, when strengthened, can help students better understand and produce language themselves.

Advantages of using real texts in real activities are many. First and foremost, a complex sentence that is part of a text draws on semantic and syntactic constructs from previous sentences and is therefore part of a more elaborated conceptual and linguistic schema that could facilitate learning. This more elaborate priming context may provide a deeper (or different) way to strengthen structural templates in long-term memory, which as previously noted, is a critical part of the language processing equation. (Montgomery et al., 2021; Singer & Bashir, 2018).

Drawing on principles of priming and statistical learning reinforces the idea that students learn language through discourse-based input alone (Plante & Gomez, 2018). They are learning even when clinicians are not asking them to do anything except listen or read. Further, the use of texts and activities similar to those of classrooms provide a stronger, more concentrated "match" of language form (complex sentences) and function. Sentences found in science texts, to illustrate, are teaching through explanation and elaboration from a position of authority—functions that call for particular structures (Scott & Balthazar, 2010) that are less likely to occur in conversations outside of school. Academic texts also provide a good opportunity for the complex syntax–semantic interface, whereby certain structures are associated with particular words (Nippold & Marr, 2022). For example, words for scientific processes and concepts in academic text may be unfamiliar terms that, of necessity, call for immediate elaboration. Thus, in the complex sentence, *the theory of relativity devised by Einstein that accounts for space–time relationships has been verified many times,* two postmodifying clauses that follow the head noun *theory* accomplish this elaboration. Finally, and perhaps most importantly, students are more likely to have a genuine stake in the transaction—in language activities that serve a real purpose.

There are also advantages of embedding more explicit routines that focus on complex structures within text-based activities. Clinicians can provide high-dose exposures to a particular structure in short training bursts, thereby increasing salience and taking advantage of statistical learning principles (Plante & Gomez, 2018). Having a visual model of a structure (e.g., the written form of a sentence, potentially further enhanced with symbols as in SHAPE CODING; Ebbels, 2007) can further increase salience. The strengthened metalinguistic awareness of structures can be put to good use, particularly in writing when there is time to be conscious and strategic in formulating sentences.

There are a number of caveats in the recommendation to embed complex sentence focus in real language activities. As of this writing, we are not aware of applicable long-term efficacy data using truly distal measures, for example, improved achievement test scores, teacher confirmation of improved functioning in the classroom, and so forth. There are many outcome measures that cross modalities and genres and vary along a continuum of proximal to distal, and we know very little about potential relationships among measures. To illustrate, the main outcome measure in Balthazar and Scott (2018) was a sentence combining probe similar to one of the intervention activities. This measure showed positive effects of treatment. However, the protocol also contained more distal outcome measures including pre- to postcomparisons of reading comprehension (a positive, albeit not statistically significant, trend) and syntactic complexity of expository writing (no change). Why the difference? Perhaps the treatment strengthened complex sentence representations generally with carryover to broad comprehension processes, but for reasons not entirely clear, participants did not draw on this knowledge in a somewhat contrived prompted writing activity.

We have not addressed age, comorbidities, and severity factors that could impact how clinicians approach interventions to build sentence complexity. Discussed in Section 3, the protocol devised by Scott (2022) for third-grade students struggling with literacy focused on building a general awareness of what constitutes a sentence (simple and complex) with the overall goal of building reading fluency. In this protocol, sentence awareness "shared the stage" with reading fluency. When working more directly on particular syntactic targets, a child's age, language level, and cognitive ability would influence the choice of procedures, activities, and texts. For example, Nippold and Marr (2022), as discussed earlier, advocated for building sentence complexity in the context of discussions

about moral messages in fables. This may not be a productive strategy with a younger child at an earlier developmental stage of moral reasoning (Carpendale, 2000).

We close with the perspective that clinical programs for building sentence complexity, in our thinking, exist "in the service of" other, broader goals. Scott (2009) discussed sentence complexity as the "workhorse" of meaning. Its raison d'être is meaning and communicative function. If clinicians and researchers agree, we should see additional interventions that target sentence complexity in context and include truly functional outcome measures.

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