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LET'S KNOW! PROXIMAL IMPACTS ON PREKINDERGARTEN THROUGH GRADE 3 STUDENTS' COMPREHENSION-RELATED SKILLS

ABSTRACT

Let's Know! is a language-focused curriculum supplement developed through the Institute of Education Sciences' Reading for Understanding initiative aimed at supporting prekindergarten through grade 3 students' listening and reading comprehension. The current study reports results concerning the impacts of 2 instantiations of Let's Know! on students' comprehension-related skills (comprehension monitoring; understanding narrative and expository text, as supported by inference making and knowledge of text structure; and vocabulary) as proximal measures of efficacy. Results from the first cohort of a large, field-based, randomized controlled trial ($N = 766$ students across grades) indicate large, consistent, and statistically significant effects on curriculum-aligned comprehension monitoring and vocabulary probes relative to control, minimal effects on understanding narrative and expository text probes relative to control, and few differences across the two instantiations. Findings are interpreted with respect to the promise of Let's Know! for achieving intended comprehension impacts, and limitations and future directions are discussed.

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UNDERSTANDING how one becomes a proficient reader is complex and has been studied extensively for decades. Yet far too many individuals do not attain proficiency as readers. Since 1992, the National Assessment of Educational Progress has periodically assessed the reading comprehension achievement of a nationally representative sample of students in grades 4, 8, and 12. Findings of the most recent test administration indicated that only 35% of grade 4 students, 36% of those in grade 8, and 38% of grade 12 students reached the proficient or higher level of achievement (National Center for Education Statistics, 2013). Lack of reading proficiency negatively affects, among other things, opportunities related to employment, the ability to evaluate information to make informed decisions, and the enjoyment afforded by being able to read. In response to this, in 2009, the U.S. Department of Education's Office of Educational Research and Improvement charged a group of scholars with the task of developing a research agenda to address the fact that, although decades of research have provided some understanding of reading comprehension development and instruction, the statistics related to proficiency in reading comprehension highlight the need for further systematic study of reading comprehension development and instruction. The Language and Reading Research Consortium (LARRC), involving investigators at multiple universities, was created to investigate whether classroom instruction could be developed that would improve students' language skills as a mechanism for improving reading comprehension. Specifically, LARRC developed curricula supplements, titled Let's Know!, focused on language skills for prekindergarten (PK) through grade 3 (G3) classrooms.

When designing the Let's Know! curricula supplements, it was important to identify which skills would be explicitly taught during classroom instruction. Our work was informed, in part, by the Simple View of Reading, which proposes that reading comprehension is the product of word recognition and listening comprehension (Gough & Tunmer, 1986). Both predict reading comprehension; however, the relative contributions of word reading and listening comprehension differ by grade level (Catts, Fey, Zhang, & Tomblin, 1999; Catts, Hogan, & Adlof, 2005; LARRC, 2015). Whereas word reading predicts less variance as students progress through school (García & Cain, 2014), listening comprehension explains more variance over time (Adlof, Catts, & Little, 2006). In fact, research has shown that students who demonstrate language delays in kindergarten (K) show an elevated risk for reading comprehension difficulties in later elementary school (Catts, Fey, Tomblin, & Zhang, 2002). Research on skilled reading has shown a variety of potentially causal associations between different language abilities and reading comprehension (e.g., Kendeou, van den Broek, White, & Lynch, 2009; Olson et al., 2011; Williams et al., 2005). Because of the importance of early language to later skilled reading comprehension, LARRC chose to focus on language and listening comprehension when developing the Let's Know! curricula supplements. This instruction was provided as part of regular, whole-classroom instruction (Tier 1) so that all students could benefit from the language skills being addressed, under the assumption that explicit instruction in language and comprehension-related skills is a necessary complement to explicit word-reading instruction.

The Importance of Lower and Higher Level Language Skills for Comprehension

Many different language skills can potentially affect later reading comprehension and are often referred to as either lower or higher level language skills (Silva & Cain, 2015). Lower level skills, such as vocabulary knowledge and syntax, develop early and without the need for considerable direct instruction for most students. These skills also form the foundation for higher level language skills, such as making inferences, using text structure to support comprehension, and comprehension monitoring. These higher level skills are widely thought of as less automatic (Cain, Oakhill, & Bryant, 2004; Perfetti, 2007) and are extremely important for reading comprehension, particularly as text becomes more complex. Measures of higher level language skills account for a significant amount of unique variance in elementary students' reading comprehension, even after accounting for lower level language processes (Cain et al., 2004). Our research team posited that providing explicit, systematic instruction in both lower and higher level language skills should have a significant effect on reading comprehension abilities, as is further supported by the research reviewed below.

To understand a text, a reader must know the meaning of at least the majority of the words in the passage, and, in fact, vocabulary knowledge is strongly related to skilled reading and overall academic success (Biemiller, 2006). Longitudinal studies have shown consistent associations between vocabulary and reading comprehension. For example, Snow, Tabors, Nicholson, and Kurland (1995) found moderate correlations between K vocabulary measures and grade 1 reading comprehension, at .44 and .53 for receptive and oral vocabulary, respectively. Vocabulary knowledge is a significant predictor of later reading comprehension as well (e.g., Catts, Nielsen, Bridges, Liu, & Bontempo, 2015; Cunningham & Stanovich, 1997; Olson et al., 2011). Because vocabulary has the potential to positively influence reading comprehension, explicit vocabulary instruction was included in Let's Know! lessons.

Research on the higher level skills of making inferences, comprehension monitoring, and using text structure suggests the critical nature of these skills to reading comprehension and the need for explicit instruction in these areas (Hogan, Bridges, Justice, & Cain, 2011). Inferences are what an individual generates to integrate parts of a text and fill in what was left out by the speaker or writer. The ability to make inferences is a key element of reading comprehension (Oakhill & Cain, 2012), and even very young children can make inferences (Kendou, Bohn-Gettler, White, & van den Broek, 2008). In a recent study with students ages 7 and 11 years, Oakhill and Cain (2012, p. 111) concluded that "early inference skills are causally related to the development of reading comprehension." Inferencing abilities at ages 8 and 9 were significantly related to reading comprehension 2 years later, over and above word reading, vocabulary, and IQ.

The ability to monitor one's comprehension is another higher level language skill necessary for successful reading comprehension (Oakhill, Cain, & Bryant, 2003). Skarakis-Doyle (2002) found that when she presented very young children (ages 30–47 months) with scripts of familiar stories that included "violations" in what they knew as the story, the children were able to detect when something

did not follow their expectations. This comprehension-monitoring ability showed a developmental pattern from the youngest children's nonverbal identification to the oldest children's verbal identification and sometimes elaborate "corrections." Such comprehension monitoring is significantly related to concurrent reading comprehension (Oakhill et al., 2003), and students exhibiting reading comprehension difficulties also tend to display poor comprehension-monitoring skills (Oakhill, Hartt, & Samols, 2005). Moreover, comprehension monitoring as assessed in students at ages 8 and 9 years significantly and uniquely predicted reading comprehension skills 2 years later (Oakhill & Cain, 2012).

A third higher order skill that proficient readers call upon is text structure knowledge. *Text structure* refers to the internal organization of a text; elements of a text can be connected in different ways, and knowledge of the types of text structures can aid readers in comprehending text. For example, the relations between events in stories form a causal structure that lends coherence to the text. This familiar, causal structure of stories aids comprehension of narratives and plays a significant role in the development of comprehension (Lynch et al., 2008). Knowledge of story structure has been found to predict reading comprehension in the elementary grades (Oakhill & Cain, 2012) and later reading comprehension difficulties (Catts, Fey, Zhang, & Tomblin, 2001). Although considerable research exists on the role of story structure in comprehension, there is little research on how young readers use the structure of expository text to aid comprehension; yet a rich literature supports the importance of expository text-structure knowledge for intermediate-grade and older students (see Ray & Meyer, 2011, for a review).

Language-Focused Comprehension Instruction: Let's Know!

Although the connection between language skills and reading comprehension is well established, there is still a lack of direct language-based classroom instruction in PK and elementary grades, and it is often of poor quality (e.g., Connor, Morrison, & Slominski, 2006; Justice, Mashburn, Hamre, Pianta, 2008; Pianta, Belsky, Houts, & Morrison, 2007). In addition, a review of the extant literature suggests that although there are studies of language-focused interventions, most target individual skills—primarily, vocabulary (e.g., Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; Neuman, Newman, & Dwyer, 2011)—or are designed for small-group instruction (e.g., Connor et al., 2014).

As previously stated, the work of the LARRC team is based on the premise that explicit and systematic instruction of the key language skills of vocabulary, making inferences, comprehension monitoring, and use of text structure will positively affect student outcomes on not only proximal measures of these skills but also listening and reading comprehension. Let's Know! was created with an established scope of instruction that transcends both the higher and lower level language skills described. Specifically, curricula were developed for PK through G3 classrooms that would guide teachers in implementing lessons targeting these language skills during whole-classroom instruction. The curricula supplements were designed to be taught for 25 weeks, 4 days per week, for approximately 30 minutes per lesson, and to augment the language arts instruction already being delivered in class-

rooms. The curriculum supplement for each grade consists of four units: two units emphasize narrative texts, and two units emphasize expository texts, with a focus on science-related topics. Each unit consists of a series of structured lessons, which are supported in the literature as a means for improving students' language and reading comprehension (e.g., Beck & McKeown, 2007; Justice, Maier, & Walpole, 2005; Nelson & Stage, 2007; Williams et al., 2005; Williams et al., 2014). These lessons occur in a specific sequence with each lesson targeting one or more of the key language skills associated with comprehension. Notably, formative research during the development of Let's Know! indicated that the curriculum supplement might be more feasibly implemented and better achieve desired impacts if the numbers of different types of lessons were reduced and students received more opportunities to practice particular skills (LARRC, 2016). In response, two instantiations of Let's Know! were created. Let's Know! Broad is the original "full" version of the curriculum supplement. Let's Know! Deep (previously referred to as "light") replaced two specific lesson types (text mapping and making inferences) with additional practice opportunities for vocabulary and comprehension monitoring. Pilot data gathered across four states indicated that, in general, both instantiations were implemented successfully by PK through G3 teachers (LARRC, 2016). Moreover, pilot research also showed greater use of language-focused comprehension supports and higher instructional quality during Let's Know! lessons than during typical language arts instruction (LARRC, Pratt, & Logan, 2014). More details concerning both Let's Know! instantiations and the rigorous, iterative process by which the curriculum supplement was developed are available in LARRC (2016).

The Current Study

The purpose of this study was to investigate the proximal impacts of the two Let's Know! instantiations on targeted comprehension-related skills. These skills—including comprehension monitoring; text understanding, as supported by inference making and knowledge of text structure; and vocabulary—compose the proximal outcomes in the Let's Know! theory of change and thereby serve as the mechanism through which we would expect further impacts on students' listening and reading comprehension. Thus, investigating impacts on these skills represents an important first step in understanding the extent to which Let's Know! may achieve its intended purpose. Although initial, small-scale pilot testing indicated potential positive impacts for PK students (LARRC, Johanson, & Arthur, 2016), the current study expands this work to examine impacts for all grade levels targeted (PK through G3) using a randomized controlled trial. The current study also adds to the extant literature by providing insights into the extent to which these comprehension-related skills may be affected by classroom instruction during the PK and elementary years, heretofore almost exclusively examined in the later grades. Our specific research question was, in each grade, to what extent do Let's Know! Broad and Let's Know! Deep have an impact on students' comprehension monitoring, understanding of narrative and expository text, and vocabulary skills? Based on pilot findings (LARRC, 2016; LARRC et al., 2014, 2016), we hypothesized that students assigned to the Let's Know! instantiations would significantly outperform those assigned to

a business-as-usual control. We also hypothesized that few differences would be apparent for students assigned to Let's Know! Broad versus Let's Know! Deep.

Method

Participants

This study involved participants from the first cohort of a randomized controlled trial of Let's Know! ($N = 862$), with 766 students included in the current analytic sample (see Preliminary Analyses for attrition information). Students were enrolled in 132 classrooms in 61 schools across six states. Of the 766 students, 167 were enrolled in PK classrooms, 155 in K, 139 in grade 1 (G1), 155 in grade 2 (G2), and 150 in G3. District and school administrators, selected by considering school or district size, diversity of students served, prior engagement in research partnerships, and geographic proximity, were initially contacted by study investigators and research staff. The number of districts and schools varied by study site to meet a priori classroom recruitment goals. With permission of administrators, the PK through G3 lead teachers participated in information sessions and self-selected to enroll in the study. Teachers were eligible to participate if they held primary teaching responsibility, did not have any planned extended absences, and agreed to complete all study activities. In addition, PK teachers were required to be in programs that met at least 4 days per week and to teach students matriculating to K the following year. In cases in which teachers taught multiple classes, only one class was selected to participate in the study. The families of all students in participating classrooms received recruitment packets, informed consent forms, and a brief screening questionnaire. Students were eligible to participate if they were proficient in English as rated by the caregiver, had no severe or profound sensory or cognitive difficulties or diagnosed disabilities that would prevent participation in assessments, and would be present in the participating teacher's classroom during the Let's Know! lessons. PK students needed to be 4 years of age by the first assessment. From all consents received, up to six eligible students were randomly selected from each classroom, or, in cases in which six or fewer eligible students consented, all were selected. Although all students in participating classrooms experienced Let's Know! lessons, these selected students also completed study assessments, including the curriculum-aligned assessments used to measure the impact of Let's Know! on proximal outcomes.

Descriptive information concerning students and their teachers and classrooms are presented by grade and condition in Tables 1 through 5. Overall, 53% of students were female, with an average age of 6.5 years ($SD = 17.9$ months) at the start of the academic year. Moreover, 86% were White, 8% were Black, 4% were Asian, and 2% were of other races; 12% were Hispanic or Latino. Per caregiver report, 6% of students had an individualized education program (IEP). Approximately 9% of students' annual family incomes were $25,000 or less; 24% had annual family incomes between $25,001 and $50,000, 13% had annual family incomes between $50,001 and $75,000, and 45% had annual family incomes greater than $75,000 (21% unreported). Half of students' mothers had a bachelor's degree or higher, and 20% of students received free or reduced-price lunch at their schools. On av-

Table 1. Descriptive Information by Condition for the Prekindergarten Analytic Sample ($n = 167$)

	Let's Know! Broad			Let's Know! Deep			Control		
	n	%		*n*	%		*n*	%	
Students (classrooms)	36 (6)			60 (11)			71 (14)		
Attrition rate of students (classrooms)		36.8 (40.0)			16.7 (15.4)			2.7 (.0)	
Teacher highest degree:									
High school/GED	2	33.3		2	20.0		0	.0	
Associate/bachelor	3	50.0		7	70.0		8	61.5	
Graduate	1	16.7		1	10.0		5	38.5	
Student characteristics:									
Female	16	44.4		33	55.0		37	52.1	
Race, non-White	2	5.9		9	15.3		10	14.9	
Ethnicity, Hispanic/Latino	4	11.4		4	6.7		9	12.7	
Parent highest degree:									
High school/GED	**7**	**20.0**		**25**	**41.7**		20	28.2	
Associate/bachelor	**17**	**48.6**		**22**	**36.6**		29	40.9	
Graduate	**11**	**31.4**		**12**	**20.0**		18	25.4	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Student age (months)	55.56	3.89	47–62	53.97	3.69	48–65	54.00	3.96	47–63
Pretest measures:									
Test of Narrative Retell:									
Comprehension questions (max = 6)	3.53	1.54	0–6	3.00	1.75	0–6	2.91	1.80	0–6
Story grammar composite (max = 28)	6.30	7.17	0–23	5.65	6.66	0–23	7.02	7.41	0–23
Expressive Vocabulary Test (max = 190)	**68.53**	**11.53**	**43–88**	63.19	12.96	25–100	**62.08**	**16.46**	**19–100**
Let's Know! vocabulary (max = 32)	**4.37**	**2.83**	**0–10**	3.66	3.71	0–18	**2.73**	**3.22**	**0–15**
Sum scores on curriculum-aligned measures:									
Comprehension monitoring (max = 16)	7.56	5.15	0–15	8.24	3.77	0–15	4.72	3.06	0–13
Understanding narrative text:									
Comprehension questions (max = 12)	9.30	2.46	3–12	8.81	2.46	2–12	9.52	2.49	1–12
Story grammar composite (max = 56)	24.74	13.08	0–45	21.67	12.64	0–44	21.23	13.90	0–46
Understanding expository text, comprehension questions (max = 8)	2.74	2.33	0–7	2.49	1.75	0–7	1.50	1.06	0–4
Let's Know! vocabulary (max = 64)	35.41	16.86	2–64	36.65	14.07	7–61	15.39	10.04	0–42

Note.—Comparisons for variables exhibiting significant differences across conditions in preliminary analyses are in bold.

erage, teachers were 42.2 years old ($SD = 10.28$ years, range: 23–62 years) and had almost 14 years of experience teaching in PK through G3 ($SD = 8.47$ years, range: 1–48 years). Overall, 94% of teachers were White, 2% were Black, and the rest identified as being of other races; 3% were Hispanic or Latino. All elementary teachers held teaching licenses, and 52% of PK teachers held teaching licenses or certification. All elementary classrooms but one were located in public schools, and the average K–G3 classroom included 21 students ($SD = 3.10$, range: 16–30 students).

Table 2. Descriptive Information by Condition for the Kindergarten Analytic Sample ($n = 155$)

	Let's Know! Broad			Let's Know! Deep			Control		
	n	%		*n*	%		*n*	%	
Students (classrooms)	48 (8)			49 (8)			58 (10)		
Attrition rate of students (classrooms)		21.3 (20.0)			2.0 (.0)			0.0 (.0)	
Teacher highest degree:									
Associate/bachelor	4	50.0		0	.0		1	10.0	
Graduate	4	50.0		7	100.0		9	90.0	
Student characteristics:									
Female	27	56.3		25	51.0		30	51.7	
Race, non-White	5	10.6		7	14.9		5	8.8	
Ethnicity, Hispanic/Latino	5	10.6		7	14.3		8	13.8	
Parent highest degree:									
High school/GED	23	48.9		24	50.1		22	37.9	
Associate/bachelor	14	29.8		13	27.1		27	46.5	
Graduate	10	21.3		8	16.7		8	13.8	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Student age (months)	65.40	5.27	56–79	66.04	5.13	57–84	66.72	4.36	56–75
Pretest measures:									
Test of Narrative Retell:									
Comprehension questions (max = 6)	4.21	1.44	0–6	3.84	1.79	0–6	3.84	1.56	0–6
Story grammar composite (max = 36)	11.73	7.71	0–25	9.06	8.44	0–26	12.13	7.87	0–28
Expressive Vocabulary Test (max = 190)	75.28	14.73	35–101	72.45	12.98	53–102	76.09	15.42	43–101
Let's Know! vocabulary (max = 32)	**5.13**	**3.75**	**0–14**	**3.48**	**2.94**	**0–11**	**3.28**	**2.98**	**0–14**
Sum scores on curriculum-aligned measures:									
Comprehension monitoring (max = 16)	10.55	3.30	3–16	10.55	4.32	0–16	5.02	2.74	0–11
Understanding narrative text:									
Comprehension questions: (max = 12)	10.87	1.50	6–12	10.21	1.96	3–12	10.06	2.11	3–12
Story grammar composite (max = 72)	32.78	9.53	15–52	30.80	14.77	0–55	29.90	12.87	0–51
Understanding expository text, comprehension questions (max = 8)	4.17	1.48	1–8	3.79	1.88	0–7	3.39	1.65	0–7
Let's Know! vocabulary (max = 64)	38.11	12.15	5–58	44.39	11.25	15–63	13.32	7.08	3–30

Note.—Comparisons for variables exhibiting significant differences across conditions in preliminary analyses are in bold.

Almost one-fourth (22%) of PK classrooms were Head Start classrooms; the average PK classroom included 17 students ($SD = 5.85$, range: 9–33 students). The vast majority of elementary (96%) and PK (92%) classrooms were using state, local, or commercially available literacy curricula to which Let's Know! served as a supplement.

Procedures

Prior to the start of the academic year, classrooms were randomly assigned to one of three conditions: Let's Know! Broad, Let's Know! Deep, or business-as-usual

Table 3. Descriptive Information by Condition for the Grade 1 Analytic Sample ($n = 139$)

	Let's Know! Broad			Let's Know! Deep			Control		
	n	%		*n*	%		*n*	%	
Students (classrooms)	42 (7)			53 (9)			44 (8)		
Attrition rate of students (classrooms)		12.5 (12.5)			25.4 (25.0)			15.4 (11.1)	
Teacher highest degree:									
Associate/bachelor	1	14.3		1	12.5		1	12.5	
Graduate	6	85.7		7	87.5		7	87.5	
Student characteristics:									
Female	23	54.8		30	56.6		23	52.3	
Race, non-White	8	20.0		7	14.3		5	13.2	
Ethnicity, Hispanic/Latino	10	23.8		13	26.0		8	18.6	
Parent highest degree:									
High school/GED	16	39.0		20	38.5		16	38.2	
Associate/bachelor	15	36.6		20	38.5		20	47.6	
Graduate	7	17.1		8	15.4		3	7.1	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Student age (months)	78.50	4.34	68–89	77.68	4.79	65–91	79.43	4.79	72–93
Pretest measures:									
Detecting Inconsistencies (max = 8)	3.12	2.38	0–7	3.21	2.35	0–8	2.98	2.49	0–8
Test of Narrative Retell:									
Comprehension questions (max = 6)	3.66	1.76	0–6	3.50	1.63	0–6	3.76	1.61	0–6
Story grammar composite (max = 36)	15.69	6.76	0–26	13.90	6.90	0–26	12.37	8.14	0–26
Expressive Vocabulary Test (max = 190)	85.59	14.14	53–112	85.21	15.92	55–118	88.72	12.86	60–113
Let's Know! vocabulary (max = 32)	**6.83**	**4.76**	**0–17**	**5.04**	**4.29**	**0–17**	**4.45**	**3.85**	**0–17**
Sum scores on curriculum-aligned measures:									
Comprehension monitoring (max = 16)	12.56	2.86	5–16	12.23	4.02	0–16	6.29	4.71	0–14
Understanding narrative text:									
Comprehension questions (max = 12)	10.44	1.50	7–12	9.82	1.63	5–12	9.37	2.32	3–12
Story grammar composite (max = 72)	31.23	9.12	7–49	34.84	10.58	2–51	30.00	13.71	5–51
Understanding expository text, comprehension questions (max = 8)	4.90	1.71	1–8	4.31	1.75	1–8	4.20	1.53	1–7
Let's Know! vocabulary (max = 64)	47.73	11.94	19–64	46.07	11.34	12–63	13.39	7.49	1–32

Note.—Comparisons for variables exhibiting significant differences across conditions in preliminary analyses are in bold.

control. Random assignment was blocked by site and grade. We opted for classroom, rather than school, randomization because (*a*) we observed no contamination across classrooms in the same schools in pilot work, in which we conducted numerous classroom observations; (*b*) contamination reduces, rather than increases, treatment effects; and (*c*) classroom randomization affords greater statistical power than does school randomization (Rhoads, 2011). In classrooms assigned to one of the two Let's Know! conditions, teachers implemented the four units composing the Let's

Table 4. Descriptive Information by Condition for the Grade 2 Analytic Sample ($n = 155$)

	Let's Know! Broad			Let's Know! Deep			Control		
	n	%		*n*	%		*n*	%	
Students (classrooms)	59 (10)			54 (9)			42 (7)		
Attrition rate of students (classrooms)		1.7 (0.0)			11.5 (10.0)			6.7 (.0)	
Teacher highest degree:									
Associate/bachelor	2	20.0		1	12.5		1	14.3	
Graduate	8	80.0		7	87.5		6	85.7	
Student characteristics:									
Female	31	52.5		25	46.3		25	59.5	
Race, non-White	4	7.4		5	9.4		2	95.1	
Ethnicity, Hispanic/Latino	7	12.5		3	5.9		1	2.4	
Parent highest degree:									
High school/GED	14	23.8		16	30.2		12	29.3	
Associate/bachelor	27	45.7		24	45.3		20	48.8	
Graduate	14	23.7		13	24.5		9	22.0	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Student age (months)	**92.07**	**4.05**	**84–100**	**89.46**	**4.39**	**80–97**	90.76	7.31	83–131
Pretest measures:									
Detecting Inconsistencies (max = 8)	4.44	2.09	0–8	4.43	1.91	0–8	4.37	2.05	0–7
Test of Narrative Retell:									
Comprehension questions (max = 6)	3.88	1.50	0–6	4.38	1.26	2–6	4.43	1.31	1–6
Story grammar composite (max = 56)	19.72	8.04	0–36	21.60	6.22	7–33	22.24	10.25	0–51
Expressive Vocabulary Test (max = 190)	96.69	14.74	66–127	98.79	10.70	70–124	97.43	13.44	73–132
Let's Know! vocabulary (max = 32)	5.10	3.32	0–13	6.09	3.59	0–15	5.69	3.20	1–18
Sum scores on curriculum-aligned measures:									
Comprehension monitoring (max = 16)	12.12	3.64	4–16	12.53	3.24	3–16	8.78	3.29	2–16
Understanding narrative text:									
Comprehension questions (max = 12)	10.38	1.52	4–12	9.96	1.73	5–12	10.28	1.72	5–12
Story grammar composite (max = 112)	49.39	12.43	15–69	47.22	11.93	10–72	50.07	13.49	20–86
Understanding expository text, comprehension questions (max = 8)	5.17	1.82	1–8	5.13	1.73	1–8	5.20	1.52	1–8
Let's Know! vocabulary (max = 64)	34.03	14.91	5–63	46.94	10.57	16–63	17.03	8.05	4–35

Note.—Comparisons for variables exhibiting significant differences across conditions in preliminary analyses are in bold.

Know! Broad or Let's Know! Deep curricula for 25 weeks over the academic year. Over the same time period, classrooms assigned to the business-as-usual control condition continued with typical language arts instruction. Teachers in all conditions participated in an equivalent number of study-related professional development hours (on nonliteracy topics such as math or classroom management for control teachers), received similar incentives, and completed similar data-collection activities, such that the only difference among conditions was use of Let's Know!.

Table 5. Descriptive Information by Condition for the Grade 3 Analytic Sample ($n = 150$)

	Let's Know! Broad			Let's Know! Deep			Control		
	n	%		*n*	%		*n*	%	
Students (classrooms)	54 (9)			48 (8)			48 (8)		
Attrition rate of students (classrooms)		3.6 (.0)			2.0 (.0)			2.0 (.0)	
Teacher highest degree:									
Associate/bachelor	1	11.1		1	12.5		4	50.0	
Graduate	8	88.9		7	87.5		4	50.0	
Student characteristics:									
Female	29	53.7		24	50.0		27	56.3	
Race, non-White	7	13.0		1	2.2		3	6.5	
Ethnicity, Hispanic/Latino	4	7.4		3	6.4		2	4.3	
Parent highest degree:									
High school/GED	**18**	**33.4**		**21**	**44.7**		**13**	**27.7**	
Associate/bachelor	**20**	**37.0**		**21**	**44.7**		**21**	**44.7**	
Graduate	**14**	**25.9**		**4**	**8.5**		**13**	**27.7**	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Student age (months)	102.17	3.89	95–110	102.04	4.40	94–110	102.31	3.78	95–110
Pretest measures:									
Detecting Inconsistencies (max = 8)	4.94	1.97	1–8	5.66	1.76	1–8	5.50	1.79	1–8
Test of Narrative Retell:									
Comprehension questions (max = 6)	4.83	1.26	2–6	4.65	1.25	1–6	4.60	1.41	1–6
Story grammar composite (max = 56)	25.30	6.11	8–36	23.81	7.81	6–40	21.98	9.19	0–45
Expressive Vocabulary Test (max = 190)	107.31	10.41	80–125	110.22	13.39	78–142	106.46	13.27	76–136
Let's Know! vocabulary (max = 32)	**6.91**	**3.62**	**1–15**	**8.79**	**4.70**	**0–18**	**6.81**	**4.04**	**0–17**
Sum scores on curriculum-aligned measures:									
Comprehension monitoring (max = 16)	13.73	2.70	6–16	13.72	3.01	5–16	10.48	4.97	0–16
Understanding narrative text:									
Comprehension questions (max = 12)	10.82	1.42	6–12	11.30	1.01	8–12	10.26	1.53	6–12
Story grammar composite (max = 112)	51.84	13.58	14–79	52.62	10.90	26–77	47.43	12.76	20–72
Understanding expository text, comprehension questions (max = 8)	4.78	1.67	0–8	5.64	1.36	2–8	5.11	1.65	2–8
Let's Know! vocabulary (max = 64)	41.96	12.06	13–61	48.17	12.04	6–62	18.21	8.01	6–42

Note.—Comparisons for variables exhibiting significant differences across conditions in preliminary analyses are in bold.

Let's Know! In the Let's Know! Broad and Let's Know! Deep conditions, students experienced the four-unit Let's Know! curriculum supplement as implemented by their teachers. Both instantiations featured 120 minutes of systematic and explicit language-focused instruction each week. Weekly instruction was organized into four 30-minute lessons, which were arranged into three 7-week units plus one 4-week unit, for 25 weeks total. The units were thematically organized (Unit 1: Fiction; Unit 2: Animals; Unit 3: Earth Materials; Unit 4: Folktales) and

focused on a specific type of text structure (compare-contrast, sequences and cycles, description, or cause and effect). Each unit included a detailed teacher's manual with information on specific teaching strategies, lessons and schedule, and any materials needed for implementation (e.g., books, manipulatives). Teachers also participated in professional development before implementation. This consisted of an initial meeting with research staff to review the manuals and lesson plans, engage in an overview of each of the lesson types, and introduce online professional development modules (6 hours total) that provided in-depth information regarding lessons and specific instructional strategies and included video exemplars. Subsequently, teachers were asked to complete the online professional development modules at their convenience, before implementation of the first lesson. These online modules were available to teachers throughout the year for reference, as needed.

To implement Let's Know!, teachers followed "soft-scripted" whole-class lessons that included language-focused objectives targeting higher and lower level language skills, a structured sequence of lesson components, empirically validated instructional techniques for promoting language skills, and suggested rather than prescribed wording for lesson delivery. Across both instantiations, the same language-focused objectives were targeted as teachers and students progressed through specific types of lessons in a given unit (see Table 6). Each unit began with a *Hook* lesson, which provided an overview of the upcoming unit and engaged student interest, and ended with a *Close* lesson, in which students consolidated their learning across the unit. Throughout each unit, students engaged in a variety of other lesson types. *Words to Know* lessons taught new vocabulary and semantic relations among words. *Integration* lessons taught inference making, comprehension monitoring, and other skills such as story grammar or identifying the main idea within the context of both narrative and expository texts. *Read to Me* lessons involved teacher read-alouds followed by rich discussion and provided opportunities to model and apply inference making, comprehension monitoring, and other comprehension-related skills to understand text. Toward the end of each unit, teachers administered curriculum-aligned measures (CAMs) during *Show Me What You Know* to assess students' learning and to inform what they wished to include in subsequent *Stretch and Review* lessons; the latter were included as designated lesson time during which teachers could review or extend content taught in earlier lessons to better meet students' individual needs and Let's Know! learning objectives.

As indicated in Table 6, the Let's Know! Broad and Let's Know! Deep instantiations differed in the use of text mapping, Read to Know, and practice lessons, although both instantiations provided the same total number of lessons and minutes of instruction. *Text Mapping* lessons provided opportunities to learn about text and grammatical structure, and Read to Know lessons provided opportunities to apply comprehension-related skills during purposeful, independent reading. These lessons were included in Let's Know! Broad. However, teacher feedback during feasibility and pilot studies indicated a desire for fewer lesson types and more practice opportunities (see LARRC, 2016). Thus, in the Let's Know! Deep instantiation, Text Mapping and Read to Know lessons were replaced with Words to Know practice and Integration practice lessons. These lessons provided additional practice on relevant skills. Additional details concerning the development of Let's Know!, its scope and sequence, and instructional techniques are available in LARRC (2016).

Table 6. Overview of Let's Know! Lesson Types by Condition and Alignment with CAM Probes

Lesson Type	Description	Number of Lessons per Unit in Each Instantiation[a]		Alignment with CAM Probe
		Let's Know! Broad	Let's Know! Deep	
Hook	Designed to capture students' attention and provide an overview of the unit and final project	1	1	
Read to Me	Designed to promote students' exposure and engagement with rich text, opportunities to engage in rich discussions, use higher level inferential language and comprehension monitoring skills	3	3	Comprehension monitoring Understanding text
Words to Know	Designed to build students' knowledge and use of unit vocabulary words	4	4	Let's Know! vocabulary
Words to Know practice	Additional Words to Know lessons	0	4	Let's Know! vocabulary
Text Mapping	Designed to target objectives related to the production and comprehension of different grammatical structures including recasting, think alouds, and navigational words	4	0	Understanding text
Integration	Designed to provide students with an opportunity to learn and practice retelling, inferencing strategies, and finding the main idea to help them become more strategic readers	4	4	Comprehension monitoring Understanding text
Integration practice	Additional Integration lessons	0	4	Comprehension monitoring Understanding text
Read to Know	Designed to promote students' engagement with reading by allowing students the autonomy to make decisions about what they read and helping them to select texts that are of interest to them	4	0	Understanding text
Show Me What You Know (CAM)	Teachers administer the CAMs to the study-selected students. Results are used to inform the Stretch and Review lessons. Time to practice CAMs was also incorporated into each unit	1	1	
Stretch and Review	Developed by the teachers based on the results of the CAMs, designed to individualize instruction and either review key concepts or delve deeper into unit topics	2	2	
Close	Designed to provide students a hands-on and engaging experience in which they can integrate the skills and knowledge developed over the unit	1	1	

Note.—CAM = curriculum-aligned measure.

[a] For the last unit (Folktales), the number of lessons was reduced, but these followed the same pattern.

Let's Know! fidelity. Throughout the academic year, teachers reported their adherence to the Let's Know! scope and sequence using written logs. Logs were completed daily and submitted by 100% of teachers. Adherence was generally high for both instantiations. In Let's Know! Broad, an average of 72 of 85 total lessons (84%) were implemented (range: 26%–100%), with the majority of lessons lasting between 21 and 40 minutes (71%). In Let's Know! Deep, an average of 70 lessons (82%) were implemented (range: 21%–100%), with 62% of lessons lasting between 21 and 40 minutes. Note that these numbers may be an underestimate, as some teachers did not report when they completed Stretch and Review or Show Me What You Know lessons. In addition, research staff observed seven randomly selected Let's Know! lessons per teacher. Lessons were coded for the presence or absence of key features of lessons using a fidelity observation checklist (percentage agreement among coders ranged from 67% to 93% across features [$M = 87\%$] for 20% of lessons that were randomly selected for double coding). Across all observations, teachers implemented 88% of key features, on average, in Let's Know! Broad (range: 50%–98%) and 85% of key features in Let's Know! Deep (range: 72%–98%).

Student Measures

Students completed assessments at multiple points during the academic year, including the CAMs administered by teachers as well as pre- and posttest measures administered by research staff. The former composed the proximal measures of interest; these and other measures relevant to the current study are described below. Other measures administered by research staff are beyond the focus of this study and will be presented in future articles.

Curriculum-aligned measures. CAMs were developed in conjunction with Let's Know! lessons to assess students' acquisition of skills taught in each unit and were administered by teachers toward the end of each Let's Know! unit (i.e., four times across the year). Teachers in control classrooms also administered the CAM measures at equivalent time points during the year. CAMs consisted of three probes aligned to proximal outcomes targeted by Let's Know!: (1) comprehension monitoring, (2) understanding text, and (3) vocabulary. Alignment between CAMs and Let's Know! lessons is presented in Table 6. The structure of CAM probes, as described below, was consistent across units and grades, but the specific content varied across units (e.g., narrative vs. expository text) and across grades (e.g., texts and questions increased in difficulty from PK to G3). CAMs were administered using standardized scripts and protocols and scored using standardized criteria. All teachers received training on the administration and scoring of CAMs via a narrated PowerPoint presentation that included video and scoring examples. Pilot work involving a separate sample of teachers and students showed high fidelity in teacher CAM administration (teachers averaged 72%–98% adherence on a nine-item administration checklist) and strong agreement between teacher and researcher scoring (91% exact agreement).

Comprehension monitoring. The comprehension monitoring probe assessed the student's ability to identify information in orally presented passages that did not make sense and to apply comprehension-monitoring strategies. A passage, either

narrative or expository to align with the Let's Know! unit, was read aloud by the teacher, and students responded to two items that required them to identify what did not make sense and to suggest an appropriate fix-up strategy. The teacher used a rubric to score the items as correct (2 points), correct after prompting (1 point), or incorrect (0 points) for a possible total of 4 points for each of the four Let's Know! units.

Understanding text. Understanding text probes assessed the students' ability to make inferences and use text structure knowledge to better understand narrative and expository text. Narrative probes were administered during the Let's Know! narrative units (Units 1 and 4), and expository probes were administered during expository units (Units 2 and 3). The narrative probe involved brief stories, derived from the Test of Narrative Retell (TNR) for preschool and school-aged students (Petersen & Spencer, 2012); two stories were administered to a student at any given assessment point, with all students responding to all stories in a counterbalanced order across administrations. The first story was read aloud by the teacher. Next, the student retold the story, which was audio recorded, and then answered three comprehension questions. The questions were developed by the research team following the procedures of Trabasso, van den Broek, and Liu (1988) and required students to make inferences related to story grammar elements. The second story was then read aloud by the teacher, and the student answered three additional comprehension questions. The six total comprehension questions were scored in real time by the teachers as correct (1 point) or incorrect (0 points), for a possible total of 6 points for each of the two narrative units. The audio-recorded retells were scored for story grammar elements using the TNR rubrics by research staff; interrater reliability, measured by intraclass correlations (ICCs) for 10% of retells, ranged from .86 to .95 across grades. The TNR story grammar composite indicated the extent to which students included the following components in their retells: character, problem, outcome, attempt, goal, emotion, and plan. The total possible points for the story grammar composite was 14 (PK), 18 (K–G1), or 28 (G2–G3) per story for each of two Let's Know! narrative units.

The expository probe also involved brief passages and comprehension questions. Because no measure comparable to the TNR existed for expository text, our research team created one (G1–G3) or two (PK–K) short expository passages per relevant Let's Know! unit (i.e., Units 2 and 3) for each grade level. The content of the passages mirrored the units in terms of the general topic (i.e., animals or earth materials) and the text structure of focus (e.g., compare-contrast, cause-effect). The team also developed multiple-choice comprehension questions for each passage that required identifying the main ideas or supporting details. A passage was read aloud by the teacher; the student then answered two comprehension questions. Next, a second passage was read (PK–K) or the original passage was reread (G1–G3) aloud by the teacher, and the student answered two more comprehension questions. The teacher scored the items as correct (1 point) or incorrect (0 points) for a possible total of 4 points for each of the two Let's Know! expository units.

Let's Know! vocabulary. The vocabulary probe assessed the student's knowledge of the eight vocabulary words taught in the relevant Let's Know! unit. Words taught in Let's Know! were selected based on their frequency in children's books, importance for understanding unit content, and relevance to a variety of learning

contexts (e.g., reading, math, science). In the vocabulary probe, the student was asked to give a definition of each target word. The teacher could prompt for more information if an incomplete definition was provided and scored responses as correct (2 points), partially correct (1 point), or incorrect (0 points) using a scoring protocol that listed acceptable answers. The possible total was 16 points for each of the four Let's Know! units.

Additional measures. Additional measures relevant to the current study included student and teacher questionnaires and pretest measures. These were used to assess initial equivalence across groups and as covariates in analyses, as explained further in the Results section. Students' caregivers completed questionnaires at the beginning of the academic year, on which basic demographic and background information was reported. Teachers also completed similar questionnaires at the beginning of the year to report demographic and classroom information. Students completed pretest assessments, individually administered by research staff during the first 3 to 4 weeks of the academic year, on a number of measures aligned with the same constructs as the CAMs. These included standardized measures such as the Expressive Vocabulary Test (Williams, 2007), the TNR for preschool, and school age (Petersen & Spencer, 2012). Pretest assessments also included an experimental Let's Know! vocabulary measure, the administration and scoring of which mirrored that of the Let's Know! vocabulary CAM probe, except that it included 16 targeted vocabulary words (four from each unit). Finally, students in G1 through G3 were assessed on an experimental measure of comprehension monitoring, based on one used previously by Oakhill and Cain (2012). This Detecting Inconsistencies measure required students to detect inconsistent information in short narrative passages ($\alpha = .66$–$.68$). Table 7 presents correlations among all measures.

Results

CAM scores served as the outcomes of interest, as proximal measures of Let's Know! effects on students' comprehension-related skills. As indicated, CAMs were administered at multiple time points across the academic year: at the end of each unit for

Table 7. Correlations among Pretest and Curriculum-Aligned Measures (CAMs)

Measure	1	2	3	4	5	6	7	8	9	10
Pretest scores:										
1. Detecting Inconsistencies	–									
2. Test of Narrative Retell: Comprehension questions	.36	–								
3. Test of Narrative Retell: Story grammar composite	.47	.46	–							
4. Expressive Vocabulary Test	.60	.49	.66	–						
5. Let's Know! vocabulary	.42	.36	.45	.62	–					
CAM sum scores:										
6. Comprehension monitoring	.33	.38	.47	.55	.43	–				
7. Understanding narrative text, comprehension questions	.32	.41	.36	.37	.29	.39	–			
8. Understanding narrative text, story grammar composite	.52	.45	.76	.67	.45	.50	.47	–		
9. Understanding expository text, comprehension questions	.32	.25	.44	.55	.33	.49	.28	.48	–	
10. Let's Know! vocabulary	.28	.26	.26	.38	.46	.66	.33	.33	.36	–

Note.—All $p < .01$.

comprehension monitoring and Let's Know! vocabulary, at the end of Units 1 and 4 for understanding narrative text and at the end of Units 2 and 3 for understanding expository text. Moreover, CAM content and items differed among units and among grades. Thus, we analyzed sum scores within grade, with each grade treated as a separate sample, to address whether the two instantiations of Let's Know! (i.e., Let's Know! Broad and Let's Know! Deep) affected students' proximal outcomes. These analyses also aligned with our random assignment process, which was blocked by grade; because random assignment was also blocked by site, site was included as a fixed effect in all analyses. Before conducting the main analyses, we conducted preliminary analyses concerning attrition and initial equivalence among conditions. We also used a multiple imputation (MI) approach to handle missing data.

Preliminary Analyses

All students with data on at least one CAM at one time point were retained in analyses ($N = 766$; sample sizes per grade presented in Tables 1–5). For the 96 students who were no longer participating in the study at the first CAM administration point and thus not included in the present analyses, the majority ($n = 76$, 79%) were withdrawn from the study because their teacher withdrew, and data collection was no longer allowed in those classrooms. Teachers reported withdrawing for a variety of reasons, including health or family issues ($n = 1$), job or position changes ($n = 2$), feeling overwhelmed or that the study demands were too challenging ($n = 7$), or other, unspecified reasons ($n = 4$). The 96 students who left the study tended to be younger, non-White, and of lower socioeconomic status. Correspondingly, these students tended to have lower scores on selected pretest measures (Expressive Vocabulary Test, Let's Know! vocabulary, TNR comprehension questions and story grammar composite, Detecting Inconsistencies). Attrition rates differed by condition, $\chi^2(2, N = 766) = 16.09$, $p < .001$; attrition rates were higher in the Let's Know! Broad (15%) and Let's Know! Deep (13%) conditions than in the control condition (5%). When disaggregated by grade (see Tables 1–5), attrition rates were significantly different among conditions in PK and K, with a similar trend in G2.

Although classrooms were randomly assigned to condition, thereby equating conditions on expectation of both measured and unmeasured characteristics of participants (Shadish, Cook, & Campbell, 2002), attrition may have affected initial equivalence across conditions. Initial equivalence was assessed for each grade on selected demographic and pretest variables using chi-square tests (categorical data) and ANOVAs with pairwise comparisons (continuous data; Welch and Dunnett T3 tests when homogeneity of variance was violated). Relevant descriptive data are presented in Tables 1 through 5. No differences among conditions were noted for any of the teacher or classroom variables listed in the tables or described in the Participants section. Conditions also did not differ with respect to student gender, race, ethnicity, or IEP status, or students' scores on the TNR comprehension questions and story grammar composite or Detecting Inconsistencies. However, some significant differences existed between conditions on other measures. Students' parent education levels were lower in the Let's Know! Deep condition compared with the Let's Know! Broad condition in the PK sample and compared with the Let's Know! Broad and control conditions in the G3 sample. G2 students assigned to the Let's

Know! Deep condition were younger than those in the Let's Know! Broad condition. With the exception of G2, students showed initial differences in their vocabulary scores that favored one of the two Let's Know! conditions. For PK only, students assigned to the Let's Know! Broad condition had initially higher Expressive Vocabulary Test scores than those assigned to control. Let's Know! vocabulary scores were significantly higher for those assigned to Let's Know! Broad compared with control in PK, K, and G1 and for those assigned to Let's Know! Deep compared with control in G3. Let's Know! vocabulary scores were also significantly different between Let's Know! instantiations, favoring those assigned to Let's Know! Broad in K and G1 and Let's Know! Deep in G3. Variables showing evidence of differences across conditions were included as covariates in the main analyses.

Missing Data

Of the 766 students included in the current analyses, 587 (77%) had complete data whereas 179 (23%) had missing data on one CAM or more at one time point or more. Missing data were treated using MI (Little & Rubin, 1987). Inclusive imputation (Schafer & Olsen, 1998) was conducted separately for each grade, such that MI models included all individual items for all CAMs as well as other variables theoretically or empirically related to the outcomes or missingness, with the latter based on the attrition analyses described. Beyond the CAMs, other variables included in the MI models were condition, gender, ethnicity, teachers' highest degree earned, pretest scores on the Expressive Vocabulary Test, Let's Know! vocabulary, TNR comprehension questions and story grammar composite, and Detecting Inconsistencies (which were administered only to students in G1–G3 and thus were included only for those samples). A multilevel (mixed) model was applied, in which classroom effects were treated as random components, to account for the nested nature of the data. Ten data sets were imputed for each grade using the option for panel or clustered data in multivariate linear mixed-effects models in R Version 3.0.3 (R Core Team, 2014). These imputed data sets were then analyzed via the MI module in Mplus Version 7.11 (Muthén & Muthén, 1998–2012), from which 10 sets of results were obtained and combined to generate the final estimates. Notably, a full information maximum likelihood (FIML) approach (Arbuckle, 1996) using the same auxiliary variables was also completed to test the stability of parameter estimates. Results produced via FIML were consistent with those yielded by MI.

Impacts of Let's Know! on Proximal Outcomes

Multilevel analyses were conducted to estimate the impacts of Let's Know! Broad and Let's Know! Deep, relative to control, on sum scores representing students' performance on the various CAM probes: comprehension monitoring, understanding narrative text comprehension questions and story grammar composite, understanding expository text comprehension questions, and Let's Know! vocabulary. Inspections of CAM data distributions showed floor and/or ceiling effects on some probes (comprehension monitoring, understanding narrative text comprehension questions, understanding narrative text story grammar [PK and K only], and understanding expository text [PK only]); thus, multilevel-censored normal re-

sponse models (Tobit models; Tobin, 1958) were used to appropriately account for the nonnormal distributions. Analyses were conducted with and without covariates; analyses with covariates included those demographic and pretest variables on which conditions appeared to initially differ. With few exceptions (noted in text), results were the same when analyses were conducted without (Table 8) or with (Table 9) covariates. Effect sizes (d) were computed in accordance with the What Works Clearinghouse recommendations (Institute of Education Sciences, 2013) and reflect effects at the student level. Effect sizes from the analysis yielding the smallest magnitude from the two sets of analyses (i.e., most conservative effect size estimates) are presented in text.

Comprehension monitoring. The ICC (generated from the empty/unconditional model), which represents between-classroom variance in outcomes, ranged from 0.28 to 0.48 across grades for comprehension monitoring sum scores; an additional 13.5% to 33.6% of the variance was accounted for by condition. With the single exception of PK, students assigned to Let's Know! Broad and to Let's Know! Deep both significantly outperformed those assigned to the control condition in all grades. For PK, only those students assigned to Let's Know! Deep significantly outperformed those in the control condition. All significant effects were large in magnitude ($d > 0.79$). No significant differences were detected between Let's Know! Broad and Let's Know! Deep.

Understanding narrative text. The ICC for sum scores on the comprehension questions portion of the understanding narrative text probe ranged from 0.13 to 0.37 across grades, and the ICC for sum scores on the story grammar portion of the understanding narrative text probe ranged from 0.08 to 0.24 across grades. An additional 0.4% to 12% and 0.3% to 11.8% of the variance was accounted for by condition, respectively. For the comprehension questions portion, students assigned to Let's Know! Deep significantly outperformed those in the control condition in G3 only ($d = 1.24$), with no other significant differences among conditions. For the story grammar portion of the understanding narrative text probe, no significant differences across conditions were detected when covariates were not included in analyses. However, when covariates were included, G1students assigned to Let's Know! Broad had significantly lower scores on the story grammar composite than those in the control condition ($d = -0.33$), and K and G1 students assigned to Let's Know! Deep had significantly higher scores than those assigned to the Let's Know! Broad instantiation ($d = 0.20$ and 0.50, respectively).

Understanding expository text. The ICC for sum scores on the understanding expository text probe ranged from 0.08 to 0.52 across grades; an additional 0.2% to 11.3% of the variance was accounted for by condition. Students assigned to Let's Know! Broad significantly outperformed those in the control condition only in K ($d = 0.43$). Students assigned to Let's Know! Deep significantly outperformed those in the control condition only in PK ($d = 0.80$). When comparing the two instantiations, G3 students assigned to Let's Know! Deep significantly outperformed those assigned to Let's Know! Broad ($d = 0.50$). No other significant differences among conditions were detected.

Let's Know! vocabulary. The ICC for sum scores on the Let's Know! vocabulary probe ranged from 0.62 to 0.73 across grades; an additional 34.7% to 64.1% of the variance was accounted for by condition. Across all grades, students assigned

Table 8. Results of Multilevel Analyses Comparing Proximal Outcomes among Conditions (without Covariates)

	Comprehension Monitoring				Understanding Narrative Text: Comprehension Questions				Understanding Narrative Text: Story Grammar Composite				Understanding Expository Text				Let's Know! Vocabulary			
	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*
Prekindergarten (n = 167):																				
Broad vs. control	3.03	1.58	.114	.78	−.19	−.39	.696	−.07	3.58	1.17	.242	.28	1.16	1.48	.138	.73	19.57	3.82	**<.001**	**1.55**
Deep vs. control	3.34	3.94	**<.001**	**.97**	−.36	−.58	.560	−.13	1.34	.46	.644	.10	1.21	2.73	**.006**	**.84**	23.52	8.05	**<.001**	**1.95**
Deep vs. Broad	.22	.11	.913	.05	−.16	−.33	.742	−.06	−2.11	−.64	.520	−.17	.08	.09	.925	.04	4.27	.88	.381	.28
Kindergarten (n = 155):																				
Broad vs. control	5.40	8.62	**<.001**	**1.73**	.80	1.74	.082	.44	.41	.17	.866	.03	.74	2.48	**.013**	**.47**	23.96	16.75	**<.001**	**2.49**
Deep vs. control	5.96	5.58	**<.001**	**1.63**	.22	.47	.639	.11	1.01	.43	.670	.07	.43	1.07	.287	.25	31.62	19.49	**<.001**	**3.45**
Deep vs. Broad	.57	.49	.622	.15	−.58	−1.15	.252	−.34	.21	.10	.921	.02	−.32	−.72	.474	−.19	7.66	3.43	**.001**	**.66**
Grade 1 (n = 139):																				
Broad vs. control	5.12	3.41	**.001**	**1.25**	.74	1.04	.297	.35	.07	.02	.981	.01	.67	1.09	.274	.40	31.17	7.14	**<.001**	**2.67**
Deep vs. control	4.97	3.48	**<.001**	**1.16**	−.02	−.02	.981	−.01	2.87	.80	.421	.25	−.06	−.11	.913	−.04	27.62	7.12	**<.001**	**2.45**
Deep vs. Broad	−.17	−.15	.883	−.05	−.74	−1.35	.178	−.38	2.92	.99	.325	.30	−.72	−1.57	.115	−.42	−3.67	−.84	.399	−.30
Grade 2 (n = 155):																				
Broad vs. control	2.71	2.31	**.021**	**.79**	−.33	−.46	.645	−.20	−1.67	−.56	.574	−.13	−.10	−.20	.841	−.06	17.23	4.76	**<.001**	**1.52**
Deep vs. control	4.09	4.98	**<.001**	**1.27**	−.43	−.82	.412	−.25	−.30	−.12	.908	−.02	.01	.02	.983	.01	29.99	13.73	**<.001**	**3.16**
Deep vs. Broad	1.37	1.26	.209	.41	−.11	−.19	.851	−.07	1.29	.43	.668	.11	.12	.23	.820	.07	12.61	3.60	**<.001**	**1.05**
Grade 3 (n = 150):																				
Broad vs. control	3.74	2.99	**.003**	**.95**	.67	1.36	.175	.46	4.59	1.67	.096	.35	−.48	−1.25	.213	−.29	22.88	7.74	**<.001**	**2.15**
Deep vs. control	4.28	2.83	**.005**	**1.06**	1.69	2.41	**.016**	**1.31**	4.11	1.33	.184	.34	.33	.87	.384	.22	3.04	9.04	**<.001**	**2.98**
Deep vs. Broad	.52	.39	.698	.18	1.02	1.57	.117	.83	−.28	−.09	.925	−.02	.82	3.79	**<.001**	**.54**	7.13	1.83	.068	.58

Note.—Significant comparisons ($p < .05$) in bold. Analyses included site as a fixed effect. Coeff. = coefficient; z = ratio of the parameter estimate to its standard error, used for approximate z test; d = student-level effect size computed in accordance with What Works Clearinghouse recommendations (Institute of Education Sciences, 2013).

Table 9. Results of Multilevel Analyses Comparing Proximal Outcomes among Conditions (with Covariates)

					Understanding Narrative Text															
	Comprehension Monitoring				Comprehension Questions				Story Grammar Composite				Understanding Expository Text				Let's Know! Vocabulary			
	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*	Coeff.	*z*	*p*	*d*
Prekindergarten (n = 167):																				
Broad vs. control	2.58	1.50	.134	.67	−.24	−.46	.645	−.09	4.03	1.57	.116	.31	1.10	1.39	.165	.69	17.47	3.61	**<.001**	**1.38**
Deep vs. control	3.32	4.02	**<.001**	**.96**	−.20	−.34	.736	−.07	2.19	.89	.372	.17	1.16	2.60	**.009**	**.80**	22.72	9.04	**<.001**	**1.88**
Deep vs. Broad	.73	.41	.683	.17	.05	.08	.938	.02	−1.65	−.55	.583	−.13	.06	.07	.943	.03	5.32	1.11	.268	.34
Kindergarten (n = 155):																				
Broad vs. control	5.09	8.32	**<.001**	**1.63**	.47	1.06	.289	.26	−1.13	−.66	.511	−.09	.67	2.57	**.010**	**.43**	22.86	15.01	**<.001**	**2.38**
Deep vs. control	6.08	6.39	**<.001**	**1.66**	.14	.31	.760	.07	1.79	.93	.352	.13	.56	1.49	.135	.32	31.84	22.46	**<.001**	**3.48**
Deep vs. Broad	.99	1.00	.318	.26	−.35	−.73	.464	−.20	2.46	2.00	**.046**	**.20**	−.11	−.32	.751	−.07	9.03	5.39	**<.001**	**.78**
Grade 1 (n = 139):																				
Broad vs. control	4.77	3.29	**.001**	**1.17**	.66	.99	.322	.32	−3.56	−2.42	**.016**	**−.33**	.62	1.09	.276	.37	28.33	6.91	**<.001**	**2.43**
Deep vs. control	5.04	4.16	**<.001**	**1.17**	.07	.09	.929	.03	1.54	.90	.367	.14	−.06	−.13	.899	−.04	26.69	1.85	**<.001**	**2.36**
Deep vs. Broad	.26	.23	.822	.07	−.58	−1.04	.297	−.30	4.90	3.80	**<.001**	**.50**	−.67	−1.72	.086	−.39	−1.63	−.39	.695	−.13
Grade 2 (n = 155):																				
Broad vs. control	2.98	2.80	**.005**	**.87**	−.04	−.06	.952	−.02	1.31	.73	.465	.10	−.07	−.15	.880	−.04	17.87	5.79	**<.001**	**1.58**
Deep vs. control	4.12	5.32	**<.001**	**1.28**	−.56	−1.08	.279	−.33	−.14	−.07	.946	.01	−.01	−.04	.970	−.01	28.87	13.05	**<.001**	**3.04**
Deep vs. Broad	1.14	1.24	.216	.34	−.53	−.92	.358	−.32	−1.48	−.64	.523	−.12	.06	.13	.897	.03	11.00	3.60	**<.001**	**.91**
Grade 3 (n = 150):																				
Broad vs. control	3.50	3.02	**.003**	**.89**	.54	1.14	.254	.37	2.68	1.17	.242	.20	−.39	−1.17	.241	−.24	23.04	9.32	**<.001**	**2.16**
Deep vs. control	4.35	3.01	**.003**	**1.08**	1.59	2.61	**.009**	**1.24**	2.41	1.28	.200	.20	.37	1.06	.290	.24	28.30	11.86	**<.001**	**2.80**
Deep vs. Broad	.86	.69	.493	.29	1.06	1.81	.071	.86	−.23	−.10	.918	−.02	.76	3.45	**.001**	**.50**	5.29	2.02	**.043**	**.43**

Note.—Significant comparisons ($p < .05$) in bold. Covariates included children's scores on all pretest assessments, parent education level, gender, age, and race, with site also included as a fixed effect. coeff = coefficient; z = ratio of the parameter estimate to its standard error, used for approximate z test; d = student-level effect size computed in accordance with What Works Clearinghouse recommendations (Institute of Education Sciences, 2013).

to Let's Know! Broad and to Let's Know! Deep both significantly outperformed those assigned to the control condition ($d > 1.38$). When comparing the two instantiations, students assigned to Let's Know! Deep outperformed those assigned to Let's Know! Broad in K ($d = 0.66$); G2 ($d = 0.91$); and, only with covariates included in analyses, G3 ($d = 0.43$). No other significant differences between instantiations were detected.

Discussion

Best practices in reading instruction require attention to both decoding and comprehension, with this instruction occurring as early as possible to decrease the likelihood that students will require specialized reading intervention. Unfortunately, instructional approaches with the potential to improve listening and reading comprehension are often not implemented in classrooms (Duke & Block, 2012). Duke and Block identified three obstacles to implementation of best practices in reading instruction, including a focus on easier to learn reading skills such as decoding, a lack of teacher expertise in how to teach skills that support reading comprehension, and limited time in the school day to teach these more difficult skills. In Let's Know! we sought to overcome these obstacles. We focused on harder to teach comprehension-related skills, specifically higher and lower level language skills. We created lessons to help teachers learn how to teach these skills as they support reading comprehension, and we designed Let's Know! to be embedded within the language arts curriculum in four 30-minute lessons per week. In this study, we examined the proximal impacts of Let's Know!, as measured by CAMs, from the first cohort of a two-cohort randomized controlled trial conducted in multiple states. Our results provide initial evidence concerning the effects of Let's Know! when implemented by PK to G3 classroom teachers, most of whom were credentialed, highly experienced, and worked in public school settings, and the largely White, middle- to higher income students enrolled in their classrooms. We highlight three major findings from the study.

Our first major finding concerned the extent to which the two instantiations of Let's Know! exhibited differential impacts on comprehension-related skills. We created Let's Know! Deep in response to pilot work that suggested the need to reduce the number of lesson types, thereby simplifying implementation for teachers and increasing practice of selected skills for students. During this pilot work, we found no differences between the instantiations in terms of teacher satisfaction or fidelity of implementation (LARRC, 2016). The current CAM results fit well with those findings. Overall, we found limited evidence to suggest that one instantiation was more effective than another. There was no difference between instantiations for performance on comprehension monitoring at any grade level, even though Let's Know! Deep included four additional lessons per unit, providing practice in applying this skill. When considering text understanding and vocabulary, Let's Know! Deep showed significant advantages over Let's Know! Broad in, at most, six comparisons. Although some of these comparisons concerned vocabulary performance and thus align with the greater vocabulary practice afforded in the Let's Know! Deep instantiation, the overall pattern of results does not support consistent differences in the impacts of the two instantiations.

Considered more broadly, the comparisons between instantiations contributes to the literature concerning instructional intensity. To date, studies comparing intensity of instruction have focused on students who are not progressing as well as their peers rather than comparing intensity in whole-classroom (Tier 1) contexts. Intervention studies show mixed findings regarding whether increased intensity results in better vocabulary learning. One study involving kindergarteners found that extended instruction (more time and practice with words) resulted in more learning (Coyne, McCoach, & Kapp, 2007). Similarly, another study involving at-risk kindergarteners also found that increased instructional intensity resulted in more learning (Puhalla, 2011). However, other studies have reported that more time on task for G4 students (Beck, Perfetti, & McKeown, 1982) or smaller versus larger group sizes for PK students as a mechanism for providing more intense instruction (Neuman & Kaefer, 2013) did not result in better vocabulary learning (see also LARRC, 2016). In each of these cases, vocabulary was the only skill manipulated as part of the study design. We could not locate any studies that varied the intensity of instruction for the other comprehension-related skills, beyond vocabulary, targeted in Let's Know! lessons, and our results provide little empirical support that increased intensity, at least as it was operationalized in Let's Know! Deep, led to greater learning.

Our second major finding concerned the impacts of Let's Know! relative to a business-as-usual control for each grade level. Results showed that in PK, K, and G3, students experiencing Let's Know! exhibited significantly higher CAM scores on three of five measures. In G1 and G2, this was true for two of five skills assessed. This pattern suggests that Let's Know! has the potential to positively affect the skills of students at each grade level for which it was developed. This is not easily achieved, as shown by the lack of evidence-based curricula that successfully target comprehension in the early grades. The U.S. Department of Education's What Works Clearinghouse (n.d.) lists only three whole-class curricula with positive or potentially positive effects that explicitly target reading comprehension at the class level. Furthermore, the What Works Clearinghouse currently does not include any curricula or studies showing evidence of impacts on listening comprehension, and curricula or students showing evidence of impacts on oral language are limited to PK.

Our third major finding concerned the extent to which Let's Know! was more effective at promoting some skills than others. We designed Let's Know! to positively affect future reading comprehension by developing students' language skills in early grades. Because of their important role in both listening and reading comprehension, we focused on lower level (grammar and vocabulary) and higher level (inference making, comprehension monitoring, knowledge and use of text structure) language skills. We found a fairly consistent pattern for comprehension monitoring across grade levels and instantiations, suggesting a significant impact of Let's Know! lessons on this comprehension-related, higher level language skill. In each case the effect sizes were quite large, ranging from 0.79 to 1.73. These results provide convincing evidence that Let's Know! has the potential to positively affect students' abilities to detect inconsistencies in text and to identify a fix-up strategy that could aid their understanding.

Similarly, we found a consistent pattern across grade levels, indicating a significant advantage in vocabulary learning for both Let's Know! instantiations. Again, effect sizes were large, ranging from 1.38 to 3.48. Because students in control class-

rooms were not explicitly taught Let's Know! vocabulary words, these large effects may not be surprising. Yet such effects are important as they show that students in Let's Know! classrooms were better able to define Tier 2 words. Research indicates a lack of effective vocabulary instruction in schools (Beck, McKeown, & Kucan, 2013; Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006; Walsh, 2003) despite evidence that well-specified and well-organized vocabularies support reading comprehension (Kintsch & Kintsch, 2005) and afford processing capacity for higher level comprehension (Perfetti, 2007). Results of this study show that Let's Know! lessons successfully promoted students' vocabulary skills across the grade levels, although additional work is necessary to determine whether the impacts of Let's Know! on vocabulary translate to better comprehension and/or generalize to other measures of vocabulary learning.

Results were less consistent when considering assessments of students' abilities to make inferences and to use text structure knowledge to better understand narrative and expository texts. Only one comparison was statistically significant relative to control when considering understanding of narrative text, favoring Let's Know! Deep in G3, and only two comparisons were statistically significant when considering understanding of expository text, favoring Let's Know! Deep in PK and Let's Know! Broad in K. The lack of significant effects for understanding expository text in later grades may be because younger students are exposed to expository texts less often than older students are (Duke, 2000); therefore, Let's Know! provided instruction using expository texts that probably was not available to PK and K students in control classrooms. With respect to grade-level differences, it may also be the case that our measures of these skills were more or less difficult for some grades versus others, although our descriptive data show variability for each grade. It will be important to further investigate effects using measures that are vertically equated.

Another potential explanation for the differences in findings across skills (vocabulary, comprehension monitoring, making inferences and using text structure) concerns the varying complexities involved in learning these skills (e.g., Paris, 2005). In considering the skills taught and tested in this study along a continuum of complexity, vocabulary was the least complex, given that a bounded set of words was taught that could be learned to mastery. The comprehension-monitoring component was more complex, yet identification of inconsistencies and appropriate fix-up strategies allowed for a more narrow focus than was possible with instruction and assessment of making inferences and using text structure. The latter are complex skills that are affected by the text (narrative and expository with varied text structures) and the task (retelling and responding to questions on unfamiliar text). However, the findings suggest that these complex skills may still be affected by Let's Know! whole-class instruction. Notably, all statistically significant comparisons were of moderate to large magnitude ($d = 0.43$–1.31). Moreover, although effects were not statistically significant, many of the comparisons between students experiencing Let's Know! versus those in the control condition showed small to moderate advantages favoring the former. For example, effect sizes of 0.28 to 0.73 favored the Let's Know! Broad condition for PK on story grammar and expository text measures. Similarly, Let's Know! Broad exhibited effect sizes of 0.44 and 0.47 for question-based narrative and expository measures in K, and small to moderate effects were also found for at least one of the two instantiations in G1 and G3 on all three of these mea-

sures. Although we cannot interpret these trends with confidence, they suggest the potential of Let's Know! for affecting complex, higher level comprehension-related skills. In addition, given that only half of the Let's Know! lessons focused on narrative or expository text (i.e., two narrative units and two expository units), it is worthwhile to consider whether more lessons on each type of text or integrating both narrative and expository text into all units would lead to intended benefits.

Limitations, Future Directions, and Conclusion

Four limitations of the current study warrant note. First, despite our best efforts to preserve the intent-to-treat randomized controlled trial design, confidence in our causal inferences concerning Let's Know! impacts are somewhat tempered by attrition. To some extent, the similar patterns in results across grade levels, including those with no evidence of differential attrition, as well as when covariates were and were not included in analyses, help alleviate these internal validity concerns. Second, although other studies have also successfully used teachers as data collectors (e.g., Mashburn, Downer, Hamre, Justice, & Pianta, 2010) and, anecdotally, we had no evidence that teacher administration biased CAM results, replication with research-administered assessments is desirable. Third, we did not consider fidelity of implementation as it related to impacts, given our focus on causally interpretable impacts in this study. Future analyses may take this into consideration. Fourth, Let's Know! was designed with the aim of supporting students' listening and reading comprehension, and results concerning its efficacy with respect to this ultimate goal remain to be seen in future research studies. However, the present study provides an important first step in testing the Let's Know! theory of change and understanding the extent to which proximal effects on comprehension-related skills are achieved.

We are encouraged that Let's Know! demonstrated large, positive impacts on comprehension monitoring and vocabulary across grade levels. We are less encouraged that results for understanding narrative and expository texts did not show statistically significant, consistent advantages in favor of Let's Know! and propose that future work, perhaps with larger sample sizes, may help us discern the extent to which Let's Know! can promote comprehension of both types of text. These results will inform our next iteration of Let's Know! as we work to create relatively efficient, language-focused curricula supplements that can be used by classroom teachers and that hold the potential to improve students' reading comprehension.

Appendix

Statistical Equations

Equations for Outcomes Analyzed Using Normal Model

For the *i*th child in the *j*th cluster,

a. Empty model used to compute intraclass correlations (ICCs):

$$\gamma_{ij} = a_0 + u_j + e_{ij},$$

$$\text{where } u_j \sim N(0, \tau^2), \text{ and } e_{ij} \sim N(0, \sigma^2);$$

a_0 is the fixed intercept, u_j indicates the random cluster (classroom) effects, and e_{ij} indicates the child-level error.

b. Model comparing proximal outcomes among conditions, no covariates (as reported in Table 8):

$$y_{ij} = a_0 + b_1\text{Broad}_j + b_2\text{Deep}_j + d_1\text{Site}_{1j} + \ldots + d_m\text{Site}_{mj} + u_j + e_{ij},$$

with control as the reference group, Broad and Deep are dummy variables, indicating the condition to which the classroom was assigned. Specifically, for children in the control group, Broad = 0, Deep = 0; for children in the Broad condition, Broad = 1, Deep = 0; for children in the Deep condition, Broad = 0, Deep = 1. Site was also included as a fixed effect using a series of dummy variables, given that random assignment was blocked by site.

c. Model comparing proximal outcomes among conditions, with covariates (as reported in Table 9):

$$y_{ij} = a_0 + b_1\text{Broad}_j + b_2\text{Deep}_j + d_1\text{Site}_{1j} + \ldots + d_m\text{Site}_{mj} + c_1X_{1ij} + \ldots + c_kX_{kij} + u_j + e_{ij},$$

$X_1, X_2, \ldots, X_k$ are covariates (i.e., children's scores on all pretest assessments, parent education level, gender, age, and race).

Equations for Outcomes Analyzed Using Tobit Model

Tobit models, also known as censored normal response models (Tobit, 1958), can be used to account for floor or ceiling effects in cases when the trait being measured is continuous but "truncated" due to properties of the measurement instrument. In the case of a floor effect, the model assumes that any data with the value of 0 or lower will be observed as 0. In the case of ceiling effects, the model assumes that any data with the value at the upper limit of the instrument (e.g., $y_{\max}$) or higher will be observed as $y_{\max}$.

Specifically, for the ith child in the jth cluster, given that its true value is $y_{ij}^{\star}$, and its observed value is y_{ij}, the general model is

$$y_{ij} = \begin{cases} 0, & \text{if } y_{ij}^{*} \le 0 \\ y_{ij}^{*}, & \text{if } 0 < y_{ij}^{*} < y_{\max}. \\ y_{\max}, & \text{if } y_{ij}^{*} \ge y_{\max} \end{cases}$$

a. Empty model used to compute ICCs:

$$y_{ij}^{*} = a_0 + u_j + e_{ij},$$
$$u_j \sim N(0, \tau^2), \text{ and } e_{ij} \sim N(0, \sigma^2);$$

a_0 is the fixed intercept, u_j indicates the random cluster (classroom) effects, and e_{ij} indicates the child-level error.

b. Model comparing proximal outcomes among conditions, no covariates (as reported in Table 8):

$$\gamma_{ij}^{*} = a_0 + b_1\text{Broad}_j + b_2\text{Deep}_j + d_1\text{Site}_{1j} + \ldots + d_m\text{Site}_{mj} + u_j + e_{ij},$$

with control group as the reference group, Broad and Deep are dummy variables indicating the condition to which the classroom was assigned. Dummy variables coding sites were also included as fixed effects.

c. Model comparing proximal outcomes among conditions, with covariates (as reported in Table 9):

$$\gamma_{ij}^{*} = a_0 + b_1\text{Broad}_j + b_2\text{Deep}_j + c_1X_{1ij} + d_1\text{Site}_{1j} + \ldots + d_m\text{Site}_{mj} + \ldots + c_kX_{kij} + u_j + e_{ij},$$

$X_1, X_2, \ldots, X_k$ are covariates (i.e., children's scores on all pretest assessments, parent education level, gender, age, and race).

Note

This study was prepared by a task force of the Language and Reading Research Consortium (LARRC), consisting of Shayne B. Piasta (convener), Mindy Sittner Bridges, Dawn Davis, Shelley Gray, Tiffany Hogan, Hui Jiang, and Diane Nielsen. LARRC project sites and investigators are as follows: Ohio State University (Columbus, OH)—Laura M. Justice (site PI), Richard Lomax, Ann O'Connell, Jill Pentimonti (now at the American Institutes of Research), Stephen A. Petrill (a LARRC coinvestigator from 2010 to 2013), Shayne B. Piasta; Arizona State University (Tempe, AZ)—Shelley Gray (site PI), Maria Adelaida Restrepo; Lancaster University (Lancaster, UK)—Kate Cain (site PI); University of Kansas (Lawrence, KS)—Hugh Catts (site PI; now at Florida State University), Mindy Bridges, Diane Nielsen; University of Nebraska-Lincoln (Lincoln, NE)—Tiffany Hogan (site PI; now at MGH Institute of Health Professions), Jim Bovaird, J. Ron Nelson (a LARRC coinvestigator from 2010 to 2012).

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