

Promotion of syntactical development and oral comprehension: Development and initial evaluation of a small-group intervention

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Abstract

This article reports on the development and preliminary implementation trials of a modular small-group intervention targeting syntax and vocabulary for children at high risk for reading comprehension difficulties in grades prekindergarten through first. The intervention, delivered by trained paraprofessionals, included 12 weeks of 20-minute lessons that included hands-on activities promoting receptive and expressive acquisition of grade-specific targeted syntax and semantic features such as prepositions, passive sentence structure, and adverbial clauses. Children ($n = 354$) ranging in age from 40–101 months were screened for inclusion on several standardized language measures and those included in the intervention (64–68 per grade, scoring below the 30th percentile on several measures) were assessed on two proximal measures of intervention-linked syntax and listening-comprehension. Results from the repeated implementation trials in each grade indicate that the intervention shows substantial promise as a method of supporting syntax growth and ultimately improving comprehension skills in young children.

Keywords

Comprehension, intervention, syntax

I Introduction

Significant research indicates that children's early language abilities can have substantial impact on their development of oral and reading comprehension (Lepola et al., 2012; Share and Leikin, 2004). Complex aspects of semantic, syntactical, and narrative skills appear to have most of their impact on reading comprehension abilities (Lonigan et al., 2008). Skills associated with comprehension include literate language structures like coherence markers (e.g. conjunctions, adverbs), mental-state verbs, and elaborated phrases (Anderson, 2011; Scott, 2009).

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1 Language skills of children from at-risk backgrounds

Children from impoverished backgrounds are often delayed in language and vocabulary at pre-school or kindergarten entry, and do not catch up during early schooling (Reynolds and Fish, 2010). Gaps in vocabulary and general language skill (Biemiller and Slonim, 2001; Fish and Pinkerman, 2003) can be large, suggesting a substantial group of children who may not qualify for special education but still demonstrate meaningful weaknesses in early language. Fish and Pinkerman (2003) found less than 30% of their at-risk sample of 4- and 5-year-old children achieved a score above 85 on standardized language assessments; they further indicated that scores remained relatively flat across time. Syntactical skills have overlap with vocabulary and other receptive and expressive language abilities (Moyle et al., 2007; Tomblin and Zhang, 2006), and can show comparable delays. By school age, many high-risk children have not mastered important language structures like auxiliary and past tense verb forms (Cain et al., 2005; Dockrell et al., 2007) and sentence-level syntactic structures (e.g. passive, pronoun referents; Anderson, 2011; van der Lely and Marshall, 2010). The substantial numbers of children in early grades with mild to moderate language weakness suggest a pressing need for new interventions that have efficacy for increasing a broad range of children's core language skills and ultimately show impacts on comprehension.

2 Association of syntax with comprehension

Although the connection between vocabulary and reading ability has garnered much attention (e.g. Catts et al., 2006; Nation, 2009), syntax appears also important for reading proficiency, in particular comprehension. For example, syntax is related to decoding and both oral and reading comprehension (Hagtvet, 2003; Nation et al., 2004; Share and Leikin, 2004). Botting et al. (2006) found that age 7 sentence comprehension predicted age 11 reading comprehension. Evidence suggests understanding and use of complex sentence features like conjunctives (e.g. *but*, *because*), and referential pronouns are related to narrative skills (Yuill and Oakhill, 1988). Building on these findings, and the strong support for the simple view of reading (Catts et al., 2006; Kendeou et al., 2009), the theory is that improvements in syntax lead to better oral comprehension. This oral development would further enhance reading comprehension, in part by aiding maintenance of sentence and text-level cohesion and coherence, and enabling correct inferences (Leikin and Assayag-Bouskila, 2004; Lepola et al., 2012; Verhoeven and van Leeuwe, 2008).

3 Prior interventions for syntactical targets

A modest literature indicates that syntactical weaknesses in children are remediable with focused intervention (Law et al., 2004). Interventions with preschool and older children indicate benefits from several varieties of language stimulation therapy and computer-assisted treatments (Ebbels, 2007; Vasilyeva et al., 2006). Two aspects of prior work warrant specific comment. First, most studies of syntax instruction have targeted children with diagnosed specific language impairment (Cirrin and Gillam, 2008). Second, most studies have primarily focused on preschool age or younger children and on morphosyntactical targets (e.g. verb conjugation, plurals; Cirrin and Gillam, 2008; Ebbels, 2007). For instance, few studies (e.g. Ebbels and van der Lely, 2001; Vasilyeva et al., 2006) have targeted passive structure. Thus, the purpose of this study was to develop a new syntax-focused intervention for children with risks for language and reading difficulties in the preschool and early elementary grades.

4 Features of the current intervention

The developed intervention included 12 weeks of brief, small group lessons addressing grade-specific syntactical targets with both receptive and expressive focus. The current intervention has several more novel features. First, longitudinal and correlational studies indicate that syntax specifically – and oral language skills in general – have an impact on comprehension for all children, not just those with the weakest abilities. This suggests that a broader array of children may benefit from a language-focused intervention. Thus, this study included both children who may have qualified for language impairment and children above this threshold. As well, because both morpho-syntax and sentence-level syntax are associated with comprehension (Scott, 2009) but sentence-level features are less frequently addressed in instruction, the current intervention targets sentence-level syntactical targets rather than morphosyntax targets. Another relatively novel feature of this intervention (cf. Boyle et al., 2009; Hutchinson and Clegg, 2011) was its implementation by paraprofessionals rather than speech and language pathologists. This goal is largely pragmatic as interventions not requiring specialist delivery can be considered more scalable.

The intervention addressed syntactical elements that appear most related to oral and reading comprehension. These included causal and temporal connectives and prepositions, and, for the oldest children, passive sentence structure and elaborated phrases. Furthermore, because many at-risk children begin school with quite marked delays in more basic syntactical abilities, intervention targets included such skills as adverbs, negatives, and *wh*-questions. Targets were selected and sequenced based on developmental progression and estimated difficulty (see Figure 1). Use of mental-state verbs (e.g. *think*, *decide*) is correlated with complex complement usage, one exemplar of elaborated sentence structure (Lee and Rescorla, 2008). Therefore, we embedded instruction and modeling of these terms to induce their inclusion within children's expressive sentence structure.

The goals of these design trials were to test the feasibility and potential efficacy of this syntax intervention. Feasibility targets included brief instruction (e.g. 20-minute lessons) that could be implemented with high fidelity by interventionists with a range of experience and certifications. Across three grades, we explored the pre to post gains for participating children in two trials per instructional unit. Given the create–implement–revise–implement cycle of this design study process, it was premature to structure this study as a controlled trial. Rather, to meet the feasibility goals, it was important to gather evidence that the intervention was enacted as designed and feasible within the target time limits. Therefore, we included *in situ* observation of the intervention sessions to record quality of implementation and session length. The specific research questions included:

1. Was the intervention implemented as designed within the target time per session?
2. Do children who participate in a small-group targeted syntax intervention show gains on intervention-aligned syntax assessments?
3. Do children who participate in a small-group targeted syntax intervention show gains on intervention-aligned listening-comprehension measures?

II Method

I Intervention description

Our goals in designing the intervention were to provide children with a ‘flooding’ of exposure to each unit’s target syntax features and to engineer numerous opportunities for children to respond

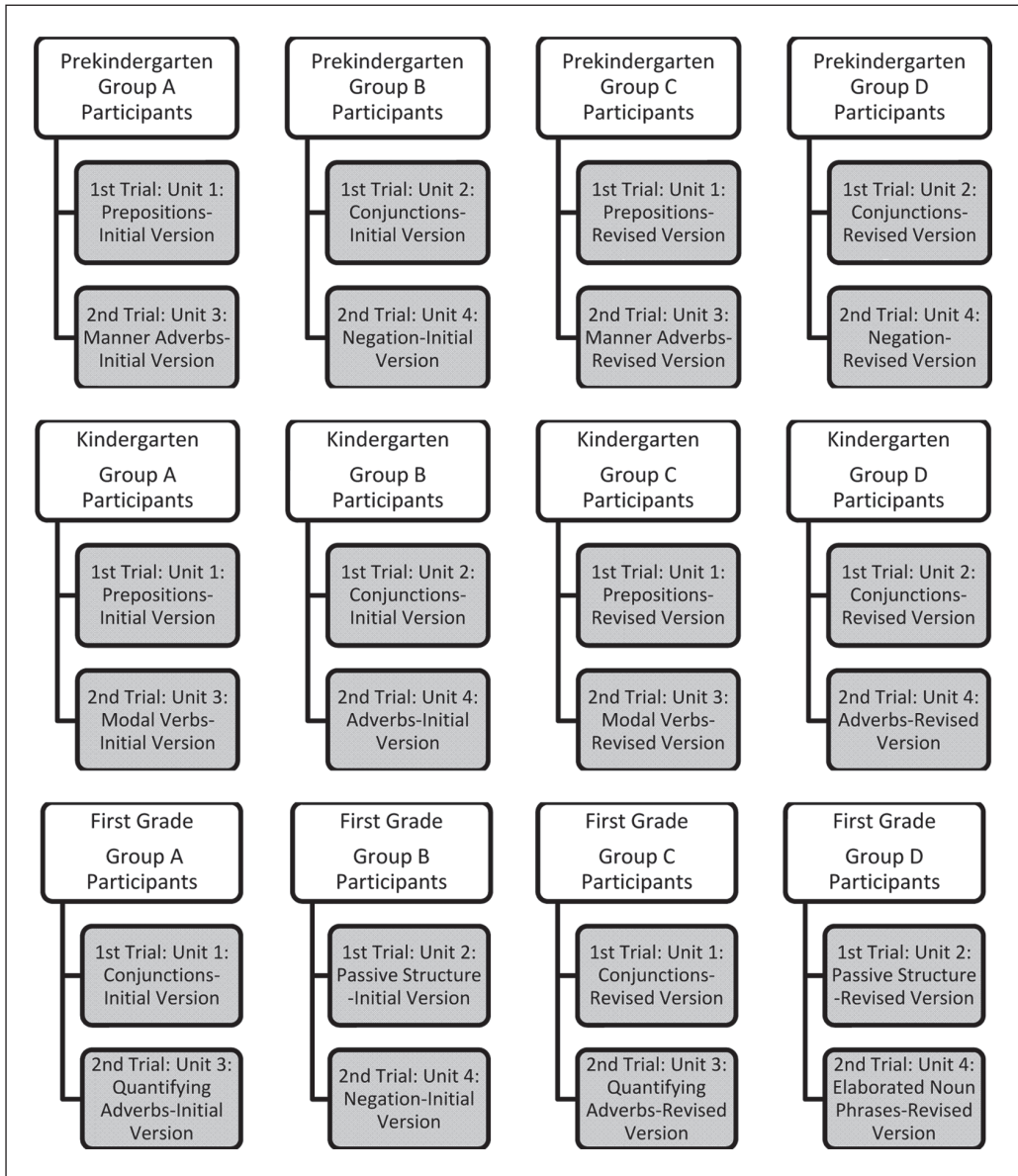


Figure 1. Panels A, B, and C in Figure 1 represent the design structure and sequence of the implementation of each of four, 3-week units in each grade level for initial and then revised trials, with four subgroups of children participating per grade. Time is depicted down each column such that the first unit listed was implemented before the second unit listed. Time is also depicted left to right, such that the initial version of a unit was always tested before its revised version was tested.

to and produce targeted structures in authentic sentence contexts. We focused on both sentence-level and discourse-level (oral-narrative-level) understanding and production. We designed four, 3-week units per grade level. Children received instruction in groups of four, 20 minutes per day,

four days a week, for a total of four hours of instruction per unit. Interventionists conducted weekly make-up sessions for absent children. We developed a sequence of targeted syntactical skills embedded in repeated activity structures. Using evidence that both conversational and more structured teaching interactions support children's grammatical acquisition and expressive utterances, particularly when the context supports child engagement and joint focus (Bruce et al., 2007), we created story-based and prop-based activities designed to solicit interest and provide an authentic, academically-relevant topic of discussion for the interventionist and children. The theme selected for all grades related to physics concepts of motion (e.g. force, friction).

Figure 1 displays the targeted syntactical features for each unit per grade level. Each unit included four systematically repeated instructional elements. First, each week included a narrative describing the adventures of a main character and his or her family and friends. These story characters were maintained across all units to diminish children's memory burden. Large illustrations with movable characters and objects were used for interactive story-linked activities that included receptive (e.g. 'place the red ball *below* the bench') and expressive requests for children's individual or choral responses. All the adventure scenes and stories included settings and descriptions of motion (e.g. roller coaster, monster truck rally, swimming pool). This motion theme was further elaborated within the second key lesson element of a motion prop (e.g. slide, marble run, or race track) that children were asked to manipulate (receptive understanding); they were then asked to describe their actions with expressive use of language. Lessons followed a 'model-supported-independent' explicit instructional sequence employed when each new target was introduced; this is very similar to an 'I do, we do, you do' instructional sequence that is frequently used. Appendix 1 includes sample lesson plan components exemplifying this sequence. During each lesson each child was provided multiple (e.g. at least six) opportunities for individual or choral responding, while also being exposed to peer responses and instructor feedback. Lesson plans guided interventionists in scaffolding and challenging individual children, affording daily opportunities for differentiated instruction. For example, an initial expressive language prompt for the target word *near* might be 'Now put your car *near* the track. Then tell me: My car is *near* ____.' A downward scaffold for a child who responded incorrectly might have the child repeat the modeled sentence, whereas an upward scaffold might ask a child to move the car and then use *near* to describe its new location in a novel sentence. Third, every fourth lesson included a board or picture game using photographs and verbal prompts that integrated the week's activities with cumulative review of the unit's syntax targets. Finally, each unit integrated explicit definitional instruction, modeling, and expressive use of two mental-state verbs that were embedded within story texts and game activities. Across the three weeks of a unit the focus shifted to include more challenging and more expressive language requests within each of the four main weekly activities.

2 Participants

Children from four elementary schools serving a moderate to high proportion of children receiving free or reduced lunch services (FRL; a marker of low socio-economic status or SES) were recruited for participation. The school-level FRL percentages ranged from 48% to 94%. Kindergarten and first grade classes represented unselected children, but the Title 1 prekindergarten program included children enrolled because of documented language delay or familial factors placing them at risk for school difficulties. Children represented 7 prekindergarten, 13 kindergarten, and 16 first grade classrooms. In this state, children must be 5 years old by September 1 to enter kindergarten, so the prekindergarteners were primarily 4 years old, whereas all kindergarten children were at least 5 years old. All children in each classroom were invited to participate. In each grade, we screened

Table 1. Means for screening measures for selected children (standard deviations are given in parentheses; ranges are given in square parentheses).

Grade	Average age in months	OWLS-LC standard score	CELF-4/ P2 SS scale score	CELF-4/P2 CFD scale score	CELF-4 FS scale score	CASL SC standard score
Prekindergarten	52.94 (5.75) [40–64]	83.03 (11.71)	6.85 (2.48)	6.45 (2.54)	–	78.86 (10.00)
Kindergarten	67.81 (3.54) [61–78]	83.34 (9.67)	7.34 (2.79)	6.45 (2.68)	3.98 (2.62)	78.44 (10.66)
First grade	81.56 (6.48) [71–101]	85.84 (9.67)	7.58 (3.05)	6.25 (2.64)	3.48 (2.48)	71.24 (12.38)

Notes. OWLS-LC = Oral and Written Language Scales: Listening Comprehension; CELF 4/P2 = Comprehensive Evaluation of Language Fundamentals 4th Edition /Second Preschool Edition SS = sentence structure; CFD = concepts and following directions; FS = formulating sentences; SC = syntax construction.

consented children until achieving a sample of at least 64 children eligible for intervention, yielding 73 prekindergarten, 144 kindergarten, and 137 first grade screened children.

Children were typically designated eligible for intervention if they scored at or below the 25th percentile on at least two of the three (for prekindergarten) or four (for older children) syntax measures administered during screening. Most (72%) were below this percentile on at least three screening tests. A few children (14; 7%) were included with just one measure meeting criteria. Of the 354 screened children, 157 (44%) did not qualify and were excluded from further participation. Table 1 includes the age ranges, average ages and the screening profile of scores for the 64–71 qualifying and participating children in each grade level. If more than the needed 64 children in a grade qualified, then 64 were selected for participation. However, as 12 children left the schools between trials, whenever possible (i.e. in seven instances) they were replaced in their groupings by another qualifying child for the second unit of participation (see Figure 1). Another small group of children (9) participated in both trials but not in all assessments due to absences. The treated sample included 97 males (49%) and 100 females, and represented 30% Caucasian, 58.5% African American, and 11.5% other ethnic backgrounds (including Asian, biracial and Native American). Whereas 11% were Hispanic, very few were English learners and all were validly assessed in English. Across all grades, selected children ranged in age from 40–101 months ($M = 67.65$, $SD = 12.96$) at initial screening. The substantial majority of the prekindergarten children (86%) were 4 or 5 years old; of these, most were 4 years old when their first intervention trial began.

3 Measures

a Screening measures. To determine eligibility children received four (prekindergarten) or five measures of language proficiency. Children completed two receptive language measures, the ‘sentence structure’ and ‘concepts and following directions’ subtests of the *Clinical Evaluation of Language Fundamentals: 4th edition* (CELF-4; Semel et al., 2003) or *CELF Preschool: 2nd edition* (CELF-P2; Semel et al., 2006). ‘Sentence structure’ assesses the child’s ability to apply grammatical rules at the sentence level while ‘concepts and following directions’ assesses children’s ability to respond to verbal prompts of increasing length and syntactical complexity. Children also completed one or two expressive measures, including the ‘syntax construction’ subtest of the *Comprehensive Assessment of Spoken Language* (CASL; Carrow-Woolfolk, 1999), which assesses children’s use of syntactical rules within their oral expression and, for both older grades, the CELF-4 ‘formulating labels’ subtest, which assesses children’s ability to orally compose grammatically and semantically correct sentences regarding a picture prompt. All children completed the ‘listening-comprehension’

subtest of the *Oral and Written Language Scales* (OWLS; Carrow-Woolfolk, 1995), which assesses children's receptive understanding of spoken phrases and sentences. All of these standardized measures have strong psychometric characteristics and have been widely used.

b Researcher designed proximal construct measures. For each instructional unit, we developed two measures of targeted syntactical content. First, we designed a sentence-level assessment test modeled after item formats of various standardized assessments (hereinafter, intervention-aligned assessment). Item formats included receptive pointing items (e.g. multiple choice with pictured targets and foils), expressive cloze items (e.g. for prekindergarten, 'Finish my sentence: Here [point] the girl is in front of the boy. Here [point] the girl is [*behind*]'), and expressive sentence repetition items. For kindergarten and first grade, some items had a format in which children were asked to say a sentence about a picture using the target word (e.g. 'tell me a sentence about this picture using the word *because*') or required children to listen to a spoken sentence and answer a related question (e.g. to identify the agent in a passive sentence presentation). These measures included from 24 to 30 items across the 12 grade by unit combinations. Most items included photographic picture stimuli images distinct from pictures used during intervention.

Second, we created intervention-aligned listening-comprehension assessments for each unit. These included relatively brief (i.e. 260 to 600 words, depending on grade and syntax focus) narrative passages incorporating the same story characters and settings as the passages children heard during intervention sessions. These assessment passages included numerous instances of each of the unit's target syntactical words (e.g. *and*, *or*) or sentence structure (e.g. passive structure). Children were asked 8–9 questions that frequently (1) included a target word/structure in the question or (2) required the children to respond with a target word/structure in their verbal response (e.g. for first grade, 'Using *either*, *and*, *or* answer the question: Where can Jolene have her birthday party?'). All questions on the listening-comprehension measures required an expressive response and included both direct comprehension and inferential items.

Whereas most items on the two types of measures were scored as correct or incorrect, some of the more challenging items for each unit were scored with partial credit. All items were scored from an established rubric by two independent raters (graduate students and paid research assistants), and any discrepancies were resolved by consensus discussions with the author to maintain scoring consistency. Items from both pre- and post-assessment waves for a trial were scored at the same time by scorers blind to whether responses were from pre- or post-testing to minimize any likelihood of scoring bias. Occasionally, items on the syntactic form assessment or the listening-comprehension assessment that demonstrated floor or ceiling effects, were judged to be unclear based on the form of responses received from children during the first trial, or tapped target words dropped from the revised intervention lesson versions were revised or replaced before the second trial of each unit was conducted. For example, in kindergarten unit 3 fewer modal verbs were instructed within the revised version, and corresponding items for dropped words were replaced.

c Observational fidelity measure. Two senior members of the lesson development team, both of whom were masters level certified teachers, observed each interventionist working with a grade during each trial (e.g. each interventionist was observed conducting each grade she taught). Seventeen total items were scored 'yes' or 'no' during the observation, where 'yes' indicated that the desired behavior was observed. Observed indices of fidelity included items regarding adherence to lesson order, text and materials, items regarding group management and child engagement, and items regarding the quality of scaffolding and differentiation of instruction. A subset (approximately

5%) of each wave of observations was completed simultaneously by two team members to judge inter-rater reliability.

4 Procedures

Eligibility screening was conducted by trained assessors in the fall and winter of the school year. Pre- and post-testing were completed in one or two individual sessions. Qualifying children were assigned to one of four subgroups of 16 children per grade (i.e. A, B, C, D; see Figure 1). In each grade, children were assigned to these four groupings in a nonrandom manner prioritizing logistical scheduling needs. Each subgroup participated in a trial of two different curriculum units, such that no subgroup received the original and revised versions of the same units. Furthermore, because the difficulty ostensibly increased across units, no children received an easier unit as their second trial.

The nine interventionists all possessed bachelor's or master's degrees and some teaching experience. All were female, ranging in age from mid-twenties to mid-fifties and possessing a wide range of teaching experience. They received intensive workshop professional development on lesson content and implementation, including modeling of sample lessons and observed practice implementing in small groups, and ongoing support via one-on-one consultation with the design team, feedback from fidelity observations, group feedback and demonstration meetings and written implementation support guides.

Session observations, fidelity results, and pre to post changes, plus detailed daily intervention logs and feedback forms from each interventionist, were used to modify the lesson plans before the second trial of a unit. In only a few instances were substantive changes made to instructional method or focus (e.g. including fewer targets); other changes were in sequence, instructions to interventionists or in the addition of more scaffolding suggestions.

III Results

Across all 24 intervention cycles attrition from pre- to post-testing was very low, due entirely to children withdrawing from school; all but one trial included 13 or more children with post-tests. Table 2 includes the pretest and posttest scores and effect sizes on the two assessments for each initial and revised trial for prekindergarten. Tables 3 and 4 present these data for kindergarten and first grade, respectively. In all three tables panels A and B represent initial and revised trials.

1 Feasibility analyses

Results for the 17-item observational fidelity measure indicated very consistent adherence to the lesson plans and high quality implementation. The average fidelity rating was 15.5 out of 17, ranging from 11 to 17, with 87% of the observed sessions scored 14 or better. Furthermore, the inter-rater reliability on the observations was excellent (i.e. 98% agreement). The majority of observed lessons were conducted within the intended 18–22 minute time window (i.e. 77%). Overall, adherence to lessons was strong and consistent across grades. As anticipated, a challenging aspect of implementation was scaffolding individual needs; the lessons included explicit examples of how to provide upward (challenge) and downward (supportive assistance) scaffolds, such that this individualization was consistent with high fidelity. Professional development addressed how to maintain appropriate pacing and content completion while differentiating.

Table 2. Means and effect sizes from the first and second trial of each unit for prekindergarten (standard deviations are given in round parentheses; ranges are given in square parentheses).

Unit (n)	Intervention-aligned syntax test			Intervention-aligned listening-comprehension measure		
	Pretest	Posttest	Effect size	Pretest	Posttest	Effect size
<i>Initial version trials:</i>						
Unit 1 (13)	6.56 (2.53) [2–11]	6.92 (2.33) [3–11]	.15	1.50 (1.32) [0–4]	2.08 (1.55) [0–5]	0.40
Unit 2 (15)	14.37 (3.26) [9–21]	14.13 (3.92) [7–20]	–0.07	2.56 (2.30) [0–6]	3.50 (2.43) [0–7]	0.40*
Unit 3 (14)	6.80 (3.43) [3–13]	9.79 (4.14) [3–16]	0.79***	1.77 (1.86) [0–6]	2.43 (2.31) [0–7]	0.32^
Unit 4 (13)	13.40 (3.92) [7–19]	17.23 (4.57) [8–23]	0.90**	2.53 (2.10) [0–6]	3.65 (2.36) [1–8]	0.50*
<i>Revised version trials:</i>						
Unit 1 (16)	4.31 (1.40) [2–7]	8.81 (3.06) [4–13]	2.05***	0.94 (1.03) [0–3]	1.31 (1.08) [0–4]	0.35
Unit 2 (14)	11.21 (4.98) [2–18]	12.82 (4.87) [5–18]	0.33	3.36 (2.00) [0–8]	4.25 (2.87) [0–8]	0.37
Unit 3 (16)	8.06 (3.71) [1–13]	14.13 (4.82) [5–22]	1.42***	1.94 (1.97) [0–7]	2.59 (2.14) [0–6]	0.32
Unit 4 (14)	15.07 (6.62) [2–23]	16.86 (5.41) [6–25]	0.30	3.18 (1.53) [0–5]	3.50 (2.31) [0–7]	0.17

Notes. *** $p < .001$, ** $p < .01$, * $p < .05$, ^ $p < .10$.

Table 3. Means and effect sizes from the first and second trial of each unit for kindergarten (standard deviations are given in round parentheses; ranges are given in square parentheses).

Unit (n)	Intervention-aligned syntax test			Intervention-aligned listening-comprehension measure		
	Pretest	Posttest	Effect size	Pretest	Posttest	Effect size
<i>Initial version trials:</i>						
Unit 1 (16)	12.31 (3.72) [6–18]	14.75 (5.12) [5–26]	0.55*	1.75 (1.81) [0–6]	2.31 (1.30) [1–6]	0.36
Unit 2 (10)	16.17 (5.72) [5–23]	17.40 (4.45) [8–22]	0.24*	1.42 (1.38) [0–4]	2.20 (1.64) [0–4]	0.52*
Unit 3 (14)	15.27 (3.96) [7–22]	17.79 (4.10) [8–23]	0.63***	4.13 (2.23) [0–9]	5.32 (2.02) [1–8]	0.56^
Unit 4 (15)	15.40 (3.31) [11–21]	15.33 (5.26) [4–24]	–0.02	1.70 (1.60) [0–5]	2.67 (1.99) [0–7]	0.54**
<i>Revised version trials:</i>						
Unit 1 (16)	15.31 (3.96) [7–23]	17.63 (4.88) [9–26]	0.52**	2.56 (2.50) [0–8]	3.69 (2.47) [0–8]	0.45*
Unit 2 (15)	13.06 (4.52) [6–22]	15.53 (3.48) [9–22]	0.62*	1.09 (1.42) [0–5]	1.23 (1.12) [0–3]	0.11
Unit 3 (16)	16.81 (3.41) [9–22]	16.38 (3.03) [10–22]	–0.13	2.94 (2.23) [0–6]	3.72 (2.26) [1–8]	0.35^
Unit 4 (15)	18.80 (3.73) [10–23]	19.20 (4.23) [12–27]	0.10	3.20 (1.57) [1–7]	3.60 (1.77) [0–7]	0.24

Notes. *** $p < .001$ ** $p < .01$ * $p < .05$ ^ $p < .10$.

2 Primary analyses

For each trial, repeated measures ANOVA were conducted on each measure. Tables 2 through 4 display the means and ranges for all measures, and indicate whether there was statistical significance for each pre- to post-test change, although this was exploratory given the small sample sizes. Given the small sample sizes, nonparametric Wilcoxon signed rank analyses were also performed on all pre to post change scores (results available from the author). All findings were consistent, thus the ANOVA findings are reported in the tables. The effect sizes presented in these tables were calculated as the difference between the means relative to the average standard deviation. In terms of traditional conceptualizations of Cohen's d , many of the effect sizes for the proximal and listening-comprehension measures were moderate to large. For instance, in prekindergarten all effect sizes for revised units were educationally meaningful (e.g. above .25; Hill et al., 2008); this was true for both

Table 4. Means and effect sizes from the first and second trial of each unit for first grade (standard deviations are given in round parentheses; ranges are given in square parentheses).

Unit (n)	Intervention-aligned syntax test			Intervention-aligned listening-comprehension measure		
	Pretest	Posttest	Effect size	Pretest	Posttest	Effect size
<i>Initial version trials:</i>						
Unit 1 (15)	7.73 (1.94) [5–12]	11.93 (2.74) [6–17]	1.79 ^{***}	5.53 (1.41) [3–8]	5.33 (1.50) [3–8]	-0.14
Unit 2 (15)	16.27 (5.48) [7–26]	18.93 (5.39) [7–27]	0.49 ^{**}	2.67 (1.74) [0–6]	3.63 (2.18) [0–7]	0.49 ^{**}
Unit 3 (14)	16.13 (2.94) [11–20]	18.36 (2.79) [12–22]	0.78 ^{**}	3.88 (1.82) [0–7]	4.36 (1.83) [2–7]	0.26
Unit 4 (16)	8.84 (2.63) [4–13]	9.84 (3.41) [5–17]	0.33	2.03 (1.49) [0–6]	2.75 (1.33) [2–6]	0.51
<i>Revised version trials:</i>						
Unit 1 (15)	10.56 (3.79) [6–17]	13.93 (3.66) [5–18]	0.71 ^{**}	5.50 (1.83) [1–8]	5.07 (2.49) [1–8]	-0.20
Unit 2 (16)	15.66 (3.97) [9–23]	19.84 (3.87) [13–26]	1.07 ^{***}	3.38 (2.21) [0–7]	5.13 (1.15) [3–8]	1.04 ^{**}
Unit 3 (15)	15.87 (3.76) [8–21]	17.53 (3.91) [7–23]	0.43 [*]	3.93 (1.94) [0–7]	4.73 (1.67) [1–7]	0.44 [^]
Unit 4 (16)	12.09 (2.41) [7–17]	14.66 (2.22) [10–18]	1.11 ^{***}	3.47 (1.53) [1–6]	4.09 (0.95) [2–6]	0.50 [*]

Notes. *** $p < .001$, ** $p < .01$, * $p < .05$, ^ $p < .10$.

initial and revised units for first grade. In kindergarten, effect sizes on the intervention-linked syntax measures were consistently moderate or strong for units one and two, but more variable on the latter two units. Overall, the average effect size for the intervention-linked sentence-level syntax measures in initial trials in prekindergarten was .44, whereas for kindergarten and first grade it was .28 and .85, respectively. The average effect size for the revised versions of each unit in prekindergarten was 1.02, whereas for kindergarten and first grade it was .28 and .83, respectively.

The unit-specific listening-comprehension measures were more challenging, in general, as all items required expressive responses. Despite this, moderate, and in some cases statistically significant, differences also were seen on these measures for both original and revised unit versions. For prekindergarten and kindergarten, the effect size met or exceeded the threshold of .25 for all units in either the original, revised or both versions. In first grade, this threshold was met for all but unit one. The average effect size was between .29 and .54 for each grade. In summary, across both target measures at least 10 of 16 effect sizes exceeded .25 for each grade.

IV Discussion

The findings from these design trials provide promising preliminary support for the efficacy of this modular syntax intervention in supporting the language and listening-comprehension development of children at high risk. The small to very large effect sizes reported were found after just four hours of instruction per trial, suggesting the potential for robust and educationally meaningful impacts from the full 16-hour interventions. A complementary positive result was finding that the interventionists, who were not speech and language specialists, could implement the structured intervention with high fidelity. There were also consistent reports from interventionists that children were highly engaged with the lesson activities and that they could complete all aspects of the daily lessons within the allotted time. All together, these results indicate substantial potential for this new intervention. Given the goal of having a ‘downstream’ effect on reading comprehension, the finding of moderate effect sizes for many trials on the intervention-aligned listening-comprehension measures was particularly compelling. These findings demonstrate that many children were able to better respond to both literal and inferential questions about stories that included

the taught syntactical structures and mental state words after just 12 brief sessions of instruction. A recent study (Clarke et al., 2010) that taught language skills and found effects on reading comprehension bolsters the idea that the very strong relation between oral and written language comprehension can be leveraged successfully to improve reading comprehension, a conclusion also drawn by Bowyer-Crane et al. (2008) in discussing their oral language intervention.

The theoretical framework behind this intervention was that improvements in receptive and expressive language, with specific attention to literate language features, could affect listening comprehension and ultimately reading comprehension. These initial findings align with this framework and suggest that targeting high frequency sentence-level syntactic features, which are rarely explicitly taught to children without diagnosed language impairment (Kolln and Hancock, 2005), may be a malleable pathway for impacting oral and reading comprehension. Of course, the true test of these possibilities requires a controlled and, for the youngest children, longitudinal efficacy trial that includes assessment of reading comprehension. Furthermore, the mediating role of proximal syntax targets in effects on listening and reading comprehension needs explicit testing. In addition, more understanding is needed regarding which types of language skills are optimal as targets when the goal is reading comprehension improvement. Just such a comparison of this intervention with ones focused on vocabulary or narrative understanding is underway. In addition, as suggested by Bowyer-Crane et al. (2008), future research will include testing this intervention in combination with programs addressing decoding and vocabulary to determine whether such a comprehensive approach maximizes the improvement of reading comprehension.

1 Limitations and next steps

The most prominent limitation of this study was the absence of a control group, without which we cannot make causal claims. This preliminary design was an intentional feature of the development process, and randomized efficacy trials of 12 weeks' duration are being conducted in each grade to fully support causal inferences for the interventions. Likewise, the small sample sizes of just 16 children per group limited capacity to detect more statistically significant findings even when effect sizes were in the range considered educationally meaningful.

Although this study utilized numerous standardized language measures to qualify children for intervention, due to the very brief trial duration these measures were not included as the pre- and post-assessments; they are included in the efficacy trials. To learn whether the focus on mental state vocabulary might have an impact on theory of mind, both mental state vocabulary and false belief understanding measures are included in these efficacy trials. An additional limitation, of interest given the desire to integrate instruction across academic content areas, is the absence of assessment indicating that the children gained in their knowledge of the science concepts that were the contextual focus of intervention. Research exploring the direct, and indirect, via language competence, impacts on science understanding should be conducted. Further investigation is also warranted of the long-term impact of the intervention and whether its effects would generalize to a range of oral and written language comprehension contexts.

Given the importance of keeping close alignment between the instruction and assessments, we made changes to both sentence-level and listening-comprehension measures between trials. This confounds potential improvements in instructional content with possible changes in item difficulty when comparing the results of initial and revised trials. Another aspect of the assessment development process that may be a limitation was the decision to create assessment stories including the same characters as the instructional stories. At post-test, some of the younger children confused

events from the previously heard intervention stories with those in the just-read assessment stories, likely lowering their correct responses scores and thus leading to a potential underestimate of the intervention association with change in intervention-aligned listening comprehension within these trials. In more recent studies we replaced these stories with passages on unrelated topics but of similar syntactical structure.

2 Implications

Although preliminary, the results presented here regarding increases in syntactical skill after just three weeks of instruction support the promise of these small-group interventions as a supplemental module that teachers could implement within their classrooms. Given the substantial proportions of screened children who qualified, the need is clear for evidence-based instruction on aspects of language that are key for both oral and written comprehension. Moreover, we demonstrated the feasibility and highly engaging format of these lessons in three distinct grade levels, a finding that, conditional on demonstrations of efficacy at multiple grade levels, may support the potential for school-wide adoption of small group instructional content that is both universal and tailored for specific age and grade level suitability.

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Declaration of conflicting interest

The author declares that there is no conflict of interest.

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Appendix I

Example lesson plan components

The lesson plan components reprinted below are for First Grade Unit 4: Elaborated Noun Phrases. The specific segments represent part of an activity using the marble run motion prop and represent the Model-Supported-Independent instructional design features of the intervention. These features include modeled behaviors, requests for receptive behaviors demonstrating understanding of spoken instructions using the targeted syntax components, and then requests for expressive utterances that included the targeted syntax.

Model

Put the marble above the wheel and orange slide.

The shiny, glass marble spins the wheel before going across the orange slide and drops into the red vortex where it rolls around in circles then goes down the hole. Did you hear me use several describing words in order to tell you exactly what the marble does?

Supported receptive activity

Now I want you to help me start the marbles.

Give each student a chance to start the marble. Remind the student to listen carefully while you say the sentence first. After you say the sentence have the student perform the action that you stated. Scaffold as needed until they complete the correct action.

The shiny round marble glides across the smooth purple slide before speeding to the bottom of the exciting marble run.

Independent expressive activity (with scaffolded support as needed)

Start the marble on the tower leading to the purple slide.

What did the marble do? Use describing words to tell us.

Scaffolded supports

Have the student start the marble and point out a specific part of the run to have them describe with multiple adjectives.

The marble is going down this slide. Tell me about this slide. What kind of slide is the marble rolling down?

The marble went down the twisty yellow slide. Now you say it.

Have the student repeat your sentence describing the marble run.

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