Use of the Curriculum Research Framework (CRF) for Developing a Reading-Comprehension

Curricular Supplement for the Primary Grades

Language and Reading Research Consortium

Abstract

This article describes nine phases of curriculum-development activities conducted by the Language and Reading Research Consortium (LARRC), the end result of which was to arrive at a research-based supplemental curriculum that could be used by teachers of English-speaking or bilingual Spanish-English speaking children in pre-kindergarten and English-speaking children in kindergarten to third grade to bring about significant changes in students' language skills as a route to improved reading comprehension. LARRC followed the Curriculum Research Framework (CRF) proposed by Clements (2007) as a means for developing curricula that can be called research-based; CRF phases include establishing the foundations of the curriculum (Phases 1-4), establishing the learning model (Phase 5), and evaluation the curriculum and its components (Phase 6-10). This description of the iterative process followed by LARRC provides the educational field with a substantive example of how research-based curricula in reading comprehension and other areas can be developed using the CRF.

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In the summer of 2010, the Institute of Education Sciences (IES) of the U.S. Department

of Education committed more than $100,000,000 to the Reading for Understanding (RFU)

initiative, which provides support to five research teams to develop and test multiple

instantiations of interventions targeting reading comprehension as the primary outcome. Each

team was charged with designing interventions that would span at least five grades and would

lead to significant improvements in students' reading comprehension. The Language and

Reading Research Consortium (LARRC), a multidisciplinary team of researchers from five

universities, was one of two teams whose work was focused specifically on designing

interventions for students in the early primary grades (pre-kindergarten to grade three). The

specific focus of LARRC was to design and test interventions that would improve students' *oral*

language skills as a mechanism for improving reading comprehension among pre-kindergarten

(pre-K) through third-grade students, and Spanish-English bilinguals in Pre-K.

The purpose of this manuscript is to describe the three-year process of intervention

design, testing, and revision, conducted from 2010 to 2013, which lead to final instantiations of

the LARRC interventions. (These instantiations are being tested in a multi-state two-cohort

randomized controlled trial (RCT) during the 2013-2014 and 2014-2015 academic years to

assess their impacts on multiple indices of students' language skill and reading comprehension.)

LARRC activities followed the ten-phase framework of the Curriculum Research Framework

(CRF; Clements (2007), which provides a means for developing curricula that can be called

"research-based." The CRF provides a framework for engaging in research as a part of the

development of curriculum, something that may be mentioned but is not typically systematically

integrated into curriculum development (Ornstein & Hunkins, 2009). The CRF involves ten phases of activities that fall into three categories, as presented in Table 1. The initial phases (1-3) generally involve establishing the general content of the curriculum, identifying learner goals, and considering various pedagogical options and activities. The next phase (4) involves developing specific learning activities and laying these out in sequence or trajectory. The final phases (5-10) involve systematic evaluation of various aspects of the curriculum, to include conducting market research, formative assessments and design studies, and summative evaluations. Development of a curriculum may utilize none, some, or all of these phases, although Clements points out that curricula that were developed using more rather than fewer CRF phases tend to have more positive impacts on students' learning.

To date, LARRC activities have progressed through each of the CRF's first nine phases to arrive at two instantiations per each of five grades of a language-focused reading-comprehension intervention, *Let's Know!),* and two instantiations for Pre-K of a bilingual version (*¡Vamos a Aprender!*), currently being tested as the tenth CRF phase. Presenting the overall process and outcomes pursuant to these phases may be useful to the educational field, as Clements' initial description of the CRF phases was situated within the context of mathematics education. He asserts that the CRF is in need of additional examples from other content area, which this manuscript provides. It is important to note that in sharing these CRF applications to generation of the *Let's Know!* curricula, we do not detail all of the development work that was undertaken, as this would be far beyond the scope of a single manuscript; rather, we provide illustrative activities, goals, and outcomes. Also note that this manuscript draws extensively from Clements' description of the phases of the CRF, thus we refer readers to that primary source for

explication of key constructs. Finally, a point is warranted regarding organization of this work, such that it follows the sequence of the ten phases (and three categories) of the CRF (Table 1).

Category 1: Establishing A Priori Foundations

Phases 1, 2, and 3 of the CRF involved establishing the educational goals, subject matter content, and proposed outcomes of the curriculum under development, largely based on broad and deep survey of the extant literature. Examples of materials studied, in addition to hundreds of peer-reviewed research articles, included research compendia (e.g., *Handbook of Language and Literacy*; Stone, Silliman, Ehren, & Apel, 2004), quantitative reviews (e.g. *National Reading Panel Report*, 2000), practice guides (Shanahan et al., 2010), textbooks, state and Common Core standards documents, and existing curricula. These resources were used to address Phase 1 (Subject Matter Foundations), which focuses on establishing curriculum content and educational goals that are relevant to students' development and achievement; Phase 2 (General Foundations), which focuses on examining general concepts related to curricula implementation and theory, including various philosophies of how to teach the given content; and Phase 3 (Pedagogical Foundations), which focuses on identifying specific activities and pedagogies to be used within the curriculum.

Phase 1 Activities and Outcomes

Phase 1 (Subject Matter Foundations) activities represented the initial undertakings of LARRC in which we established the general curriculum content and educational goals specific to improving reading comprehension for Pre-K to third grade students. This undertaking was somewhat more challenging than might be anticipated, as children in the lower range of the targeted grades (pre-kindergarten and kindergarten) are not typically able to read, much less comprehend what they read. However, given that children's language comprehension and

reading comprehension are intricately related in most if not all models of skilled reading (e.g., Gough & Tunmer, 1986; Kintsch & Kintsch, 2005; Perfetti, 1999), the consortium determined that its curricular focus would emphasize improvements in children's *language comprehension* rather than reading comprehension, theorizing that improvements in children's language comprehension would result in improvements in reading comprehension (Bowyer-Crane et al., 2008; Williams et al., 2005). This is an innovative focus with respect to designing a reading-comprehension curriculum, in that LARRC was seeking to leverage the relations between language and reading comprehension as a means to improve both the former and the latter.

Upon deciding to emphasize language comprehension as the overall focus of the curriculum (rather than reading comprehension, per se), the next undertaking was to determine the scope of the curriculum in terms of *which* language-comprehension skills to target. Skilled reading comprehension draws upon many component language skills, as well as their interplay (Cain, Oakhill, & Bryant, 2004; Catts, Fey, Tomblin, & Zhang, 1999). Of particular importance to being able to eventually read for meaning is the child's lexicon: the lexicon contains representations of the *forms* and *meanings* of individual words (Perfetti, 2007), often referred to as the language domains of grammar (syntax and morphology) and vocabulary. Both grammar and vocabulary make significant, direct contributions to reading comprehension (Catts et al., 1999; Verhoeven & van Leeuwe, 2008), representing "automatic, resource-cheap word-level processes" that directly support one's ability to read for meaning (Perfetti, 2007, p. 358). These *lower-level language skills* – automatically-derived representations of form and meaning - are used to construct the literal meaning of a text, referred to by some as the *textbase* (Kintsch & Kintsch, 2005). Theoretically, when lexical representations are well-specified and coherently organized – that is, are *verbally efficient* (Perfetti, 2007) – one is able to draw upon *higher-level*

cognitive skills (Cain et al., 2004) to engage in higher-level comprehension of text; higher-level comprehension involves creating a mental model of the text that integrates the text with one's prior knowledge and organizes its multiple propositions into an integrated whole (Kintsch & Kintsch, 2005). Higher-level cognitive skills particularly influential to skilled comprehension include *inferencing, comprehension monitoring,* and use of *text-structure knowledge,* which are referred to as "higher level meaning construction skills" and "higher-level factors in comprehension" (respectively, Cain et al., 2004; Perfetti et al., 2005). LARRC refers to these three component skills as *higher-level language skills* (Hogan, Bridges, Justice, & Cain, 2011).

Given the theoretical importance of both lower- and higher-level language skills to reading comprehension, and the fact that these skills develop in early childhood through the primary grades (the span of the LARRC activities), the LARRC curriculum established a fourfold *scope of instruction* that transcended both higher- and lower-level language skills, organized into four domains (see Table 2). The term "domain" was used to represent a general set of language skills. The scope included two domains reflecting higher-level skills, text-structure knowledge and integration (which included both inferencing and comprehension monitoring), and two reflecting lower-level language skills, word knowledge and grammar.

LARRC curriculum development activities also included a Spanish-English bilingual focus at Pre-K only. In this phase and all future phases, the bilingual activities were conducted in parallel to development of the English curriculum. The lower- and higher-level language skills targeted in the English version were paralleled in the bilingual version, but would be taught in both Spanish and English. This decision was based on the premise that children's Spanish skills will show more substantial, positive transfer to English if children have the opportunity to strengthen their Spanish language and listening comprehension skills prior to beginning English

reading instruction in kindergarten (Cummins, 1979). Our approach was informed by findings showing that transitional Spanish-English bilingual instruction is effective for promoting oral language and emergent literacy skills in English and Spanish in dual-language preschoolers (Farver, Lonigan, & Eppe, 2009), and positive cross-linguistic correlations for higher-level oral language and reading comprehension skills (Proctor, August, Carlo, & Snow, 2006).

Once the initial scope of instruction was established, it was necessary to generate *grade-level objectives* for each domain, given that the curriculum would span five grades. A thorough search of the literature, to include examination of textbooks, scholarly articles, and numerous standards documents (including the Common Core), was conducted to generate grade-appropriate indicators for each objective for each of five grades. When this task was completed, we saw considerable redundancy in indicators across various grades, particularly for pre-K and kindergarten and for grades 2 and 3. With input from our advisory board, the five grade levels were collapsed into three "levels": Level 1 indicators mapped to pre-kindergarten and kindergarten classrooms, Level 2 for first grade classrooms, and Level 3 for second and third grade classrooms. Table 3 shows objectives for the Integration domain, as an example, across the three levels. (Consistent with the iterative nature of this work, we would revert in the future to having specific objectives for each of the five grades, as pilot testing would help to differentiate instructional objectives for Pre-K and kindergarten, and grades 2 and 3. Thus, Table 3 represents a relic of our development activities.)

The above-referenced Phase 1 research activities were conducted by a subcommittee of LARRC investigators who met face-to-face twice and convened weekly in a standing meeting by conference call. Additionally, an advisory group was also convened at each of the four sites which met and reviewed subcommittee products at regular intervals. At the ASU site, the

advisory group included Spanish-English bilingual teachers and administrators. In Phase 1, the group largely provided feedback on the scope, objectives, and indicators by grade. Advisory-group members comprised eight principals, 24 teachers (eight pre-K, five kindergarten, four first grade, four second grade, three third grade), six reading coaches/language-arts coordinators, one speech-language pathologist, and one special education director. The advisors would be particularly useful in Phase 5 with respect to market research, and we discuss the group more thoroughly in description of Phase 5 activities. In general, curriculum-related products and decisions resulted from a dialectic process that involved all subcommittee members and took into advisory group feedback into consideration, and subsequently were reviewed and approved by the consortium members as a whole.

Phase 2 Activities and Outcomes

Phase 2 (General Foundations) activities followed initial establishment of the domains, scope, objectives, and grade-level indicators to address two general issues prior to beginning to develop an initial draft of the curriculum. The first concerned establishing the theoretical framework governing how children would learn (and teachers would teach) the curricular content (i.e., language skills). Given that the LARRC researchers consisted of individuals from a variety of backgrounds (speech-language pathology, developmental psychology, general education, special education, evaluation), there was active discussion and occasional disagreement regarding what would be the "active ingredients" of language-based comprehension instruction. Many discussions focused on whether instruction would emphasize explicit and/or direct instruction versus a scaffolding approach; both are tenable approaches to developing children's language skills (Pence, Turnbull, & Justice, 2010). In addition, the wide range of age, amount of

reading instruction, and language ability levels covered (i.e., preschool to third grade children) necessitated a discussion on how to bridge the curriculum across grades.

Ultimately, the research team adopted many tenets of scaffolded instruction, such that instruction would emphasize children's engagement in complex activities while being supported through differentiation by the teacher via scaffolding and supportive discussions. Active learning and gradual release of responsibility are important facets of scaffolded instruction (Rodgers & Rodgers, 2004). However, we also adopted key tenets of explicit instruction, particularly the importance of explicitly teaching students specific strategies to employ to monitor their comprehension. To this end, the consortium members agreed that no single pedagogy (explicit instruction *or* scaffolded instruction) would underlie the curriculum so as to ensure its effectiveness for spanning multiple grades and a potentially large array of language-skill objectives. Rather, they approached planning lessons through Pearson and Gallagher's (1983) framework for instruction, which includes both the elements of explicit instruction (modeling, guided practice, independent practice) and acknowledges that the "proportion of responsibility for task completion" (p. 337), essentially the amount of "explicitness" necessary and level of scaffolding, will vary depending on what is being taught and at what age level.

The second general issue concerned whether LARRC would seek to create an entire language-arts curriculum or rather a comprehension-focused supplement that could be embedded into a larger curriculum. Advisory-board input made it clear that many districts have invested heavily into language-arts curricula, including not only purchase of the curricula but also training in its use, and that the curricula used vary substantially from district to district. Additionally, advisors noted that many existing curricula are reasonably strong with respect to developing students' word-recognition skills, but that the curricula appear weak with respect to promoting

comprehension-related abilities. They indicated that the LARRC curriculum would be more marketable to districts (particularly during the evaluation work to be conducted in Phases 6-10) if it could be embedded into their existing language-arts structure but be "value-added" in terms of enhancing comprehension-related instruction and students' language skills.

Recent studies have shown that curriculum supplements embedded into the general classroom curriculum can improve children's comprehension skills (see Williams et al., 2005, 2009). For instance, researchers tested a supplemental classroom intervention targeting lower- and higher-level language skills (e.g., vocabulary, text-structure knowledge) for second graders in ten classrooms ($n = 128$), who participated in 15, 45-minute semi-scripted sessions embedded within the classroom curriculum twice weekly. Exposure to the curriculum supplement had positive impacts on the language skills targeted as well as text comprehension (Williams et al., 2005). Thus, a primary outcome of Phase 2 activities was agreement that the LARRC curriculum would be designed as a supplement to augment the comprehension component of any language-arts program. Importantly, because it would be a supplement, consortium members established the parameter in Phase 2 that curriculum implementation could not require more than about 30-minutes of instruction per day, corresponding to about 2.5 hours per week.

Phase 3 Activities and Outcomes

Phase 3 (Pedagogical Foundation) activities generally focused on establishing the "look and feel" of the curriculum with respect to (a) the techniques to be used in individual lessons to target instructional objectives, and (b) the overall schedule and organization of instruction over time. Phase 3 involved establishing initial prototypes for both the English and bilingual versions, which we discuss here, although it is important to note that each aspect was subsequently revised, in some cases extensively so, during the later evaluation phases (Phases 6-9).

Subcommittee members conducted a thorough review of the literature in order to identify instructional techniques to be used to address the LARRC objectives. The review focused on identifying, for each objective, experimental research studies linking a specific instructional technique to that objective. For instance, to improve children's vocabulary skills, the team identified "rich instruction" as an empirically validated approach. Rich instruction (also called robust instruction) involves targeting a small set of high-utility words via highly informative and repeated exposures to these words (e.g., see Beck & McKeown, 2007). These techniques (e.g., rich instruction) would be used to populate the lessons themselves, developed in Phase 4. For the Pre-K bilingual curriculum, this phase also considered examining recent literature on techniques used to facilitate language growth in English-Spanish bilinguals (e.g., Farver et al., 2009). At times, a research-based teaching technique for a language domain could not be found for a particular grade level, such as teaching inferencing to pre-kindergarteners. On these occasions, researchers identified a technique utilized in a similar grade level and discussed ways to adjust the technique. Table 4 provides an overview of techniques identified in an initial literature review for the Integration domain, many retained through to the final curriculum draft.

To identify the overall schedule and organization of instruction over an academic year, it had been previously agreed upon (in Phase 2) that the curriculum supplement could require no more than 2.5 hours of classroom instruction per week. By Phase 3, with curriculum objectives, indicators, and techniques generally agreed upon, the consortium examined the extant literature extensively to determine how instruction should be scheduled within a given week (e.g., daily short lessons vs. weekly longer lessons?) and in terms of ordering objectives across the targeted domains of language. Operating on the assumption that instruction would involve teachers following some sort of lesson plans organized into some sort of broader unit or theme, the

consortium considered, for instance, whether one objective should be targeted extensively within a given lesson, or whether multiple objectives should be targeted within a lesson. Literature regarding the benefits of *distributed practice* was carefully studied by the consortium, which refers to interspersing periods of learning opportunities with periods of rest or focus on alternative skills (Burdick, 1977). Some research studies find that distributing learning opportunities across time, rather than concentrating all learning of a skill in a single session, is useful for maximizing learning of new skills (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006). Thus, the consortium determined that objectives pursuant to a specific language domain would be distributed over an entire academic year, consistent with distributed practice. For instance, a text-structure domain objective "Identifies similarities and differences across expository text structures" in the third-grade supplement occurs in lessons over the entire academic year, with periods of instructional focus interspersed with periods of focus on alternative objectives.

An additional activity conducted as part of Phase 3 was determining the overall organizational scheme to be used for instruction. This initially concerned how to parse an academic year into periods of instruction; initial decisions made in Phase 3 involved parsing the curriculum supplement into five seven-week units so as to span 35 weeks of instruction. Multiple district calendars were consulted to establish the practicality of this decision.

Decisions that flowed subsequently included an interest in using scientific topics as the focus of each of the five units. A content-area specialist in the area of science was therefore hired to consult with the project in this phase. The decision to use science as a focus was drawn from several studies showing the utility of embedding language- and reading-comprehension instruction in content-area instruction, particularly science (Williams et al., 2005, 2009). A science focus also seemed to provide instructional opportunities to engage students with both

narrative and expository texts aligned to a given topic; an initial unit prototype focused on animals and their habitats, and included a variety of narrative and expository texts on the topic.

In addition to determining in Phase 3 that the curriculum would be organized into units, it was also determined that units would consist of individual structured lessons, which are supported in the literature as a means for improving students' language and reading comprehension (e.g., Nelson & Stage, 2007; Beck & McKeown, 2007; Justice et al., 2009; Williams et al., 2005, 2009). Not all language-focused curricula employ structured lessons; some interventions, for instance, involve reading texts in certain ways to students to accentuate vocabulary development. In developing initial prototypes of lessons, we elected to create and rely upon "soft-scripted" lessons that teachers would follow. Soft-scripted lessons include *suggested* rather than *prescribed* wording to guide teachers as they implemented a lesson. At this time, there was debate as to whether the lessons should be implemented in small- versus whole-class formats. Initial instantiations of lessons involved both: some lessons were written for small-group instruction whereas others involved only whole-class instruction. Eventually, the curriculum supplement would involve only whole-class instruction, as a result of pilot research showing that use of small-group lessons was making the lessons last much longer than practical.

It should be noted that a number of decisions made during Phase 3 would be substantially revised in future phases, reflecting the iterative nature of this work. For instance, the overall unit focus on scientific content would eventually shift so that a specific text structure -- *compare and contrast, cycles and sequences, description,* and *cause and effect*- would serve as a guiding "theme" for each unit. [This would occur in Phase 6 in response to a majority perspective from teachers indicating that they wanted greater transparency between the objectives targeted within a unit (e.g., vocabulary, text structure) and the overall focus of each unit.] Further, the

curriculum's organization would eventually be modified to comprise four rather than five units, consisting of three 7-week units and one shorter 5-week unit, to provide 26 weeks of instruction. [This would occur in Phase 7 following consistent evidence showing that teachers were taking about seven weeks to complete what we viewed as five weeks of instruction.]

Phase 4: Establishing the Learning Model

Phase 4 of the CRF involves establishing the model by which the curriculum would be enacted; this may include a variety of activities, to include organizing the sequence or trajectory of instruction over time into a set of lessons and considering how objectives should be organized over time. As Clements (2007) points out, curriculum-development activities in this phase are explicitly drawn from subject matter content, to include research and theory on how children learn the content being targeted. For our purposes, given that improving children's language skills was the targeted content, we relied on extant research and theoretical positions concerning how children acquire language, encompassing both lower-level and higher-level skills.

By Phase 4, a series of decisions had already been made with respect to the scope of instruction, the identification of specific objectives and indicators, the use of units to parse the curriculum into smaller periods of instruction, the reliance on structured soft-scripted lessons to guide teachers' instruction, and the techniques to be used within structured lessons. A primary activity at Phase 4 was thus to finalize the *layout* of individual lessons as a means to actualize all of the decisions made thus far. Drafting initial prototypes of lessons involved identifying any materials that would be necessary accompaniments of lessons (e.g., student journals, commercial trade books, glossary of terms, description of research support) as well as crafting the lessons themselves with respect to the extent of scripting to be used and the order of lesson content. LARRC members examined many published curricula and research reports showing examples of

instructional lessons. We also generated multiple drafts of our own rendering. Lesson drafts were reviewed and revised repeatedly by LARRC investigators and staff and project advisors. Drafts generated in Phase 4 would be revised in all of the following phases (within Phases 5-8), but three basic design considerations that emerged during Phase 4 were retained throughout.

First, each lesson emphasized repeated readings and explorations of authentic commercial texts, comprising either narrative or expository books. Initially, some units involved up to five different texts, with the texts explicitly selected to support the objectives of the units (e.g., teaching a cause-effect sequence) as well as individual lessons. The selection process involved a number of activities, to include working with librarians to identify candidate texts, vetting selections with the Advisory Board, and conducting pilot work in classrooms. Expository texts selected were reviewed for accuracy of information, inclusion of features that supported different types of text structure (e.g., sequences, cycles), general appeal to children via special features and illustrations, and the potential for extension activities to build upon the text's content.   Narrative texts (fiction and folktales) selected were reviewed for inclusion of story-grammar components (characters, setting, theme, and a plot comprising an initiating event, goal conflict, and outcome or resolution), character development through their thoughts, actions, and words, settings developed through description and/or illustration, and plots developed through the actions of the characters as they seek resolution to conflict. For the bilingual curricula, researchers translated one English book for which a Spanish version was not available.

Second, each lesson was of a specific type, which generally corresponded to the objectives being targeted. Early drafts of lesson targeted a variety of different language objectives within a single lesson. For instance, an early lesson prototype included several objectives from *each* of the four different language domains (text structure, integration, word

knowledge, grammar). Targeting objectives across multiple domains within a single lesson was initially considered given an interest in *interleaving*; interleaving involves weaving different skills (in this case, different domains of language) into a single learning opportunity, and some evidence suggests that this approach to ordering instruction boosts learning (Birnbaum, Kornell, Bjork, & Bjork, 2013). The lesson structure thus involved a series of different activities, such as a large-group reading of a text followed by hands-on writing activities, with different objectives targeted in different activities (e.g., targeting of inferencing during whole-group reading, and targeting of grammar during writing activities).

Advisory-group input indicated that the lessons seemed overly complex, and pilot work indicated that the lessons took much longer than desired for completion. In Phase 4, the decision was thus made for each lesson to target only one or two domains of language. This resulted in development and design of three different lesson templates that were aligned with specific objectives: *Words to Know* lessons targeted word knowledge/vocabulary (see Figure 1 for the template for this lesson type), *Integration* lessons targeted integration (comprising inferencing and comprehension monitoring), and *Text Mapping* lessons targeted text-structure knowledge and grammar. These three lesson types (*Words to Know, Integration, Text Mapping*) were then nested into a larger unit structure, which would start with a *Hook* and end with a *Close*. In generating these lesson templates, and organizing them across a unit, concerns were raised about the limited opportunities for children to participate in read-aloud experiences that would potentially enhance their language skills through engagement in authentic comprehension tasks. Thus, two additional lesson templates were created (*Read to Me, Read to Know*), which provided children with focused and authentic opportunities to engage with written texts. The seven lesson types would eventually be organized into a complete unit (see Table 5).

Note that the bilingual version of *Let's Know!,¡Vamos a Aprender!,* was developed in tandem with the English-only version using the same iterative processes. It has the same instructional context, scope and sequence of instruction, overall organization, lesson types, lesson layout, and instructional techniques as *Let's Know!,* but about half of the lessons are taught in Spanish. In all units, the Hook is presented in Spanish, the intervention books are read first in Spanish then English in subsequent lessons, and each type of lesson is taught in Spanish and in English. The Spanish lessons are not translations of previously taught English lessons; rather, they provide foundational knowledge in Spanish upon which English lessons build.

Third, in this phase an interest in monitoring children's learning as they progressed through the curriculum emerged, particularly as a means to support children who may struggle with curriculum content and for whom differentiation would be necessary. The development of curriculum-based measures (CBMs) tailored to LARRC content began in this phase, although the CBMs would undergo as much revision as the curriculum itself over subsequent phases. As a starting point, the extant literature was reviewed concerning how teachers use progress-monitoring data to inform instruction (e.g., Hosp, Hosp, & Howell, 2006; Roehrig, Duggar, Moats, Glover, & Mincey, 2008; Stecker, Fuchs, & Fuchs, 2005) and the role of testing in improving children's learning (Meyer & Logan, 2013). Initial drafts of the *Let's Know!* curriculum-based measure (CBM), eventually named *Show Me What You Know (SMWYK)*, were generated and embedded within each unit during the fifth week of instruction. The initial CBMs (one per each grade per unit) comprised a brief set of items designed to span development across all targeted domains, to include vocabulary, grammar, integration, and text mapping. Since there were no models to follow for creating such CBMs, the team examined prior research for examples of tasks used in experimental work to probe these skills in children, and adapted these

tasks for progress-monitoring. For instance, a simple experimental task used with first graders to assess their comprehension monitoring (Markman, 1979) was adapted for use across all grades as a measure of skill in this higher-level skill. In Phase 4, initial CBM drafts were pilot-tested on a small number of children. For the bilingual version, CBMs are administered in both Spanish and English using different items for each language, but assessing the same skills as in the English version. The intention was for teachers to be able to complete the CBM on each child in the classroom in about 10 minutes, such that the administration of all CBMs within a classroom could be completed within about two hours distributed over the week. Future pilot work would contribute to numerous revisions of the SMWYK, in response to data collected on the length of time it took teachers to use the CBM, how teachers used the data, and psychometric findings regarding reliability of the tool and its apparent sensitivity to children's gains in language skill.

Phases 5-10: Evaluation

Phase 5-10 involved a series of evaluations of the curriculum, initially relying on market research and then through formative studies. The final phase of the CFR is large-scale evaluation (see Table 1), which is scheduled to take place during the 2013-2014 and 2014-2015 academic years and will involve an estimated 295 pre-kindergarten to third-grade teachers and nearly 2,000 students sampled from their classrooms. The curriculum submitted to the large-scale evaluation was the result of the Phase 1 to 9 activities discussed herein. In much of this evaluation work, a driving interest was to ensure that the interventions developed could be used with a high degree of fidelity and perceived value (i.e., social valence) by pre-K to third-grade teachers working in a wide variety of contexts and with students from diverse backgrounds (see Bradley & Reinking, 2011). Put differently, the initial years of work on intervention development emphasized the need to develop interventions with the potential to be taken to scale, given that effective

interventions that cannot be reliably implemented and that have limited perceived benefits are

unlikely to be taken to scale (O'Donnell, 2008), and thus have limited utility to the field.

Phase 5 Activities and Outcomes

Phase 5 (Market Research) activities are consumer-oriented research activities designed

to learn about what the customer wants (Clements, 2007). A 36-member advisory board,

representing a number of school-based personnel working in four different states, was involved

in numerous development activities over the first two years of curriculum development. These

advisors also helped us to engage in market research designed to learn about potential adopters

of a curriculum with respect to their goals and needs, as well as the probability that they would

adopt the tool if developed.

Our advisors (34 females, 2 males), referenced earlier, included administrators, general

educators, special educators, and specialized personnel (e.g., reading specialists). They had, on

average, 19 years of experience within the field of education (range 5 to 40 years) and ranged

from 29 to 60 years. Each advisor was affiliated with one of the four LARRC project sites, and

was compensated by their site with stipends for their participation either on a per-meeting basis

or an annual stipend (based on site-specific practices).

Eight advisory-group panels were convened across the project sites during the first year

of LARRC activities, as we have discussed. There were typically six to eight advisors involved

in each session, and sessions lasted approximately two hours. Each session was moderated by a

LARRC investigator who followed a scripted Discussion Guide, which specified (a) all advanced

materials needed, (b) general session guidelines, and (c) discussion questions with suggested

time limits. Panels were convened largely to discuss key decisions being made and to react to

them; thus, achieving consensus among panelists was never intended. A standardized

PowerPoint presentation was also used to start each session that provided an overview of LARRC activities to date and outlined the role of the advisors in these activities. The first set of sessions (four panels convened in four states) discussed general design considerations relevant to Phases 1 to 4, such as the use of whole- versus small-group lessons, the relevance of curricular objectives to the Common Core, and the extent to which terms appearing in curricular materials were clear and relevant. The second set of sessions (four panels convened in three states, with two conducted at one site) corresponded to Phase 5 of the CFR, and was conducted immediately prior to an initial pilot study (Phase 6). Prior to the session, advisors were provided with a set of guiding principles governing the curriculum as a whole, a proposed scope and sequence of instruction, and a sample two-week unit, and were asked to review this prior to the meeting and mark suggested revisions directly on the materials. Advisors provided their marked-upon units to the moderator and these were compiled and used for future unit revisions. These sessions generally assessed advisors' reactions to the guiding principles of the curriculum, the proposed scope and sequence, and the unit/lessons provided.

Following panel meetings, a transcript plus summary of each session was generated locally and then forwarded to one LARRC site, at which a staff member reviewed all content and identified salient, consistent cross-site trends. LARRC investigators then would read panel transcripts and the summary of cross-site trends so as to identify aspects of the curriculum that should be maintained or revised. Aspects to be retained, for instance, included the level of scriptedness for lessons, the use of both narrative and expository texts, and the coherence of objectives to the Common Core. Advisory group members reported that while they would not have agreed to prescribed wording, they felt that some level of scripting can be helpful to all teachers, but particularly critical to have for novice teachers and teachers new to a grade level.

Revisions requested included the use of different lesson types (instead of interweaving objectives in a single lesson), the need to enhance student engagement in lessons (many were seen as too academic or dry), the need to help teachers to differentiate instruction to students of different skill levels, and a need to reduce the length and complexity of lessons. Cross-site trends were used to revise the initial unit prior to the Phase 6 pilot study.

Phase 6 Activities and Outcomes

Phase 6 (Formative Research: Small Group) activities involve pilot testing of specific components of the curriculum or sections of the curriculum. For our purposes, we conducted an initial design experiment to test a prototype of the curriculum which involved two weeks of lessons. This was conducted in winter of 2011, approximately seven months after the development activities commenced. Teachers at selected grades implemented a 2-week (6-lesson) unit, after which the unit was revised. The primary goal of this formative research was to assess teachers' preparation and planning for the lessons, the length of time required for lesson implementation (and teachers' perceptions about lesson length), and their fidelity of implementation when delivering the lesson prototypes. Noted earlier, the lessons were soft-scripted such that lesson objectives were identified, specific activities were delineated, and suggested language was provided; we wanted to determine the extent to which teachers adhered to the script provided and if they were generally satisfied with the level of scripting. Also, we sought to assess students' engagement within the lessons, particularly given that lessons had a scripted feel to them.

Participants. Participants in the two-week Phase 6 pilot study were 16 teachers (all White females) working in schools in four different states; five worked in pre-kindergarten classrooms, four in kindergarten, four in grade one, and three in grade two. (We did not have any three grade

teachers participate at that time; rather, we anticipated that we could generalize findings from our second grade teachers.) The teachers averaged 11 years of teaching experience (range 3 to 23). Teachers recruited into the study worked in schools that had established a formal relationship with LARRC and were involved in a variety of Consortium-related activities; some served on the advisory board. All teachers volunteered to participate in this study and provided informed consent prior to engaging in any research activities.

General procedures. Teachers implemented one of two prototype units based on grade (pre-kindergarten and kindergarten teachers implemented one prototype, first and second grade teachers the other). Each unit comprised a total of six lessons, and teachers were asked to implement three lessons per week on a schedule provided by the research staff. Prior to implementation, each teacher met with a member of the research staff for an overview of the implementation plan; this 90-min session was conducted in teachers' classrooms and involved providing teachers within information about the units' teaching objectives, activities, and materials. During this meeting, teachers received all materials that they would need to complete the 2-week unit, including a binder containing all lessons in the unit as well as any supplementary materials needed. For instance, pre-kindergarten and kindergarten teachers received two trade books, whereas first and second grade teachers received three trade books and three leveled readers.

During the implementation of the units, data-collection activities were conducted for formative purposes. These included teacher completion of electronic surveys after each of three lessons (randomly assigned to each teacher so that surveys covered all six lessons) as well as classroom observations. The surveys contained six questions addressed on a Likert-type 5-point response scale (1= lowest/most negative rating, 5=highest/most positive rating) followed by

three open-ended questions with an unlimited amount of electronic space to respond. The classroom observations, which lasted approximately 45 minutes, were conducted by research staff; during the observation they completed an observational tool developed for the purpose of this study. Using a scale of 1 (low) to 5 (high), staff provided ratings for (a) general delivery of the lesson (preparation, staying within allotted time, following script, enthusiasm), (b) materials (preparedness, visibility to children), (c) specifics of lesson delivery (effectiveness of covering learning objectives, differentiating instruction, students ability to complete tasks within lessons, progress monitoring, modeling vocabulary words, evaluated and expanded on students' phrases and engaged students), and (d) students' responses to the books/texts in the lessons. Field notes were also maintained to capture salient impressions during lesson implementation.

 Results and revisions. Data collected in Phase 6 included 33 surveys completed by the 16 teachers following lesson implementation and 34 classroom observations conducted by LARRC staff. In this and all future phases, the LARRC team had to identify a means for aggregating data from a variety of different types (e.g., survey responses, observation data) and locations (four study sites) so as to effectively guide substantive curricular revisions in a very rapid manner. Often, we sought to begin curricular revisions within one month after fieldwork was completed, so as to have revised curricula available at the time of the next planned field study. In general, our approach was to have a team (typically two or three investigators) be responsible for a given measure: they would be responsible for (a) developing and cleaning the relevant data, (b) generating a summary report (following a template established for this purpose) sharing relevant data) that included explicit recommendations for future revisions, and (c) presenting their report to all investigators. At that time, the investigators would consider the recommendations and work

to consensus regarding the need for or against suggested revisions. Oftentimes, these discussions would seek to balance revision recommendations with time constraints.

Examination of Phase 6 data resulted in the following consequential recommendations for revision, prior to future field tests: (a) lessons would be modified to only involve whole-class instruction, (b) lessons would be modified so that could be implemented in a much shorter duration, (b) the scope and sequence of instruction would be revised so that fewer objectives would be covered over an academic year (necessary given the overhaul of lessons), and (c) some unit supplements would be eliminated (e.g., certain types of vocabulary stimuli, student readers).

An important outcome of Phase 6 was the obvious need to simplify the curriculum so that it could readily "fit" within language-arts instruction. Lesson plans were overhauled so that each lesson would follow the same instructional *routine* featuring five ordered components adhering to a scaffolded instructional approach (Fisher & Frey, 2008): Set, I Do, We Do, You Do, and Close. The purpose of the Set was to identify the goal of the lesson (typically the lesson's objective), and to grab the children's attention and help them to relate their experiences to the goal of the lesson. The purpose of I Do was for the teacher to model for students what it is they are to do or learn in the lesson, which is followed by the We Do, in which the teacher and children co-participate in doing or learning something. In the You Do, children practice on their own whatever it is they are doing or learning, often with a peer. Finally, in the Close, the teacher summarizes again the goal of the lesson (what was learned). With this new framework for individual lessons, we theorized that the curriculum could more readily be embedded into everyday instruction. (Figure 1 shows how this framework was used within a lesson.) With these revisions in hand, we generated one complete unit for each of three grades (pre-K, kindergarten, second grade) for further formative evaluation. Approximately three months were used to

generate new units and new lesson prototypes, based on the Phase 6 outcomes, which were tested in Phase 7.

Phase 7 Activities and Outcomes

Phase 7 (Formative Research: Single Classroom/Curricular Enactment) activities involve extensive observation of the implementation of the curriculum so as to "examine learning in the context of the curriculum with teachers who can enact it in concert with the developers' visions" (Clements, 2007, p. 49). Clements refers to this as "super-realization," or assessing impacts of the curriculum when implemented at its best; it thus involves close collaboration between teachers and developers at this phase. For LARRC, our Phase 7 formative research activities involved eight teachers (two teaching the bilingual pre-kindergarten curriculum supplement) who implemented a six-week unit comprising 17 separate lessons. This was conducted in fall of 2011. In this presumed "super-realization" of the curriculum, we elected to observe all lessons implemented in order to arrive at deep understanding of how each lesson, and each lesson's components, were or were not being effectively enacted within the six classrooms. Three primary research aims guided the Phase 7 pilot study were to determine the extent to which the lessons were implemented as intended; the extent to which teachers were able to implement the curriculum in their classrooms; and the extent to which teachers expressed satisfaction with the curriculum. Our interest at this phase largely concerned teachers' enactment of the curriculum, rather than students' learning outcomes. Given that the targets of instruction (e.g., word knowledge, text structure knowledge) and techniques used (e.g., rich discussion) were empirically validated for impacting students' language and/or reading comprehension, the goal of our formative work was ensuring that teachers could enact the curriculum as intended.

Participants. Eight teachers in four states participated in the Phase 7 feasibility study (two in each of pre-kindergarten, kindergarten, and grade two English versions and two in pre-kindergarten bilingual versions). Although not all targeted grades were represented in this phase of formative research, we anticipated that we could generalize findings to the omitted grades (first and third). Teachers self-selected into the study and provided informed consent for participation. Important to note is that over the course of the feasibility study, two teachers (kindergarten and grade two) dropped from the study without completing the entire unit of implementation. Although attrition of teachers was not originally intended to serve as a Phase 7 data point, the loss of two of six teachers during this formative work was influential to the revisions that resulted from Phase 7 research. Subsequent interviews with the teachers held us better understand the contexts in which teachers were worked, particularly their concerns about fitting the LARRC curriculum into their extant curriculum and adoption of Common Core.

General procedures. The six teachers implemented a 17-lesson unit (each lesson to last approximately 30 minutes) that included six different lesson types (Hook, Word Detectives, Integration, Text Structure, Read to Know, Close) comprising five lesson components (Set, I Do, We Do, You Do, and Close). In addition, teachers implemented the unit's SMWYK CBM in the fifth week of instruction to all of the students in their classrooms. This was the first formal trial of the CBMs, and a principle interest was to determine how long it took teachers to administer these, as they were designed to require less than 10 minutes per student, ideally.

During the six-week period of implementation, data-collection activities largely involved classroom observations, which occurred for all lessons implemented ($n = 117$, which includes observations of some CBM administrations), teacher logs completed following each lesson, and an end-of-unit teacher survey and guided interview. During classroom observations, research

staff sat in an unobtrusive location and used a notation system on each lesson plan to monitor

implementation of specific lesson components (Set, I Do, We Do, You Do, and Close); the

observer also completed a summary section at the end of each lesson to provide qualitative

impressions of lesson implementation. No feedback was provided to teachers. The teacher logs

were completed by teachers to provide information for each lesson specific to the ease of

implementation, length of lessons, student engagement and motivation, effectiveness of lessons,

lessons alignment with teaching objectives, and satisfaction and future use of curriculum.

Results and revisions. The primary data used for formative purposes during Phase 7 were

derived from the 117 classroom observations. As in the prior phase, a team was responsible for

examining these observational data so as to generate a summary report of the data collected and

provide explicit recommendations for future revisions. That team report noted that 74% of the

lessons were implemented with high fidelity and 26% with mid-level fidelity, indicating overall

fidelity to be generally acceptable. However, some lesson types, such as Word Detectives, were

implemented with lower levels of fidelity than others, and some lesson components, namely the

We Do complement near the end of each lesson, were often omitted from lesson implementation.

The report also noted that some lesson components were not seen very favorably (only 50% of

the You Do components were viewed favorably). Additional reports were generated to examine

the data provided from 102 teacher lesson logs, five end-of-unit surveys, and six guided

interviews, all of which was aggregated to further revise the curriculum. A report on the

teachers' feedback specific to the use of CBMs was also generated.

Specific changes that resulted from the e Phase 7 post-research recommendations

included the following. First, lessons were further shortened and simplified so that they could be

implemented in no more than 30 minutes. Second, the number of units to be implemented was

decreased from five to four, and the total duration of instruction was shortened from 35 weeks to

26 weeks, thus giving teachers time to make-up missed lessons and slow the pace as needed.

Third, the use of hands-on activities was increased in an effort to promote student engagement,

as well as the number of trade books featured in each unit (to promote refreshing of content over

a seven-week period of implementation). Fourth, lessons providing the opportunity for students

to practice previously addressed objectives were created. Fifth, professional development

modules were drafted to promote teachers' use of certain techniques with higher levels of fidelity

and to emphasize the importance of certain lesson components (e.g., the We Do component).

Sixth, the lessons were also redesigned to promote more opportunities for children to engage in

discussion with others, including peers. Seventh, feasibility data on teachers' implementation of

the CBMs showed that they took the desired length of time to administer (less than five minutes,

on average), but there were numerous needs for refinement. For instance, teachers were unclear

as to what to do with the CBM data once it was administered. An important revision to the

curriculum subsequently was to incorporate a week of "stretch and review" post CBM-

administration, in which teachers could work individually with students who appeared to have

difficulties acquiring specific targeted language skills (e.g., unit vocabulary).

Following completion of the Phase 7 study, LARRC engaged in substantial revisions of

the tested unit as well as expansion of units to cover all targeted grades (pre-K through grade

three) and an entire year of instruction. An additional and significant result of Phase 7 was the

decision to create a second instantiation of *Let's Know!* that would serve to reduce the number of

different lesson types occurring in each unit, thus simplifying implementation, while increasing

the opportunities for children to practice certain skills. Specifically, in this "Light" version, the

Read to Know and *Text Mapping* lesson types were eliminated and substituted with repetitions

and extensions of the *Words to Know* and *Integration* lesson types (see Table 6 and 7 for the English and bilingual lesson sequence), in which students received opportunities for further practice of newly taught skills. Retention of the *Read to Me* lesson types across both instantiations ensured that children in the Light version would have experiences with the curriculum texts. Given that two teachers had attritioned from the Phase 7 research reportedly due to perceived burdens of integrating the curriculum with district standards, we sought to test whether a more "simplified version of the curriculum, featuring fewer lesson types and more opportunities to participate targeted language skills, may promote retention and implementation. Approximately three months were used for revision prior to moving into Phase 8 activities.

Phase 8 Activities and Outcomes

Phase 8 (Formative Research: Multiple Classrooms) activities involve examination of implementation of the two *Let's Know!* curricular instantiations in multiple classrooms, with the purpose of assessing the effectiveness and usability of the curriculum in more varied circumstances and to compare the Light and Full versions. Specifically, the goal of the Phase 8 study was to determine whether the revised lesson prototypes (representing two instantiations) could be delivered in prekindergarten to grade three classrooms with acceptable levels of consistency, fidelity, and satisfaction. LARRC's Phase 8 activities involved testing a new unit of the curriculum, now requiring an estimated seven weeks of instruction, across all five targeted grades and with a larger number of teachers; teachers were randomly assigned to implement either the Full or the Light version. This was conducted in spring of 2012.

Participants. Participants were 50 teachers working in schools in four different states; the teachers were equally distributed across the five grades (10 pre-kindergarten, 10 kindergarten, etc.). Additionally, seven pre-kindergarten teachers of the bilingual curriculum

participated at the ASU site. Teachers self-selected into the study at the invitation of their school

districts. The teachers agreed to random assignment of one of the two curricular instantiations,

although specific information about differences between instantiations was withheld.

General procedures. All teachers implemented a 7-week unit comprising 24 lessons

during the spring of the academic year. Teachers received one-on-one orientation to research

activities and also completed an online self-paced professional development module designed to

enhance understanding of the instructional techniques used in lessons. Data-collection activities

included an online survey following completion of the professional development module, three

observations of lessons by LARRC staff to assess implementation fidelity, a lesson log

completed by teachers following every lesson, and an end-of-unit teacher survey and guided

interview. Many of the data-collection tools made use of tools from prior phases of work. Data

considered most closely by the research team were threefold: (a) the lesson logs completed by

teachers after each lesson, (b) the end-of-unit teacher survey and face-to-face interview, and (c)

the classroom observations (three per teacher).

Results and revisions. The 50 teachers participating in Phase 8 completed 1,015 logs;

logs captured teachers' satisfaction on a 5-point scale (0=not at all satisfied, 4=very satisfied) for

each of five lesson components (i.e., Set, I Do, We Do, You Do, Close) and across all lesson

types (e.g., Word Detectives, Read to Me). A mean satisfaction score per lesson was created by

averaging the teacher ratings across the five components. Overall, teachers were generally

satisfied with the lessons ($M = 3.2$, $SD = .7$), with little differences observed between the two

instantiations ($M = 3.2$ and 3.1 for the Full vs. Light Instantiations, respectively).

Teachers' logs were also useful for examining satisfaction with the timing and length of

lessons, which had been a matter of interest across all previous phases. Revisions following

Phase 7 explicitly sought to simplify and shorten lessons. Two dichotomous (1 = yes / 0 = no) items on the lesson logs captured teacher satisfaction with the overall timing of lesson implementation. These items asked if the teachers were able to implement all lesson components within the 30 minute timeframe and if they were satisfied with the pace of the lesson. For all logs for which these data were available (n = 992), 631 (64%) were scored as 1 (yes) for the former and 768 (83%) were scored as 1 (yes) for the latter. Thus, the majority of lessons were appropriate in length and pacing, although not all were.

Additionally, logs were useful for examining teacher impressions regarding students' engagement during lessons. For each lesson, teachers rated students' engagement on a five-point scale (0 = not at all satisfied, 4 = very satisfied); the mean rating for all lessons was 3.3, and 87% of lessons were scored as >3 (satisfied or very satisfied). Thus, lessons were generally seen as engaging for students, with no differences observed between instantiations.

An important contribution of the teachers' logs is that they were able to provide additional input in an open-ended response option. Teachers provided an enormous volume of very specific input for a majority of the 992 logs completed; for instance, they would make suggestions for wording changes when lessons were unclear, or discuss how children did with respect to a given objective. These open-ended responses were aggregated into a single document and all suggestions were considered for revision.

The end-of-unit teacher survey data were available for 45 teachers: 19 teachers in the Full version and 26 in the Light version. The teachers reported their satisfaction with respect to 11 factors related to curriculum implementation based on a scale of 0-4 (0 = strongly disagree, 4 = strongly agree). Table 8 provides these results across the two instantiations, and shows that teachers provide generally high ratings to these factors (about 3 of 4 points across items, on

average) and that neither instantiation was better than the other. We did not find that teachers

using a simplified version of the curriculum had heightened satisfaction ratings.

The classroom observations were useful for examining the overall length of time needed

for lesson implementation and for examining teachers' fidelity to various components of the

lessons as well as student engagement; the observational data could be triangulated with teacher

reports, which were favorably disposed to these aspects of implementation. Classroom

observations showed that, on average, all lesson types for all grades and both instantiations were

above 30 minutes. Integration lessons were lasting particularly long, averaging more than 40

minutes. Second, fidelity of implementation was relatively high, ranging from 68 to 94% on

fidelity checklists. These data did show, however, that fidelity ranged somewhat across teachers.

Third, the majority of lessons were rated as 'engaging' across grades, lesson types, and

instantiations, although variability was noted across some lesson types and across grades (pre-

kindergarteners were generally less engaged than older pupils

Phase 8 data (much of it not discussed here due to space constraints), in its aggregate,

suggested that the lessons themselves were satisfactory to teachers with respect to (a) the ease of

teaching the lesson techniques, (b) specific lesson components, (c) the teaching objectives as

related to developmental appropriateness, alignment with state/district language arts standards,

and opportunities to differentiate instruction, (d) the overall length of lessons, and (e) student

engagement during instruction. There were modest differences across the instantiations;

however, these were not enough to lead to a prioritization of one instantiation over the other in

terms of teacher satisfaction. Consequently, no significant or substantive changes were made to

the units and lessons following Phase 8, aside from addressing specific comments provided by

teachers in logs tied to every lesson. With this final 7-week, 17-lesson prototype unit in hand, the

consortium then moved to summative research testing implementation of the curriculum over much of the academic year. The prototype units provided the basis to generate two additional units per grade for testing at Phase 9.

Phase 9 Activities and Outcomes

Phase 9 (Summative Research: Small Scale) activities provide initial tests of the potential impacts of the curriculum subsequent to its development over the 9 prior phases. At Phase 9, LARRC conducted a quasi-experimental three-group pilot study to examine impacts of curriculum implementation on general and specific features of language-arts instruction (not discussed here due to space limitations) and researcher-designed measures of student learning of targeted language skills. As a quasi-experimental study, findings are interpreted cautiously but are important for assuring the appropriateness of moving to a larger-scale field study at Phase 10.

In the LARRC pilot study, three units of the curriculum (two revised units as well as one new unit, all based on the prototype tested at Phase 8) were implemented across five grades (pre-K to grade three) with a larger number of teachers than in previous phases and thus representing greater diversity in instructional conditions. In this phase, teachers were assigned to one of three groups: business-as-usual instruction (control group) or the Full or Light versions of *Let's Know!*. At the time of this manuscript, we can present results specific to student learning based on *Let's Know!* CBMs (SMWYK) collected following seven weeks of exposure to the curriculum, at the close of Unit 1.

Participants. Participants were 60 teachers working in schools in four different states, with teachers again distributed equally across pre-kindergarten through grade 3. In addition, seven pre-kindergarten teachers of the bilingual *Let's Know!* curriculum participated at the ASU site. Teachers self-selected into the study, and many had participated in the Phase 7 and Phase 8

formative studies. Because of this, any teacher involved in prior research activities was randomly assigned to implement either the full or light version of the curriculum. Any new teachers to the study were randomly assigned to one of the three conditions, although in some sites business-as-usual teachers could not be randomly assigned due to various school-specific complexities (e.g., a teacher had been exposed to *Let's Know!* previously). Five students were sampled from each classroom to take part in data collection activities, with a total of 300 students represented from the 60 English classrooms and a total of 35 students from the pre-kindergarten bilingual classrooms. The students were randomly selected from among all students in a classroom for whom informed caregiver consent was provided.

General procedures. All teachers implemented the first *Let's Know!* unit (Fiction) in the fall of the 2012-2013 academic year. As in the previous pilot study, teachers received a one-on-one orientation to the research process, and, in addition, implementation teachers completed self-paced professional development modules. These modules were similar to those utilized in the previous trial; revisions to the original modules were made based on feedback from teachers during Phase 8. These revisions included clarifying information related to specific research activities, such as administering CBMs, as well as providing teachers with an increased number of videos that modeled implementation of *Let's Know!* lessons. Data-collection activities related to teachers' implementation included an online survey following completion of the professional development module, nine classroom observations by LARRC staff to assess fidelity, a lesson log completed by teachers following every lesson, and end-of-unit teacher survey. Many of the data-collection tools were used in prior phases of work. A new activity in this phase was collection of progress-monitoring data based on the LARRC SMWYK for 300 students in each classroom at the end of the unit as a potential index of students' learning.

SMWYK examines students' learning at the close of each unit in three of the four language domains targeted in *Let's Know:* Word Knowledge, Text Structure, and Integration. Grammar would also eventually be coded through analysis of stories children produced during administration of the CBM (e.g., analysis of complex sentence structures), although this coding is not yet scheduled for completion. All SMWYKs were implemented by teachers following training in implementation; these audio-recorded in order to allow for double-coding to check for reliability of teachers' scoring, calculated on a randomly selected 10% of the assessments per site. These results showed high overall inter-rater agreement in scoring (91%).

SMWYK includes three different sets of items, all implemented in an oral context. Word Knowledge items (e.g., "Tell me what solution means") asked students to provide definitions of vocabulary words that occurred in *Let's Know!* instruction (e.g., compare, admire, relieve, similar); responses were scored for partial credit (1 point) or full credit. Text Structure items included three categories of items (story grammar, cohesion, episode structure) that were scored in a task that required students to listen to a story, retell it, and answer questions about it; up to 43 points were possible. Integration items focused specifically on comprehension monitoring; students listened to a storybook that contained inconsistent information and were prompted to identify when this occurred; up to 4 points were possible. For the present purposes, we summed all CBM items to arrive at a raw score for each student, and compared these for students receiving *Let's Know!* instruction versus those receiving business-as-usual instruction.

Table 9 provides a comparison of scores for students in four of the five targeted grades (first grade data for the control condition and data for bilingual classrooms were not yet available) who had received the Unit 1 CBM. For three of the four grades (pre-K, kindergarten, third grade), scores were significantly higher for students who had received *Let's Know!*

instruction (all *p*s <.001) compared to those receiving business-as-usual instruction, based on *t*-tests of mean differences. Effect-size indices show that for two of the three grades (pre-K, kindergarten) impacts were quite large. It is unclear whether these preliminary results will translate to impacts on more distal measures of reading comprehension, which would obviously be less closely aligned to the intervention. However, we speculate that these short-term improvements in students' skills in word knowledge, text structure, and integration, even if they are closely aligned to the intervention, should theoretically lead to improvements in reading comprehension, a premise that we will assess directly in Phase 10 of this multi-phase project.

Conclusions

In recent years, public interest and investments in reading comprehension have increased substantially, to include considerable federal sponsorship of research designed to develop effective interventions via the RFU initiative. Five federally supported RFU research teams, of which LARRC is one, are designing, developing, and testing reading-comprehension interventions The present article summarizes the process pursued by LARRC as it developed two instantiations of an English reading-comprehension curricular supplement and two instantiations of a pre-K bilingual curricular supplement designed explicitly to improve student's language skills as a vehicle for improving curriculum. The process described here was fruitful in terms of arriving at the final versions of the curriculum, and may be useful for other researchers who are invested in developing research-based practices and programs. Following a systematic approach such as the Curriculum Research Framework (Clements, 2007) provides a means for developing research-based tools that can elevate students' learning on a magnitude that is educationally significant. Application of the CRF to th development of the *Let's Know!* curriculum involved heavy emphasis on incorporating extant research findings, most prominently with respect to

identifying targets and techniques of instruction; incorporating a high level of involvement of stake-holders, including school administrators and teachers, in the development activities; and following a principled approach to pilot testing and formative evaluation in the design process.

A possible limitation to generalizing the work presented here is that it is very resource intensive (see Table 1). Many research teams may not have the time and financial resources that were available to LARRC, and thus may perceive that they cannot engage in the breadth and depth of activities relevant to each phase as recommended in the CRF and used by LARRC. However, an important feature of CRF is that its systematicity creates a "coherent structure" for curriculum development (Clements, 2007, p. 40). There are many less-intensive ways to complete each of the CRF phases that occurred in LARRC. For instance, Phases 2, 4, and 5 involved advisory-group feedback, which for LARRC involved 36 individuals in four different states. Advisory groups can involve far fewer individuals and be convened less frequently than we did. In addition, many of our field studies (Phases 6-9) involved a relatively large number of teachers (e.g., 16 teachers in Phase 6) and observations. Some questions pertinent to these phases can be addressed with fewer teachers and observations. Thus, in applying the CFR to future curriculum-development activities, research teams should seek to engage in activities that span all of the first nine phases, but consider less-intensive ways to do so. As Clements (2007) points out, curricula that adhere to a systematic process of development are more likely to positively affect students' achievement than those that do not.

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Table 1

Categories and Phases of the Curriculum Research Framework (Clements, 2007) and LARRC-Specific Research Activities

Phase	LARRC-Specific Activities
Category 1: Establishing A Priori Foundations	
1. Subject-Matter Foundations	Extensive survey of extant literature (textbooks, research reports, standards) to establish focus of intervention (lower- and higher-level language skills), scope of instruction (four domains), objectives within each domain, and indicators of skills per grade level; review of all products by advisory board at each of four sites
2. General Foundations	Consortium-level discussions and advisory-board feedback to determine the general pedagogical framework and nature of instruction (complete curriculum vs. supplement)
3. Pedagogical Foundations	Consortium-level discussions and research review to identify instructional techniques, organization of objectives into lessons (e.g., massed vs. distributed learning), and the organization of lessons into units
Category 2: Establishing the Learning Model	
4. Activity Design	Extensive survey of extant curricula and research, generation of prototypes, and review by consortium and advisory board to establish lesson plan prototypes
Category 3: Evaluating the Curriculum and Its Components	
5. Market Research	Seven advisory-board meetings with focus groups and discussions to vet numerous aspects of early curricular development (e.g, scope and sequence, lesson prototypes)
6. Formative Research: Small Groups	Design study involving 16 teachers (spanning three grades) in a 2-week implementation period (six lessons total) to test initial lesson prototypes; teacher-level outcomes only
7. Formative Research: Single Classroom	*Feasibility study* involving 6 teachers (spanning in three grades) in a 6-week period (17 lessons) to test one complete unit; teacher-level outcomes only
8. Formative Research: Multiple Classrooms	Quasi-experimental two-group *pilot study* involving 50 teachers (spanning five grades) in a 7-week period (24 lessons) to test revised unit; teacher-level outcomes only
9. Summative Research: Small Scale	Quasi-experimental three-group *pilot study* involving 60 teachers (spanning all five grades) in a 21-week implementation period to test three complete revised units; teacher- and student-level outcomes collected
10. Summative Research: Large Scale	Experimental *three-group randomized controlled trial* involving 320 teachers (spanning five grades, implemented over two cohorts) in a 26-week implementation period to test entire revised *Let's Know!* curriculum supplement

Table 2

Scope of Instruction: Four Language Domains Targeted in Let's Know! Instruction

Domain	Language Skills Targeted within Domain
Text Structure	Children's ability to use the key features of narrative (e.g., dialogue) and expository texts (e.g. compare/contrast charts) and knowledge of differences between the two types of texts; to identify main topic and subtopics; to identify major story grammar units; and to use key words to identify major text structures (e.g., cycle/sequence)
Integration	Children's ability to synthesize information within texts (narrative and expository); to make inferences about texts; to monitor comprehension and identify when something does or does not make sense; and to generate predictions and to confirm and revise these
Word Knowledge	Children's ability to use and define a variety of academically relevant words of various classes (verbs, adverbs, etc.); to distinguish shades of among for these words and generate associations among them; and to use key words to identify relations within texts (e.g., sequences)
Grammar	Children's ability to use a variety of complex sentence types and phrasal structures; to use word structure elements to determine and analyze word meanings; to use a variety of inflectional and derivational morphemes

Table 3

Example Objectives for Three Levels for the Integration Domain

	Objectives		
Level	1	2	3
Level 1 (pre-kindergarten and kindergarten	Identify main idea and two or more key details of an informational text.	Identify incongruent information within or between texts and ask for help.	Generate and answer questions related to main characters, their goals and attempts to reach their goals, and outcome in stories read aloud
Level 2 (first grade)	Identify one main idea and at least two key supporting details of grade-level informational text read independently.	Identify incongruent information within or between texts. Identify strategies that can be used to assist comprehension.	Generate and answer questions related to main characters, their goals and attempts to reach their goals, and outcome in stories read in grade-level stories read independently.
Level 3 (second grade and third grade)	Identify the main ideas and key supporting details of a multi-paragraph, grade-level informational text read independently. Refer to the text to support choices.	Identify incongruent information within or between texts. Identify and use strategies that can assist comprehension.	Generate and answer questions related to the main idea(s) and supporting information in grade-level informational text read independently and support answers with information from the text.

Table 4

Examples of Empirically Validated Techniques used in Curriculum Design

Language Domain	Sample Instructional Technique	Sample References
Text Structure	Clue words Graphic organizers	Kim, Vaughn, Wanzek, & Wei, 2004; Williams et al, 2005
Integration	Inferential questioning Content highlighting Clue words	Glaubman, Glaubman, & Offir, 1997; van Kleeck et al., 2008; Zipke, Ehri, & Cairns, 2009
Word Knowledge	Rich, extended instruction Multiple meaning instruction	Beck & McKeown, 2007; Coyne et al., 2007; Nelson & Stage, 2007
Grammar	Focused stimulation Affix instruction Sentence combining	Fey, Cleave, Long, & Hughes, 1993; Baumann, Edwards, Boland, Olejnik, & Kame-enui 2002

Table 5

Lesson Templates Generated During Phase 4 and Organized into a Unit

Week	Lesson Number	Lesson Type
1	1	Hook
	2	Read To Me
	3	Words to Know
	4	Show Me What You Know (preview*)
2	5	Text Mapping
	6	Words to Know
	7	Integration
	8	Read to Know
3	9	Read to Me
	10	Text Mapping
	11	Integration
	12	Words to Know
4	13	Text Mapping
	14	Integration
	15	Words to Know
	16	Read to Know
5	17	Read to Me
	18	Text Mapping
	19	Integration
	20	Read to Know
6	21	Read to Know
	--	Show Me What You Know (CBMs)
7	22	Stretch and Review (based on CBMs)
	23	Stretch and Review (based on CBMs)
	24	Close

*The Week 1 (lesson 4) Show Me What You Know provides teachers the opportunity to show students the skills they will be learning over the unit with a preview of the tasks in the SMWYK CBM. Teachers' interest in this preview was identified in Phase 4 of curriculum development.

Table 6

Full versus Light Versions of a Let's Know! Unit

		Full Version	Light Version
Week	Lesson	Lesson Type	Lesson Type
1	1	Hook	Hook
	2	Read To Me	Read to Me
	3	Words to Know	Words to Know
	4	SMWYK* preview	SMWYK* preview
2	5	Text Mapping	Words to Know
	6	Words to Know	Words to Know practice
	7	Integration	Integration
	8	Read to Know	Integration practice
3	9	Read to Me	Read to Me
	10	Text Mapping	Integration
	11	Integration	Words to Know practice
	12	Words to Know	Words to Know
4	13	Text Mapping	Integration
	14	Integration	Integration practice
	15	Words to Know	Words to Know
	16	Read to Know	Words to Know practice
5	17	Read to Me	Read to Me
	18	Text Mapping	Integration
	19	Integration	Integration practice
	20	Read to Know	Words to Know practice
6	21	Read to Know	Integration practice
	--	SMWYK CBMs	SMWYK CBMs
7	22	Stretch and Review	Stretch and Review
	23	Stretch and Review	Stretch and Review
	24	Close	Close

*SMWYK = Show Me What You Know curriculum-based measure developed for the Let's Know curriculum supplement.

Table 7

Full and Light Versions of a Let's Know! Bilingual Pre-Kindergarten Unit

Bilingual Week	PK Lesson	Language	Full Version Lesson Type	Language	Light Version Lesson Type
1	1	Spanish	Hook	Spanish	Hook
	2	Spanish	Read To Me	Spanish	Read to Me
	3	Spanish	Words to Know	Spanish	Words to Know
	4	English	SMWYK* preview	English	SMWYK* preview
2	5	Spanish	Text Mapping	English	Words to Know
	6	English	Words to Know	Spanish	Words to Know practice
	7	Spanish	Integration	Spanish	Integration
	8	Spanish	Read to Know	English	Integration practice
3	9	Spanish	Read to Me	Spanish	Read to Me
	10	English	Text Mapping	Spanish	Integration
	11	English	Integration	English	Words to Know practice
	12	Spanish	Words to Know	Spanish	Words to Know
4	13	Spanish	Text Mapping	Spanish	Integration
	14	Spanish	Integration	English	Integration practice
	15	English	Words to Know	English	Words to Know
	16	English	Read to Know	Spanish	Words to Know practice
5	17	English	Read to Me	English	Read to Me
	18	English	Text Mapping	Spanish	Integration
	19	English	Integration	English	Integration practice
	20	Spanish	Read to Know	English	Words to Know practice
6	21	English	Read to Know	English	Integration practice
	--	Both	SMWYK CBMs*	Both	SMWYK CBMs*
7	22	Spanish	Stretch and Review	Spanish	Stretch and Review
	23	English	Stretch and Review	English	Stretch and Review
	24	English	Close	English	Close

*SMWYK = Show Me What You Know curriculum-based measures developed for the Let's Know! curriculum supplement.

Table 8

Teacher Satisfaction for Unit Implemented in Phase 8: Comparison of Instantiations

	Let's Know! Instantiation	
Survey Item	Full ($n = 19$)	Light ($n = 26$)
Easy to implement	2.86 (.58)	2.79 (.51)
Lesson length reasonable	2.48 (1.09)	2.00 (1.02)
Teaching goals aligned with objectives	3.24 (.69)	3.52 (.51)
Students were engaged	3.14 (.74)	3.17 (.64)
Helped students learn to comprehend	3.41 (.68)	3.46 (.59)
Would use this unit in the future	2.93(1.07)	2.96(.81)
Recommend this to a colleague	2.69 (1.14)	2.88 (.85)
Time effort required was beneficial	2.72 (1.07)	3.08 (.83)
Positively impacts learning outcomes	3.31 (.54)	3.25 (.67)
Professional Development prepared me	2.90 (.77)	3.00 (.78)
Request on my time to complete was appropriate	3.28 (.65)	3.27 (.70)

Note: Teachers reported their satisfaction for these 11 items based on a scale of 0-4 (0 = strongly

disagree, 4 = strongly agree).

Table 9

Student Performance on the Let's Know! CBM (SMWYK) in Two Conditions for Four Grades

Grade	n	Let's Know! Instruction	BAU Instruction	d
Pre-Kindergarten	29	8.5 (5.1)	2.6 (1.7)*	1.28
Kindergarten	29	15.6 (4.0	2.5 (2.2)*	3.70
Second Grade	48	19.4 (6.9)	15.8 (6.3)	0.52
Third Grade	53	20.2 (6.6)	9.6 (5.6)*	1.66

*$p < .001$

Note: First-grade data were not available at the time of this report for students in the BAU condition and thus are not included. Teachers in the *Let's Know!* group implemented one of two instantiations of the curriculum – the Full and the Light versions; data were collapsed to create one group.

Figure 1. *Example of a 'Words to Know' Lesson Template Generated in Phase 4*

LET'S KNOW! KINDERGARTEN	ANIMALS COMPARE AND CONTRAST	WORDS TO KNOW LESSON 3
SHOW ME WHAT YOU KNOW! We will make a book about animals in different habitats, showing similarities and differences.		
TEACHING OBJECTIVES: • Define words by providing a simple definition: **compare, main idea, attach, related** • Use the words in spoken sentences.		

TEACHING TECHNIQUES: • Rich Instruction **LESSON TEXT:** • <u>Life in a Coral Reef</u> by Wendy Pfeffer **TALK STRUCTURE FOR WE DO/YOU DO:** • Think-Pair-Share	**LESSON MATERIALS YOU PROVIDE:** • N/A **UNIT MATERIALS PROVIDED:** • Words to Know rings and word strips • Vocabulary Picture Cards: **compare, main idea, attach, related**

LESSON ROUTINE	
SET	**Engage students' interest; activate their background knowledge on the skill or concept you will teach by providing an example. State the purpose of the lesson and why it's important for listening or reading comprehension.** **You could say:** *(lesson writers populated this section with a suggested script teachers could follow if desired)*
I DO/ WE DO	**Teach main concept or skill using clear explanations and/or steps. Model two examples for the skill or concept students will practice in YOU DO. Show a completed sample if appropriate. Provide guided practice, feedback, and support, ensuring active participation of all students. Check for understanding, ensuring that students are ready for independent practice before moving to YOU DO.** **You could say:** *(lesson writers populated this section with a suggested script teachers could follow if desired)*
YOU DO	**Provide at least two opportunities for each student to complete independent practice of the skill or application of the concept. Provide individualized feedback. At the end of YOU DO bring students back together and focus their attention on you before beginning the CLOSE.** **You could say:** *(lesson writers populated this section with a suggested script teachers could follow if desired)*
CLOSE	***Help students briefly review the key skills or concepts they learned, suggest how they could apply them in other activities or contexts, and bring the lesson to an orderly close.*** ***You could say:*** *(lesson writers populated this section with a suggested script teachers could follow if desired)*