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Promise and feasibility of teaching expository text structure: a primary grade pilot study

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Abstract Research to guide text structure interventions for the primary grades is very limited, yet as early as in kindergarten, many state standards increasingly emphasize exposure to challenging expository texts. The purpose of the present study was to provide preliminary evidence of the feasibility and promise (or the effects) of three brief text structure interventions for kindergarten, first, and second graders who had average to low-average comprehension and relatively weak vocabulary skills. A total of 172 students participated (with 52, 62, and 58 in kindergarten, first and second grades, respectively). Students were randomly assigned within classrooms to one of three conditions: sequencing, compare and contrast, or cause and effect. Interventionists provided the interventions for four weeks to small groups of students. The findings demonstrated significant growth for all conditions on the taught text structure items of a researcher-made measure; significant growth was also reported on standardized measures of comprehension and oral language measures in the compare and contrast and cause and effect conditions, but not for sequencing.

Keywords Reading comprehension · Elementary school · Literacy · Text structure intervention · Tier 2 · Small group intervention · Oral language · Primary grades

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Introduction

Reading to comprehend text requires students to actively engage with text through a variety of tasks including: using strategies, activating prior vocabulary or background knowledge, making inferences, and getting the gist or main idea (e.g., Cromley & Azevedo, 2007; Kintsch, 1998). Researchers have demonstrated that comprehension of expository text is more challenging than narrative text (e.g., Englert & Thomas, 1987; McNamara, Kintsche, Songer, & Kintsch, 1996; Williams, 2005) particularly for poor readers who struggle to recall and organize facts (Cain, Oakhill, Barnes, & Bryant, 2001; Haager & Vaughn, 2013). In particular, understanding expository text requires students to move beyond comprehension strategies such as using a familiar story structure, which involves features such as characters, a setting, a plot and a solution to being required to learn to use less familiar and cognitively more complex structures. Specifically, Meyer (1987) described several common text structure features in expository text such as description, sequence, cause and effect, compare and contrast, and problem and solution.

Other issues that can make expository text more challenging to comprehend than narrative text include specialized vocabulary and the need to remember many details that make lack coherence (Lee & Spratley, 2010). Furthermore, expository text is not always organized in an explicit or obvious manner (Mesmer, Cunningham, & Hiebert, 2012). The historical lack of informational text in elementary classrooms (e.g., Duke, 2000) could also limit young readers' access to and practice with informational text. The Common Core Standards (CCSS) for English Language Arts (National Governors Association for Best Practices and the Council of Chief State School Officers, 2010) and other state standards have begun to emphasize the importance of listening and reading comprehension in both narrative and informational, or expository texts beginning in kindergarten. Thus, the purpose of the intervention, Teaching Expository Text Structures, as we describe here, was to provide an effective and feasible program for teaching text structure to students in kindergarten through second grade who have weaker reading comprehension skills.

Text structure and rationale for the teaching expository text structures (TEXTS) intervention

Meyer and Poon (2004) proposed that students' reading comprehension in expository text would be improved by teaching children to be aware of and to use the major types of text structures including: sequencing, which emphasizes a numerical or chronological order to describe items or events; cause/effect, which delineates one or more causes and then describes the ensuing effects; and compare/contrast, which compares and contrasts two or more similar events, topics, or objects. Earlier Meyer (1987) had proposed that understanding the schema or text structure the author was intending to use supports comprehension of expository text. More recently, Meyer and Wijekumar (2016) have summarized a decade of work

with older elementary students, which culminates in an intelligent tutorial to support text structure.

A recent meta-analysis (Hebert, Bohaty, Nelson, & Brown, 2016) represents the first examination of the effects of text structure instruction on the expository reading comprehension for students in grades 2–12. Their search located 45 studies and included 323 effect sizes, with an overall mean effect size of 0.57 on researcher-created expository text comprehension measures. The most commonly taught text structures were either compare/contrast (46%) or cause/effect (23%) Interestingly, Hebert et al., noted that instruction in more than one text structure was important, with an increased 0.13 effect accruing for each taught text structure. Further, studies that included writing (e.g., note-taking, answering short questions or responding to text) were associated with a 0.38 increase in effect size. The authors noted the need for future research with younger children and research that included instruction in multiple text structures. Hebert et al. noted that their study extended findings from prior syntheses of expository or informational interventions were particularly beneficial, producing moderate to large effects for students struggling with comprehension or who had reading disabilities (e.g., Ciullo, Lo, Wanzek, & Reed, 2016; Gajria, Jitendra, Sood, & Sacks, 2007).

To date, the youngest students participating in empirical studies of expository text structure have been second graders, and they were trained only in cause and effect (e.g., Hall, Sabey, & McClellan, 2005; Reutzel, Smith, & Fawson, 2005; Williams, 2005; Williams et al., 2005, 2007, 2016). Williams et al. (2007) found that text structure training for second graders was more powerful when it involved completion of graphic organizers and the text was limited to brief paragraphs. However, in our search of the literature, we were surprised to find no empirical studies with kindergarten or first grade and no studies in second grade that focused on teaching the structures of sequencing or cause/effect.

Thus, in our study, we intended to extend the research by focusing on students from kindergarten to second grade with comprehension skills at or below grade level in order to investigate the feasibility and promise of three relatively brief intervention modules of text structure instruction, which could eventually be combined. Our working hypothesis was that the more a beginning reader was aware of how expository text was organized or connected through signal words, the easier it would be to read (or in kindergarten, to listen) and comprehend the causal, temporal, or comparative links across and within sentences or information. Given research showing that students benefit from direct and explicit instruction, we planned instructional routines that incorporated modeling, guided, and individual practice. For example, with regard to sequencing text structure, we hypothesized that beginning readers might understand the temporal nature of a sequence of events better when (1) they could read or be read to using text that explicitly used temporal language, (2) they were directly taught relevant connectives (e.g., first, next, last), and (3) when they were directly taught to use a graphic organizer as a scaffold for retelling the text.

We also intended to extend the research by considering for whom our intervention may have promise. Thus we considered the association between participation in the TEXTS intervention and children's developing language skills.

The links between children language, particularly vocabulary, has been well established (e.g., Nation, 2005; National Reading Panel, 2000). Students with stronger language skills, including lexical, semantic, and metalinguistic skills generally have stronger reading comprehension skills as one of the best predictors of later reading comprehension is children's language skills (National Early Literacy Panel, 2008).

The TEXTS design study

The purpose of the present study was to provide preliminary evidence of the feasibility and promise (or the effects) of three brief text structure interventions for kindergarten, first, and second graders who had average to low-average comprehension and relatively weak vocabulary skills. Specifically, this was a pilot design study that was part of a larger IES-funded examination of Reading for Understanding (https://ies.ed.gov/ncer/projects/program.asp?ProgID=62), which had included our initial smaller scale design study (Connor et al. 2014). For the present study, we used a pattern exploration design (Shadish, Cooke, & Campbell, 2002) where eligible children at each grade level were randomly assigned to one of three interventions targeting one of three specific text structures: sequencing, cause and effect; and compare and contrast. The proximal measure, the ETSS, included six specific items for each target text structure plus counterfactual items assessing children's knowledge of problem solving text structure. In this design, there was not a no-treatment control condition, rather the items not aligned with the target are used as the counter factual. That is, we hypothesized that students would make greater gains on the items that were specifically targeted in their text structure intervention, but we also hypothesized that some students might be able to transfer their understanding of text structure beyond the type they were directly taught to another structure. This design allowed us to quickly assess the promise of each of the brief interventions and to collect qualitative data on feasibility and student engagement through field notes of interventionists, informal observations of students, communication with classroom teachers, notes from interventionists' team meetings, and other related artifacts.

Three sets of research questions guided our pilot design study. The first set related to assessing feasibility and usability: What is the nature and variability of expository text structure skills in elementary students? How did the students respond to the three TEXTs interventions? What design components were effective and which needed to be changed or revised? The second set assessed the promise of these brief intervention modules: To what extent do the three brief interventions impact the targeted text structure compared to other text structures that were not specifically targeted. Does expository text structure instruction affect comprehension of untaught expository text structures? The third set explored the relation between expository text structure instruction and language and literacy outcomes? Does this relation depend on intervention assignment and grade?

Methods

Schools and participants

Consistent with the intent of the larger study to explore reading for understanding in schools serving high poverty populations, we recruited four schools in a rural and coastal area within a southeastern state to participate in the TEXTS (Teaching Expository Text Structures) intervention pilot study during the 2011–2012 school year. The majority of these four schools served a population of high poverty students in a rural Florida county. We sought parental consent from all students in each participating class (9 kindergarten classrooms, 10 first grade classrooms, and 14 second grade classrooms; two classrooms were multi-age) and then screened these students to determine qualification. The screener included two stages. First, we administered a standardized measure of Passage Comprehension, and then we administered a researcher-created expository text structure screener (ETSS) (both measures are described in the Methods section). Qualifying students scored below a standard score of 100 on the Passage Comprehension subtest and also answered less than half of the text structure questions correctly for each text structure targeted by the intervention. Then, we randomly assigned qualified students within classroom to one of three expository text structure conditions: sequencing, cause and effect, or compare and contrast. A total of 172 students qualified; of these 58.72% were male and most were Caucasian (32 were African American, three were Asian, one was Native American, and 9 were Multi-racial). Of the 52 participating kindergarteners, 16, 17 and 19 students respectively were assigned to sequencing, cause and effect, or the compare and contrast conditions; the numbers of first graders ($n = 62$) assigned to these conditions were 21, 19, and 22 and the numbers of second graders ($n = 58$) assigned to these conditions were 19, 19, and 20.

Intervention and interventionists

A total of three research assistants provided four weeks of the TEXTs interventions in the condition to which they were assigned (sequencing, compare/contrast, or cause/effect). All three were female and had teaching certification and experience at the primary level. Training was provided by the first author and research assistants who helped design TEXTs and comprised a full day work shop and observation of lessons until all of the aspects of TEXTs were provided as intended (i.e., strong fidelity). Training took about 2 weeks. Intervention lessons were conducted in a small group (ranging from three to five students), four days per week, for four weeks, lasting approximately 15–20 min each day. The fifth day of each week was used as an assessment day wherein each child was individually administered a passage and corresponding comprehension questions that represented the condition to which they were assigned. These assessments were used to determine the speed of mastery with which students were learning the content. However, for purposes of the pilot study to gauge the promise of the intervention, the intervention was

	Day 1	Day 2	Day 3	Day 4
Clue Words	Introduce Clue Words	Clue Word Memory	Clue Word Bingo	I'm Thinking of a Clue Word
Visual Examples	Show Visual Examples	Show Visual Examples		
Text Reading	Story Reading	Cloze Story	Comic Strip Stories	Clueless Stories
Application Activities	Story Picture Sort Q and A (4th)	Graphic Organizer Story Maker	Clue Word Spinner	Story Picture Sort Q and A (4th)
Conclusion	Review Clue Words	Review Clue Words	Review Clue Words	Review Clue Words

Fig. 1 TEXTS Lesson structure

provided in a standard protocol; thus the duration and the pacing of the intervention did not change based on individual students' results on these weekly assessments.

The TEXTS lessons were designed to instruct students on the three text structures following uniform routines. Interventionists trained students on the specific signal words (which we called "clue" words with the children) that were associated with the specific expository text structure (see Fig. 1 for a sample of the instructional routines for a week). Then, as interventionists introduced the brief texts, they explained the nature and function of the text structure. Each day throughout the week, students participated in repeated readings of the same story, practiced recognition of clue words therein, and used graphic organizers to retell and organize the story by its structure. Repeated readings followed an explicit instruction framework that included explicit teaching and modeling, as well as guided practice, which was followed by independent practice. During modeling, the interventionists read expository text and emphasized the clue words associated with the structure (e.g., first, next, last; same, different; because). Guided practice allowed students the opportunity do the same activities that were modeled during explicit teaching and to discuss the meaning of the text and to practice oral retelling. During independent practice, kindergarten students used pictures to complete the graphic organizers independently while first and second grade students wrote to create their own graphic organizers to retell.

Measures and procedures

The expository text structure screener (ETSS) included 20 questions which targeted each expository text structure. Six questions were allocated to each structure

Table 1 HLM fitted means with no intercept and effect sizes for TEXTS conditions

	Cause effect	Compare contrast	Sequencing
Post CE RS (1.15)	2.109	1.83	1.74
Post CC (1.17)	1.16	1.75	1.53
Post Seq (1.50)	2.51	2.69	2.85
Post PS (.70)	1.072	1.065	1.129
Effect size of (d) calculated using fitted means			
Post CE RS (1.15)	1.833	1.59	1.51
Post CC (1.17)	0.991	1.49	1.307
Post Seq (1.50)	1.67	1.793	1.9
Post PS Control (.609)	1.53	1.52	1.61
Mean difference ES with control (d)	.303	−.03	.29

targeted by the intervention (Sequencing, Cause and Effect, and Compare and Contrast). Two questions were assigned as counterfactual items to measured knowledge of Problem and Solution, a structure not taught by the intervention.

Students were also administered other language and literacy tests that might be influenced by text structure knowledge gains. For oral language, these included four subtests of the *Woodcock Johnson Test of Achievement* (*WJ-III;* Woodcock, McGrew, & Mather, 2001): Listening Comprehension, Story Recall, Picture Vocabulary, and Oral Language. For literacy, we administered the *WJ-III* Passage Comprehension subtest, which measures comprehension of both expository and narrative passages. Students are asked to complete a sentence with the correct word. For young students, a picture accompanies the sentence. As the test progresses, pictures are not used and sentences become short passages on a specific topic. The Word Identification subtest was also given at pretest to approximate decoding skills to describe the qualifying population.

Members of the research team, who were blind to students' condition, individually administered all measures in a quiet area of the school. The team were well-trained and all protocols were double checked for accuracy prior to data entry (Table 1).

Results

Variability in initial skills, feasibility and usability of TEXTS

Our first set of research questions assessed the feasibility and usability of the intervention. We found wide variability in students' understanding of text structure prior to receiving the TEXTs interventions. For example, on the pre-intervention ETSS, students achieved an overall mean of 5.35 (2.27) with a possible score of 20, with a range of 0 to only 9. Their performance improved significantly

[t (171) = 7.639, $p < .001$] after participating in TEXTs (keeping in mind they were taught only one structure (6 items), with a mean score of 7.19 (2.796) and a range of 1–18 items correct out of 20 items. Of the various text structures, students' mean score (out of a possible 6) was highest for Sequencing (M = 1.88, SD = .954, range 0–4) and the lowest was Compare and Contrast (M = .95, SD = .891, range 0–3, See Fig. 2).

Again, only students with passage comprehension skills at or below grade level (standard score <101) were selected to receive TEXTs, mean standard scores on the measures were below the expected standard score mean of 100, with passage comprehension lowest at 88 (9.89). More telling is the range of standard scores, which ranged from a low standard score of 12 on the Listening Comprehension task to a high of 127 on the Story Recall task (see Table 2). ETSS score pre-intervention was not significantly correlated to passage comprehension or the four language measures, although there were trends for positive associations (e.g., Story Recall, $r = .142$, $p = .063$).

We also carefully reviewed interviews with students and interventionists, as well as classroom teachers to assess feasibility and student engagement. We also reviewed design team meeting notes and other artifacts collected during the implementation of the study. Based on our overall review, the interventionists provided TEXTS as intended and with consistently high fidelity. This is not surprising since the interventionists were part of the research team. In a number of classrooms, the teachers asked that we provide TEXTS as a push-in center wherease other teachers preferred that the children be served outside the classroom. In all cases, we provided TEXTS following the teachers preference. In all, the interventionists reported that TEXTS was esy to implement although they observed

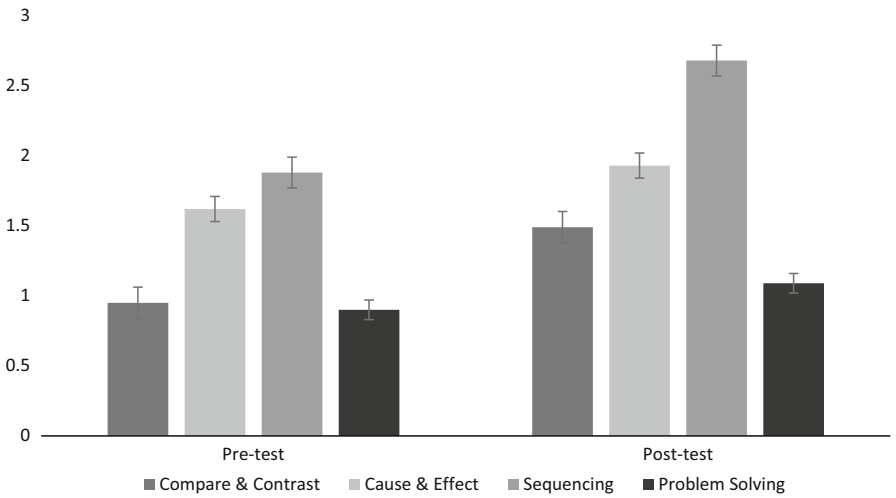

Fig. 2 Pre-post intervention mean raw scores for the text structure sub-tests. *Error bars* are standard errors. Paired sample *t*-tests indicate that gains pre- to post-intervention were significantly different than 0 (p ranges from .008 to <.001). The smallest mean differ was for Problem Solving, as hypothesized

Table 2 HLM results on ETSS for sequencing

Pretest mean (intercept)	K			K	First	Second
	CO	SE	*p* value		Calculated intercept	Calculated intercept
Sequencing	1.42	0.22	<0.001			
Grade	0.37	0.18	0.05	1.42	1.79	2.16
Cause and effect	1.41	0.22	<0.001			
Grade	0.60	0.15	<0.001	1.41	2.00	2.60
Compare and contrast	1.56	0.14	<0.001			
Grade	0.25	0.14	0.07	1.56	1.56	1.56
Linear (slope)					Calculated slope	Calculated slope
Sequencing	0.68	0.30	0.02			
Grade	0.35	0.25	0.16	0.68	0.68	0.68
Cause and effect	0.39	0.30	0.19			
Grade	0.11	0.23	0.65	0.00	0.00	0.00
Compare and contrast	0.79	0.39	0.05			
Grade	0.05	0.26	0.84	0.79	0.79	0.79

Calculated score denotes the adjusted pretest mean or slope for first and second grade, depending on its significant from the reference group (Kindergarten)

that the pacing, which was standardized, was not ideal for all students—too fast for some and too slow for others.

Assessing the promise of TEXTS

Our second set of research questions asked the following: To what extent do the three brief interventions impact the targeted text structure compared to other text structures that were not specifically taught? Does expository text structure instruction affect comprehension of untaught expository text structures? Did students transfer an understanding of the structure they were taught to any untaught structures?

We used Hierarchical Linear Modeling (HLM, Raudenbush & Bryck, 2002) to accommodate the nested structure of the data, students nested in groups and classrooms. Because groups were composed within classrooms, controlling for shared variance at the classroom level in a two-level model (students nested in groups/classrooms) provided the best fit for the data. Each intervention was dummy coded using 0,1 (sequencing = 0,1, cause and effect = 0,1, compare and contrast = 0,1). Intercepts were removed at level two so that coefficients could represent specific intercepts and slopes for each intervention without the use of a reference group. We tested for the impact of grade and pre-intervention literacy and language skills, but they had no significant effect on the results and so were trimmed

from the models to preserve parsimony. Using the fitted means from the HLM models, we computed effect sizes (*d)* using the level 1 standard deviation.

Results are presented in Table 1 with fitted means and standard deviations (top) and effect sizes (bottom). For cause and effect and sequencing, the pattern of results was as hypothesized on the ETSS items. Students made greater gains on the items that assessed the targeted text structure with large effect sizes (1.49 for compare and contrast, 1.8 for cause and effect, and 1.9 for sequencing). When we considered effect sizes controlling for our counterfactual items (problem solving), effect sizes were smaller but still educationally meaningful at .30 for cause and effect, and .29 for sequencing. For compare and contrast, there was no significant effect when the effect size controlled for the counterfactual ($d = -.03$). Surprisingly, the compare and contrast intervention had a larger effect on sequencing.

We then considered a three-level HLM model to examine growth from pre- to post-intervention by grade level. Outcomes for the TEXTS proximal measure and other standardized language and literacy measures were tested as follows: Growth or change from pre- to post-intervention was examined at level one where 0 represented scores at time one and one represented scores at time two. Therefore, intercepts represented fitted pretest means. A total of six points (for six items) was possible to score for each ETSS subtest structure (sequencing, cause and effect, compare and contrast). Two points (two items) were available for problem and solution items (which were untaught). For the *WJ-III* subtests, w scores were used in all models of analyses.

Level-1 Model

$$\text{Ytij (Outcome measure)} = \pi_{0jk} + \pi_{1jk}\left(\text{Time}_{ijk}\right) + e_{ijk}$$

Level-2 Model

$$\begin{aligned}\pi 0jk &= \beta 01(SEQk) + \beta_{02k}\left(CE_{jk}\right) + \beta_{03k}\left(CC_{jk}\right) + r_{0jk}\\ \pi 1jk &= \beta 11(SEQk) + \beta_{12k}\left(CE_{jk}\right) + \beta_{13k}\left(CC_{jk}\right)\end{aligned}$$

Level-3 Model

$$\begin{aligned}\beta_{01k} &= \gamma_{010} + \gamma_{011}(GRADE_k) + u_{01k}\\ \beta_{02k} &= \gamma_{020} + \gamma_{021}(GRADE_k)\\ \beta_{03k} &= \gamma_{030} + \gamma_{031}(GRADE_k)\\ \beta_{11k} &= \gamma_{110} + \gamma_{111}(GRADE_k)\\ \beta_{12k} &= \gamma_{120} + \gamma_{121}(GRADE_k)\\ \beta_{13k} &= \gamma_{130} + \gamma_{131}(GRADE_k)\end{aligned}$$

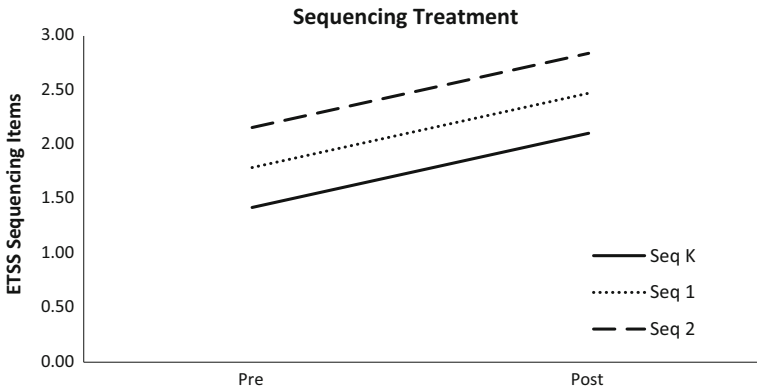

Fig. 3 Graph of HLM model for ETSS sequencing items

Overall, the pattern of results were highly similar to the previous analyses using effect sizes. On average, students who were assigned to the sequencing condition for all grades made significant gains on the ETSS sequencing items (see Fig. 3 for a graph and Table 3). Pretest scores on the ETSS Sequencing items differed significantly by grade whereas the amount of growth from pre to post intervention was not significantly different by grade. Students in the sequencing condition did not make significant gains in the untaught conditions cause and effect or compare contrast.

Students assigned to the cause and effect condition made significant gains from pre to post test. Pretest scores on the cause and effect items were not significantly different by grade and growth was also consistent across grades (See Fig. 4; Table 3). Uniquely, students in the cause and effect condition also made significant gains on the ETSS problem and solution items which were untaught.

Gains for students assigned to the compare and contrast condition depended on grade level (Fig. 5 for a graph and Table 4). Pretest scores on the ETSS compare and contrast items did not significantly differ by grade but change from pre to post test was unique to grade with kindergarten students experiencing no significant gains, in contrast to first and second graders who did make significant gains. Students in the compare and contrast intervention also made significant gains on the ETSS Sequencing items even though this structure was not taught to them. Figures 6 and 7 represent this pattern of the effect of compare and contrast intervention on sequencing and problem and solution items.

Examining the relation between TEXTS and language and literacy skills

Our third set of research questions addressed the relation between expository text structure instruction and language and literacy outcomes. We examined the effect of the TEXTs interventions on Passage Comprehension using HLM. Students assigned to the cause and effect intervention or to the compare and contrast intervention

Table 3 HLM model for ETSS CE items

Pretest mean (intercept)	K			K	First	Second
	CO	SE	*p* value		Calculated intercept	Calculated intercept
Sequencing	1.99	0.23	<0.001			
Grade	−0.38	0.17	0.03	1.99	1.61	1.23
Cause and effect	1.46	0.31	<0.001			
Grade	−0.09	0.20	0.68	1.46	1.46	1.46
Compare and contrast	1.90	0.20	<0.001			
Grade	−0.24	0.14	0.09	1.90	1.90	1.90
Linear (slope)					Calculated slope	Calculated slope
Sequencing	0.37	0.32	0.26			
Grade	−0.21	0.23	0.36	0.00	0.00	0.00
Cause and effect	1.15	0.34	<0.001			
Grade	−0.42	0.25	0.10	1.15	1.15	1.15
Compare and contrast	0.12	0.25	0.62			
Grade	−0.03	0.22	0.91	0.00	0.00	0.00

Calculated score denotes the adjusted pretest mean or slope for first and second grade, depending on its significant from the reference group (Kindergarten)

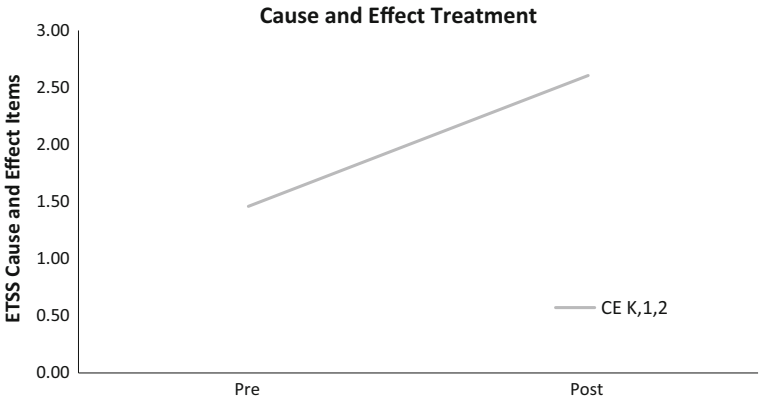

Fig. 4 Graph of HLM model for ETSS cause and effect items

made significant gains on the Passage Comprehension. However, students assigned to the sequencing intervention did not demonstrate significant gains (see Fig. 8; Table 5).

Because we had four different language measures, we used multivariate multilevel models with repeated measures nested in students (see Table 6), controlling for pre-intervention Story Retell W score. The unrestricted model had the better fit [X^2 (8) = 415, $p < .001$]. Overall, all three TEXTS interventions

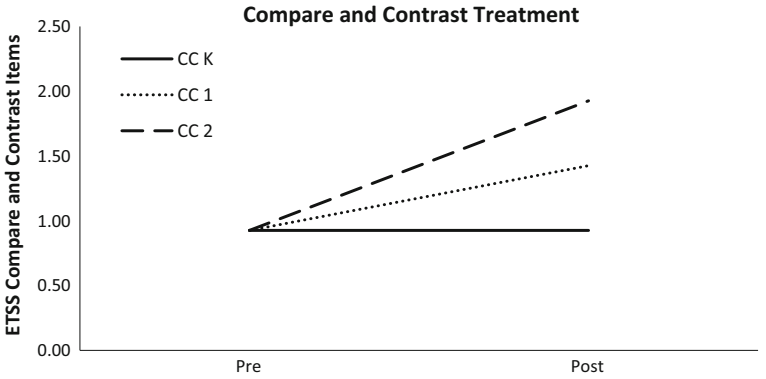

Fig. 5 Graph of HLM model for ETSS compare and contrast items

Table 4 HLM model for ETSS compare and contrast items

Pretest mean (intercept)	K			K	First	Second
	CO	SE	*p* value		Calculated intercept	Calculated intercept
Sequencing	0.81	0.17	<0.001			
Grade	0.05	0.14	0.71	0.81	0.81	0.81
Cause and effect	0.81	0.21	<0.001			
Grade	0.25	0.18	0.16	0.81	0.81	0.81
Compare and contrast	0.93	0.17	<0.001			
Grade	−0.01	0.16	0.96	0.93	0.93	0.93
Linear (slope)					Calculated slope	Calculated slope
Sequencing	0.31	0.23	0.18			
Grade	0.35	0.23	0.12	0.00	0.00	0.00
Cause and effect	0.44	0.26	0.09			
Grade	−0.31	0.21	0.14	0.00	0.00	0.00
Compare and contrast	0.27	0.24	0.26			
Grade	0.50	0.21	0.02	0.00	0.50	1.00

Calculated score denotes the adjusted pretest mean or slope for first and second grade, depending on its significant from the reference group (Kindergarten)

predicted language skills to the same extent. Post-hoc assessments using HLM growth curve models suggested that students assigned to the sequencing condition did not make significant gains on other language and literacy skills except for WJ-III Picture Vocabulary. Students assigned to the cause and effect and the compare and contrast conditions made significant gains from pre to post test on Oral Language, Listening Comprehension, and Passage Comprehension, but not on Story Recall. Notably, the largest coefficient of growth was observed for Passage Comprehension.

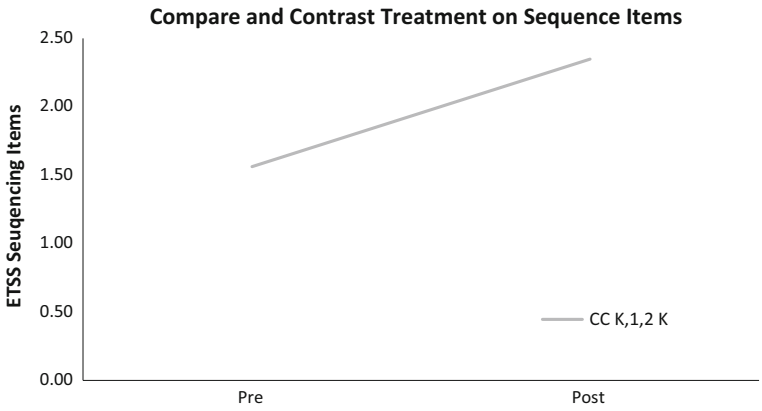

Fig. 6 Graph of HLM model for ETSS compare and contrast treatment on sequencing items

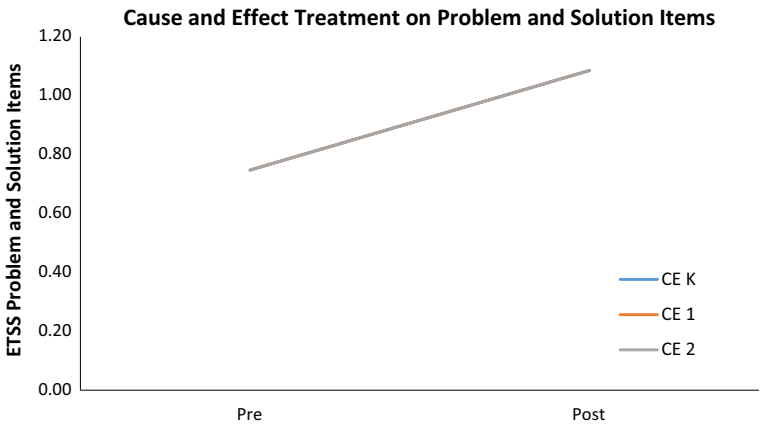

Fig. 7 Graph of HLM model for ETSS compare and contrast treatment on problem and solution items

Discussion

The purpose of this pilot study was to extend existing research demonstrating the efficacy of text structure instruction for older students to younger primary grade students with average to low comprehension skills. Although research has shown the efficacy of text structure instruction for students in second grade and beyond (e.g., Ciullo et al., 2016; Hebert et al., 2016), designing interventions that teach expository text to students in the primary grades is needed given that many state standards (and the CCSS) emphasize informational texts beginning in kindergarten and given the challenges this genre places on students (Haager & Vaughn, 2013). We had followed an iterative design process to create the TEXTS intervention to incorporate instructional routines that were effective for older students (e.g., explicit instruction, signal words, brief text, graphic organizers, and written retells) and also adapted some routines that had evidence for older students for our younger students

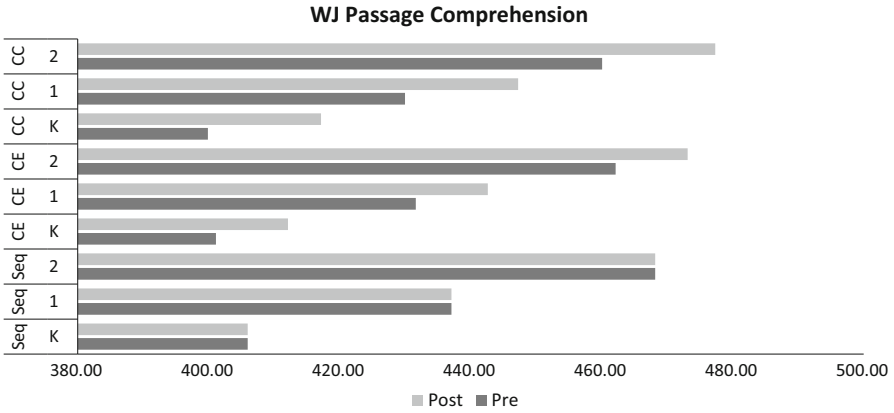

Fig. 8 Pre to post W scores on WJ-III passage comprehension by grade and intervention condition. *Seq* sequencing; *CE* cause and effect; *CC* compare and contrast

Table 5 HLM models for Woodcock Johnson passage comprehension

Pretest mean (intercept)	K			K	First	Second
	CO	SE	*p* value		Calculated intercept	Calculated intercept
WJPC sequencing intercept	405.96	3.11	<0.001			
Grade	31.11	1.83	<0.001	405.96	437.06	468.17
WJPC cause and effect intercept	401.12	3.50	<0.001			
Grade	30.51	2.64	<0.001	401.12	431.63	462.13
WJPC compare and contrast intercept	399.88	3.57	<0.001			
Grade	30.10	2.05	<0.001	399.88	429.98	460.07
Linear (slope)					Calculated slope	Calculated slope
WJPC sequencing intercept	7.27	4.67	0.12			
Grade	4.06	3.09	0.19	0.00	0.00	0.00
WJPC cause and effect intercept	11.00	4.40	0.01			
Grade	3.15	2.93	0.28	11.00	11.00	11.00
WJPC compare and contrast intercept	17.27	3.37	<0.001			
Grade	−1.29	2.04	0.53	17.27	17.27	17.27

Calculated score denotes the adjusted pretest mean or slope for first and second grade, depending on its significant from the reference group (Kindergarten)

(e.g., reading aloud to them, using manipulatives to scaffold retells). In this study, we examined the preliminary feasibility and promise of the TEXTS interventions for improving primary grade students' understanding of taught and untaught text

Table 6 Final estimation of fixed effects

	Coefficient	Standard error	t-ratio	Approx. d.f.	p value
For INTRCPT1, π_0					
SEQ (β_{00})	488.054613	0.755162	646.292	168	<0.001
CE (β_{01})	−0.916155	1.073261	−0.854	168	0.394
CC (β_{02})	−0.285148	1.044825	−0.273	168	0.785
PRESRW (β_{03})	0.487817	0.054758	8.909	168	<0.001

structures on a researcher-made expository text measure and for improving their language and literacy skills assessed on standardized measures.

Summary of findings and major implications

In answering our first set of research questions related to the initial variability in knowledge of text structure, we found that our selected sample of students with average to low comprehension skills had limited knowledge of text structure prior to intervention; of all structures, they had the most familiarity with sequencing. This finding is consistent with studies of older students with poor reading skills (e.g., Cain et al., 2001; Haager & Vaughn, 2013).

In terms of the feasibility of TEXTS interventions, classroom teachers reported that the intervention fit into their schedule and they wished their students had access to all three text structure modules. Some teachers preferred push-into the pull-out method we used. Our three interventionists expressed satisfaction with the program and reported students were engaged and that they particularly enjoyed retelling with the manipulatives. Further, they indicated that the signal, or clue words, did assist students in reading for understanding. The length of sessions was adequate, but interventionists indicated that some children mastered lessons (particularly in sequencing) fairly quickly, and other children need extra practice, but for fidelity purposes, they were constrained from individualizing the pacing of the program.

The impact of text structure interventions on comprehension of expository text have been well documented for older students, particularly for struggling readers and students with reading disabilities with moderate to large effect sizes reported in meta-analytic studies (e.g., Ciullo et al., 2016; Gajria et al., 2007; Hebert et al., 2016). The moderate to large effects on our researcher-made text structure measure replicates and extends this work with younger students; to our knowledge our study included the youngest sample of students to date. Further our findings are consistent with the limited existing research demonstrating the impact of cause and effect text structure interventions for second graders (e.g., Hall et al., 2005; Reutzel et al., 2005; Williams, 2005; Williams et al., 2007, 2016) but also demonstrates positive effects on two additional text structures: cause and effect and sequencing. Findings are also consistent with Meyer, Ray & Middlemiss (2012) regarding signal words. We were somewhat surprised that students in the cause and effect TEXTS condition

appeared to transfer their understanding of text structure to sequencing until we consulted Hebert et al. who also found an effect size of 0.62 on transfer; specifically they argued that cause and effect may have reinforced that something came first (the cause), which was temporally followed by an effect.

In addition, our study employed one of the widest array of standardized measures of language and literacy to date. We found that students in both the cause and effect and compare and contrast conditions made significant gains in Passage Comprehension, Oral Language, Picture Vocabulary, and Listening Comprehension following only four weeks of intervention. However, students in the sequencing condition only showed significant gains on Picture Vocabulary. Interestingly, none of the groups showed significant gains in Story Retell. By contrast, Ciullo et al. cautioned that only two of their 18 studies included any standardized reading measures and Hebert et al. reported that 9 of the 45 studies they reviewed included nor-referenced measures and that the average weighted effect size was very small (0.15); further in four of these 9 studies, the effect sizes were negative.

Finally, our findings also add uniquely to the research in terms of the rigor of our research methodology. We employed a nuanced research design that allowed us to examine effects relative to counterfactual problem and solution items, which indicated some transfer of text structure knowledge to untaught structures. Our sample was large relative to the existing studies and we randomly assigned students to condition. We also used sophisticated data analytic methods that allowed us to account for students being nested within intervention groups and classrooms.

Limitations and directions for future research

As with any school-based research, there are several limitations to our study that we acknowledge, and that inform directions for future research. First, and foremost, we did not formally observe fidelity of intervention, future research should do so. Our assumption was that the interventionists were part of the research team and therefore would implement the intervention as designed. Informal observation showed high fidelity of implementation. Second, our findings are not generalizable to students with above average comprehension or students outside our demographics, but are circumscribed to populations similar to our sample, which by design included high needs low SES schools and students with average to low reading comprehension. Relatedly, students received instruction and TEXTS intervention in English only and none of our students received bilingual or ESL services. Third, our intervention was brief and future research should examine the efficacy of the combination of TEXTS interventions and could also explore whether there is a hierarchy or optimal order for teaching. Fourth, it would be interesting to develop a far-transfer measure that would assess students' ability to use text structure and their subsequent comprehension while reading grade level content area reading texts, for example social studies or science texts. Finally, we believe that it will be important to develop a more flexible and individualized pacing program that could also be informed by initial skills.

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