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A Hitchhiker's Guide to Thinking about Literacy, Learning Progressions, and Instruction

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CPRE
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A HITCHHIKER'S GUIDE
to Thinking about Literacy, Learning Progressions, and Instruction

RESEARCH REPORT

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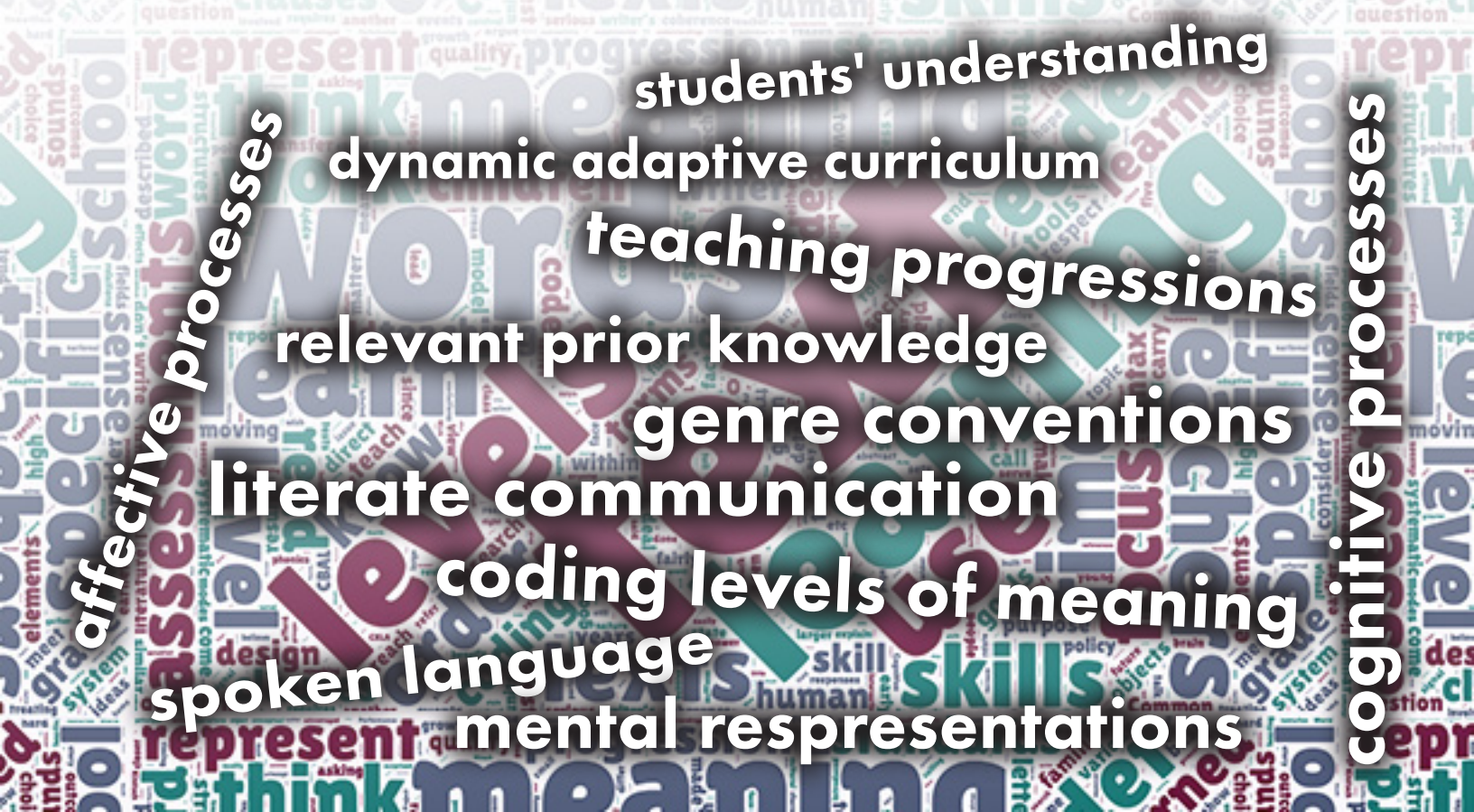

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About the Consortium for Policy Research in Education (CPRE)

Established in 1985, CPRE unites researchers f rom seven of the nation's leading research institutions in efforts to improve elementary and secondary education through practical research on policy, finance, school reform, and school governance. CPRE studies alternative approaches to education reform to determine how state and local policies can promote student learning. The Consortium's member institutions are the University of Pennsylvania, Teachers College-Columbia University, Harvard University, Stanford University, the University of Michigan, University of Wisconsin-Madison, and Northwestern University.

In March 2006, CPRE launched the Center on Continual Instructional Improvement (CCII), a center engaged in research and development on tools, processes, and policies intended to promote the continual improvement of instructional practice. From 2006-2015, CCII aspired to be a forum for sharing, discussing, and strengthening the work of leading researchers, developers and practitioners, both in the United States and across the globe.

Author Biographies

Margaret Heritage is Senior Scientist at WestEd. Prior to this role she was at UCLA for 22 years, serving first as principal of the laboratory school and then as Assistant Director at the National Center for Research on Evaluation, Standards and Student Testing - CRESST. Heritage's current work focuses primarily on formative assessment and she has written extensively on the connection between formative assessment and learning progressions. Her work is published in peer-reviewed journals, edited books and practitioner journals. Her latest books, *Formative Assessment in Practice: A Process of Inquiry and Action* and her co-authored book, *English Language Learners and the New Standards*, are published by Harvard Education Press.

Frederic A. (Fritz) Mosher is Senior Research Consultant to CPRE. Mosher is a cognitive/social psychologist and knowledgeable about the development and use of learning progressions. He has worked with CPRE on the CCII since its inception, helping to design the Center and taking a lead role in the Center's work on learning progressions. Mosher also has extensive knowledge of, and connections with the philanthropic community, reform organizations, and federal agencies. He has been advisor to the Spencer Foundation, a RAND Corporation adjunct staff member, advisor to the Assistant Secretary for Research and Improvement in the U.S. Department of Education, and a consultant to Achieve, Inc. For 36 years he was a program specialist with varying responsibilities at Carnegie Corporation of New York.

Acknowledgements

First, we would like to thank the William and Flora Hewlett Foundation for their generous support of CCII's work on the improvement of instruction, begun at the initiative of Hewlett Education Program Director Marshall (Mike) Smith and continued by his successor Barbara Chow, from 2006-2016. Tom Corcoran, Co-Director of CPRE and Principal Investigator for CCII, was instrumental in refining Mike Smith's hope, that the Center would review and extend our understanding of how schools and educators could be encouraged to engage in cycles of continuous improvement of instruction, to focus that search more precisely by recognizing that instructional improvement involves an interaction between the cycles of students' learning–improvement of their knowledge and skill–and of their teachers' learning how better to help each of them to learn, both in turn grounded in cycles of improvement of humanity's understanding of the subjects and skills being learned, and of how that growth might be replicated. We recognized that, in order for instruction to enable every student to learn to high levels, providing a base for further learning, teaching has to be informed by a specific understanding of what student learning looks like as it improves so that teachers know how to identify evidence of where students are in their learning and take specific measures to help them to move on to the next step in that learning. This concern for helping teachers to engage in this practice of "adaptive instruction," led us, among other things, to a focus on the concept of "learning progressions" as a label for knowledge of the steps students go through as they learn specific subjects–one of the kinds of knowledge teachers have to have if they are to engage in this kind of practice. Hewlett's support, along with also generous supplementary support for the mathematics and science work from the Pearson Educational Foundation, allowed us to explore and report on the state of understanding and application of this learning progressions concept in the teaching of science and mathematics, and now to produce this parallel effort to understand its relevance to the teaching and learning of literacy–of reading and writing.

Throughout the time it has taken for us to try to understand what is known about literate communication, how it may be learned, and how the idea of learning progressions may, or may not, be relevant to it–and then how to report what we have learned to potentially interested readers, Tom Corcoran has acted as a helpful sounding board, contributing insights and constructive criticism, and adding tolerant and somewhat bemused pressure to remember our audiences, but also just to get it done. We hope he will think it has been worth the effort.

Anyone who writes for public consumption should be aware of the possibility of getting it wrong or of failing to communicate. Anyone who writes about writing faces the additional possibility of committing unintentional irony by doing it badly. We are grateful to a number of people who have tried to help us avoid these pitfalls–in particular: to our external and internal reviewers, Catherine Snow, Ruth Wattenberg, and Gerrit Jones-Rooy; to our CPRE colleagues, including especially Kelly Fair, Jackie Kerstetter, and Yolanda Green at the University of Pennsylvania, who, particularly Kelly, put this together and checked and cleaned it up; to the wonderful editor, Caroline Chauncey, who in an early volunteer look, kindly and constructively pointed out some fundamental issues; and, of course, we've tried to hold each other accountable

over the long time it has taken to figure out what we really were trying to say. None of these people is responsible for any remaining flaws, except for the last two. We hope the rest will not be embarrassed to be thanked.

Individually we would like to acknowledge a few other debts:

One is to Jerry Bruner, my long-ago thesis advisor, who died this past year after living a full century and arguably playing a central role in shaping a nameable century's transformation in our understanding of human psychology. During the moving memorial service at NYU, and as I have looked back at his writing as we finished this report, I realized that the seeds he planted some fifty-five and more years ago about how to think about thinking seem to have grown, without much explicit tending since I left his Harvard Center, to parallel some of the places his ideas went subsequently, so that they deeply shaped how I was inclined to think about thinking and communication when I lately came back to that. Among many lessons, he taught me that it is better to have an incorrect hypothesis rather than no hypothesis at all–that way you at least have the possibility to be surprised, and maybe guided toward developing a better one.

The second is to Marilyn Jager Adams. Readers of the full report will certainly see why, but I particularly want to note what seems to be kind of a fundamental law of comprehension, one that I have repeatedly experienced when re-reading papers of hers over the years. What I have found almost every time is that there are insights there that I simply didn't really understand or even notice until I came back to them after having myself worried a problem and developed enough of a tentative approach so that when I looked again I realized, "Oh, that's what she was saying." Sometimes that was affirming, sometimes convincingly corrective, but it always has been illuminating. For that I am extremely grateful.

—Fritz Mosher

I would like to acknowledge the children I taught to read early in my career. They taught me more about learning to read than the host of course and reading material I encountered that were supposed to be my teachers. The children's various struggles and their excitement as they learned to read authors' messages were a constant source of inspiration and encouragement.

I am also grateful to all the teachers I have worked with on understanding what it means to learn to read, and to read well. Beginning with candidate teachers at the University of Warwick, England and later at ULCA, I developed deep insights into what it takes to teach adults to teach children. When a child learns to read, it is magical, but there is no magic ingredient for teachers. Instead, teachers learn about children's reading by deep inquiry into an extensive set of knowledge and skills that we have tried to capture in this report.

Consistently returning to what I learned from children and teachers has grounded this report in the daily realities of schools and classrooms. Learning to read is complex; teaching children to read is complex. Let us hope that this report illuminates the complexities and the joy.

—Margaret Heritage

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Summary

Previous work that CPRE's Center on Continual Instructional Improvement had undertaken, with support from The William and Flora Hewlett Foundation, evaluated the significance of the concept of "learning progressions," and existing research and development based on it, for the fields of science and mathematics instruction. Working groups of experts in those two fields produced reports that concluded that there was empirical and theoretical support for the idea that the ways children learn some of the concepts and practices of science and mathematics could be characterized as typically advancing through identifiable levels or steps of growing understanding and skill (see Daro, Mosher, & Corcoran, 2011; Corcoran, Mosher, & Rogat, 2009). There also was support for the notion that children typically encounter identifiable difficulties or problems along the way which may hinder their movement from level to level on the progression.

CPRE found that there was reason to hope that knowledge of these levels and problems would support teachers in adopting the practices of "adaptive instruction," a process that requires teachers during teaching to gather evidence on where each child might be in their learning, and to react contingently based on that evidence to modify instruction in ways intended to help each child keep moving ahead. CPRE also argued that it might be possible to develop assessments that would directly reference where students were located in terms of the levels the progressions identified. Doing so would provide more useful evidence for informing instruction than is provided by most of the explicitly or implicitly norm-referenced achievement assessments now used by schools for accountability or for interim feedback on students' progress. CPRE's nuanced assessment was that the promise of the construct for use in these ways was modest, and it implied the necessity of a great deal of further empirical design and development work, but it was hopeful (cf. Mosher, 2011).

This report extends CPRE's prior work on science and mathematics progressions to the idea of learning progressions in literacy.

WHAT ARE LEARNING PROGRESSIONS?

We think the term *Learning Progressions* should be reserved to label inferences or hypotheses describing the order of definable steps, stages, or levels that students' understanding and skill in a subject or discipline are likely to go through over time in response to instruction and experience as they reach the levels of understanding and skill that are the goals of instruction. They might also describe the steps or ways that understanding may plateau or reach *other* end points in response to variations

in instruction and experience. The inferences should be based on empirical evidence from student work, assessment performance, responses to clinical interviews, or other observations by teachers or researchers. They may describe likely steps or growth paths in the context of typical instruction, or they could describe what becomes possible with more effective instruction.

The strong, or more optimistic, form of the progressions hypothesis holds that the number of likely paths is small; the steps along the way can be fairly clearly distinguished from each other; and they represent more or less complex configurations of understanding and related skills that are stable for some discernible time, though in the period between steps there may be multiple sub-steps, confusion, and regression of various kinds, as a student's thinking undergoes reorganization into a new configuration. Students may at any time along the way show a reversion to the characteristic thinking and cognitive practices of earlier stages in the face of stress, complexity, or other challenges.

The weaker form is agnostic about the number of likely progressions and how well defined their levels may be, but holds that some teaching-learning paths will be more likely than others to reach desired, or better, outcomes. Those paths can be identified through repeated cycles of design, development, and testing, paying close attention to each student's learning and to what pedagogical responses to them are effective. If such attention is in fact, paid, and the results are captured and aggregated, in the long run that should increase our knowledge of which paths work better for whom. Over time those results also might, or might not, provide evidence for the stronger progressions hypothesis.

At the end of this report we come to some conclusions based on what we have learned about literacy and what that implies for progressions, and for practice and policy. We provide a preview here:

Literacy is the capability to communicate meaning to others, or to get meaning from others' communications, using the conventionalized representation systems—for instance, writing systems that represent spoken language—developed by human cultures to enable communication across time and distance, beyond face-to-face interaction. Both spoken languages and literate communication representation systems have evolved, and continue to evolve, conventions for expressing more and more complex meanings, as the human beings who use such systems have found that they have more, and more complex thoughts, feelings, and needs that they want to communicate. Languages carry meaning through words–vocal signs that denote or stand for things, actions, concepts—anything human beings can conceive of. But they also carry meaning through the way they relate the words—through grammar or syntax, and higher levels of organization of discourse—meanings such as temporal or causal order, emphasis, degrees of certainty, and on and on.

Literate systems in turn code these spoken ways of representing meaning—for instance, through the alphabetic (grapho-phonemic) code for representing words, and through order on the page, punctuation, and text structure for representing syntax and coding higher levels of conceptual organization. As these latter are extended in text that is,

for example, increasingly abstract, or adopts idiosyncratic organization structures, or is specific to academic disciplines and supplemented with such devices as figures, graphs, and tables, they add new ways of expressing meaning and complexity that go beyond what normally is represented in spoken interaction.

The general conventions of literate communication, along with genre-specific conventions, constitute a kind of framework, or a finite set of building blocks for coding and communicating aspects of the meaning in a particular message. The number of messages and meanings that can be built from the interactions between the meanings carried by the conventions and the specific contents and concepts, as coded in the vocabulary of specific disciplines or activities, can be legion.

Given the near infinite variety of the messages that spoken language and literate communication can carry, we do not think it is fruitful to try to identify general progressions in the complexity or sophistication of the specific messages students learn to communicate or understand—at least not at the grain size of progress that should be the focus of day-to-day or lesson-to-lesson instruction. If progressions can be identified that would be useful in ongoing instruction, it seems that they are more likely to be found in the ways students learn particular concepts or skills in specific disciplines or subject matter (as we earlier saw some evidence for in science and mathematics). The closest analog of that kind of specificity in literate communication seems to us to be the way students learn to understand and use the general, cross-genre-, and the genre-specific-, conventions for coding and expressing meaning, starting with the alphabetic (grapho-phonemic) code, and including grammar, syntax, figures and graphs, text structure and organization, and the more specific genre variations and additions to these conventions.

No particular order of instruction is necessary, but we argue that picking a reasonable order across a school or school system (and even more widely if possible) is wise, and likely to be more effective than leaving the choice solely to individual teachers.

However, we also do not see compelling evidence that students tend to learn to understand and use these conventions in any particular order other than that they are likely to go from expressing or understanding simpler to more complex meanings, and perhaps from concrete to more abstract. An exception to this may be the order of learning of the grapho-phonemic code and fluent decoding, but while the research on this question of "phonics" is voluminous, and clear on the value of explicit instruction, it is not clearly dispositive on the issue of order. It seems different instructional orders will work as long as the teaching is systematic and explicit, with sufficient practice, as needed by individual students.

In fact we would generalize this advice. No particular order of instruction is necessary, but we argue that picking a reasonable order across a school or school system (and even more widely if possible) is wise, and likely to be more effective than leaving the choice solely to individual teachers. We recommend the development and selection of curricula that specify the order, or perhaps orders and cycles, in which students will be introduced to the conventions of literate communication based on the best available hypotheses about how much and what kinds of exposure to interpreting and using those conventions

for communication, for reading and writing, are likely to help substantially all students meet or exceed the ambitious goals set for them. Curricular hypotheses should be treated as exactly that—good faith bets on what is likely to work that should be given adequate time and best efforts to prove themselves, but they should be continually monitored and refined, revised, or abandoned if necessary, depending on the results.

A well-defined, ordered curriculum can function, and provide many of the same benefits, as have been claimed for the stronger hypothesis of learning progressions. The steps in the curriculum along with the activities and materials, and the associated assessments or evidence from students' work, provide a definition of how learning is expected to proceed and how to tell whether it in fact is going as expected, along with pointers to what may be the problem if it is not. If the curriculum is designed to support individualization by defining the order or orders of learning experiences but allowing the pace to vary as needed, as progressions would, it can honestly represent having the same expectations for all students, while accepting the likelihood that they may differ in how long they will take to meet them.

We suggest that just as most children, with adequate instruction, practice, and motivation can learn grapho-phonemic decoding, they also can learn to understand and use the conventions for representation of meanings in text if they have had a chance to construct (think of or recognize) the actual meanings for themselves and/or by having them directly pointed out, and if they are given instructional support for associating the representations with the actual meanings. However, whether they can fully understand complex text about subjects or experiences that are relatively new to them is less certain. An understanding of general purpose vocabulary and syntactical and organizational cues, based on their earlier experience of them with more familiar material, will give them some idea of what is being said or written, but real understanding of more complex ideas and meaning in a new domain will always entail a learning curve involving direct exposure to the specific meanings (the phenomena and vocabulary) of that domain.

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Our reading of the literature suggests that curricula should be designed to provide students with a systematic exposure to increasingly complex meanings (i.e. substantive knowledge) and ways of coding meanings, and grounding them in experiences with particular content and topics, in each of the socially and culturally important literate communication genres. This is itself a complex task. We do not really know how much exposure to how many instances of increasingly sophisticated reading, writing, and thinking would be necessary and sufficient to enable substantially all students to cope with new instances of textual material at levels that would be required by "college or careers," as the current standards rhetoric puts it. Finding that "sweet spot" level of necessary and sufficient exposure that might efficiently enable all students to function at levels comparable to those who have had more advantaged but less systematic exposure to similar experiences outside of school is crucial. It probably is the only sensible hope for delivering on the "gap closing" promises so dear to the rhetoric of education reform.

Most curriculum designers would probably not frame what they are doing in quite this way, but in our search we found some examples of designers who are making serious efforts to devise experiences and materials very much along the lines we are recommending, and we describe a few in some detail as a way of providing a better idea of what this might mean.

As for assessment, our view of literate communication would suggest that it is not accurate or instructionally useful to think of reading comprehension or writing capability as being unitary skills such that individuals as readers or writers are arrayed along a single dimension running from, for instance, weak to strong. Rather, with respect to literacy, what one should want to know about students is whether, and up to what level of coding, they are able to understand and use the conventions of literate communication in each of the genres considered important for them to know at their particular ages or stage, or as school graduates.

We define reading comprehension as the mental representation(s) a reader forms, during and after reading a text, of what that text means, or meant (judged by the reader in terms of whatever her or his purposes for reading the text were). Of course such representations cannot be observed directly by anyone other than the reader. Consequently, their nature and quality has to be inferred from what the reader says, writes, or does in response to questions or requests designed to reveal whether the reader developed what the assessor considers to be the, or a, correct or adequate representation. The logic is, if the reader has the right representation, he or she will respond in the right, expected or defined, way. Of course a "correct" response need not imply that the assessor's assumed representation is the only one that could have produced the answer–one of the many uncertainties in the assessment business.

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The trouble is that no text of any complexity at all communicates all of its meaning on the "surface" based simply on the words on the page. That's not the way these codes work. The words and their arrangement stand simply for more complex referents, and the writer assumes that the readers will have the equivalent of a codebook or set of associations in their heads that will bring up some version of the fuller meaning when they see them. Inference and prior knowledge are *always* necessary for full comprehension. So, when you assess someone's reading comprehension by asking questions or observing behavior or performance, you are looking at complex phenomena that are influenced both by knowledge of the general meanings of cross-genre and genre-specific conventions, and by prior knowledge of the specific content and kinds of situation that the text is trying to communicate more about. Readers' variations in this latter kind of prior knowledge are partially captured by the idea that they vary in the size of their "vocabularies." If the assessment tasks also ask readers to make judgments, or comparisons with other texts, or use the information in the text to solve problems, or to be better able to solve future problems, they are adding the requirement to think and process representations that go beyond just the ability to

understand the meanings coded at various levels of the particular text.

Now, we do want students to be able to do all those things, and to learn to do them better, but learning to decode and use the conventions of literate communication is probably easier, and we probably know more about how to teach it, or can learn more about that sooner, than we know or can learn about how to teach better thinking. And the latter is much more subject to variation both in outside of school experience and opportunity, and in individual variations in aptitude. So if policymakers want to use assessments of students' literacy performance to make inferences about teachers' and schools' effectiveness in teaching such things to students, they, and the test makers they rely on, really should be much more careful than they are now to justify the inference that the assessments are in fact measuring things that the schools ought to know how to teach. That of course is particularly true if the inferences have high stakes consequences.

But if the purpose of assessment is to inform teaching and learning, then we think the use of large-scale assessments—standardized, multiple choice and/or short answer items administered in short, one to four hour or so, time slots relatively simultaneously across many schools and jurisdictions, or assessments designed in the same way as these large-scale assessments, but used on a more *ad hoc* basis—is basically a kind of **scam.** Even when they are called "criterion-" or "standards- referenced," such tests are designed using psychometric models that really emphasize distinguishing among, or sorting, individuals rather than distinguishing among levels of performance or understanding, or identifying specifically what students know or can do. The models grew out of a tradition focused on selection or ranking (for placement in the military, for college admissions, for jobs, etc.—in competitive or mass situations), rather than on informing instruction. And the limited time and restricted task formats, coupled with concerns about cost, mean that they sample too lightly and can provide very little specific information about what students understand or do not understand even at basic levels, not to mention more ambitious levels of understanding and performance that might qualify for the labels "Deeper Learning" or "21st Century Skills." In addition, because such assessments, for political and commercial reasons, cannot assume what curriculum students have been exposed to, it is difficult to assess, for instance, the degree to which students' performance is affected by knowledge of the conventions versus relevant background- or "world-" knowledge, particularly when they are dealing with more complex text.

Assuming they have the kind of clearly defined and ordered curriculum we are recommending, teachers should have a chance during the course of instruction to observe how their students are progressing and whether any difficulties stem from not understanding the conventions, or from lack of background knowledge, or some mix, along of course with issues of motivation, interest, disposition, and aptitude. Their observations in such a context should provide a much more nuanced and valid view of how students are progressing than any current standardized tests designed for large-scale use can provide, and they have the added virtue of being able to inform teachers' adaptive responses to their students' needs on a timely basis, when they have the best chance to be effective (and when they have a chance to be corrected by subsequent observations, if the teacher's inferences prove to be wrong).

With a few exceptions for technical diagnostic purposes, we really see no instructional value in the use of norm-referenced, or curriculum neutral "drop from the sky" large-scale assessments, or for "interim" assessments designed on the same basis. We would challenge those who think otherwise to provide carefully validated evidence of any examples of real constructive effects of the use of such assessments beyond the symbolic value of seeming to hold schools and teachers "accountable." The only rationale we can understand for mandating this kind of external test-based accountability is lack of trust in schools' and teachers' willingness to take, or capability for taking, responsibility to attend to each of their students' progress and act on it.

However, we would agree that, in the current situation in American education, schools and teachers do lack the tools and professional resources—most importantly a well-designed, coherent, common curriculum or curriculum framework that would support their taking this kind of responsibility and help them develop the knowledge they would need to understand what student progress should look like, while helping to make evidence of that progress visible to them. But we think that current large-scale assessment programs, particularly when they are thought to entail high stakes for schools, teachers, and children, are worse than useless for encouraging better instruction. They are much more likely to drive instruction in the wrong direction—to a focus on "skills" divorced from meaning—and they just seem to make everyone a little crazy, or worse. It remains to be seen whether the new Common Core assessments developed by the state consortia will, as they have promised, be more informative. Given the constraints they face, those promises deserve respectful but skeptical evaluation.

Our general message to policymakers is fairly simple but very hard for them to accept and act on. Do not think you can ensure that all or most students will be able to read and write "college- and career-ready" levels of text by the end of high school just by setting those high expectations and leaving schools and teachers to figure out how to do that on their own. Do not think you can even tell whether or not students really have met such expectations using large-scale, relatively short, and short-answer, curriculum-neutral assessments. You may learn that some students are pretty likely not to meet the expectations, but you will not learn a lot about the specifics of why, or of what to do about it. And you will not be sure, for those who meet the standards as defined by the assessments, whether all of them will perform as hoped in real life.

Only if you know in some detail what in particular students should have studied and how they have been asked to think, read, and write about it, can you ask meaningful and fair high-level questions about what they have learned and what they can do with it. And those questions will look much more like other countries' syllabus-based examination questions than they look like standard American tests.

So we suggest that schools should devote a substantial portion of their literacy learning time, and their reading and writing in other subjects, to a systematic introduction to, and development over the school years of, both an understanding of the ways communication conventions in speech and text code increasingly complex meanings, and sustained

attention to growing understanding of particular important and interesting topics and subjects, in all of the significant school genres and disciplines. That means identifying and adopting a curriculum, or a small set of alternative curricula with similar design goals, for wide use—ones that sustain focus and build across multiple years using high-quality text and media of increasing complexity and sophistication.

What we are recommending will require a lot of design and development—and a lot of systematic trial and error. We provide some examples of promising attempts along these lines, but there is a real shortage of high quality, increasingly complex text and media that could sustain a topical focus and interest over many grades, even on one or two topics, let alone enough to support students in acquiring the capability for transfer and application of what they have learned. We certainly are not in a position to provide detailed design specifications or make firm curricular recommendations. Moving in this direction will require substantial investments, and repeated, honest, evidence-based cycles of design, testing, and re-design, involving serious attention to developing new institutional infrastructure to support continual collaboration among researchers, designers, and practitioners. But we are confident that moving in these directions, no matter how much of the trial and error involves error, will do better than we now are doing, and it is the only way we may get to a lot better in the longer run.

I. Introduction

This report grew out of an effort by CPRE's Center on Continual Instructional Improvement (CCII) to extend its evaluation of the usefulness of the concept of "Learning Progressions" for the fields of mathematics and science education, to include literacy teaching and learning. It seemed likely that the concept would apply differently to literacy, if it applies at all, since literate communication systems provide the media of communication over time and space for every discipline, and, for that matter, for almost everything that human beings wish to communicate about. As we looked at the field, it quickly became evident that the relevant literature is vast, and there are more experts on its many aspects than we could hope reasonably to sample and assemble in a room, even if we had the resources to try. Nevertheless, given the current enthusiasm for the idea of progressions, it seemed that a more informal, smaller-scale appreciation of the literacy literature seen from the learning progressions perspective could be useful. We hoped it could in any case help us to understand and define the issues in literacy learning in a way that might be useful to practice and policy, and offer guidance to future research and development.

Our journey into literacy learning was like a kind of hitchhiking. We would find a scholar, a school of thought, or an experienced practitioner, and bum rides with them to listen to what they had to say. Then we would jot down notes at the truck stop while we looked for the next ride going our way. We may not have fully captured what our fellow travelers said; we may not do them justice in what we have assimilated from them; and we may have forgotten some of the rides; but we will try to give credit for the things we remember best and have found most useful.

So what are some things that we think we have learned as we engaged in our review of the literature on literacy?

As a human invention, literacy has to be taught and learned. Human beings don't have to learn to think. Thinking is innate. But thinking does develop, and people can learn to do it better. It can be encouraged, modeled, and improved with experience and feedback, so thinking too can be "taught" in that sense. Thinking and learning make spoken language and literacy possible, but spoken language and literacy in turn can become tools or media for learning to think better.

Human **spoken languages** have developed as tools for helping to coordinate actions and communicate across the gap between human minds. **Literate representation systems** have developed as tools for communicating across time and space—often, but not solely, by representing spoken language in a more persistent form. Writing and reading are the most obvious examples of using these literate communication tools. If they are to serve their functions within a society or social group, both spoken languages and literate representation systems have to be substantially conventionalized—that is, the ways a

spoken language represents meaning, and the ways literate systems represent language, and other meanings as well, have to be relatively standardized, learned, and shared within the relevant communities. However, both language and the literate representation of language and meaning do grow and change at the edges and within sub-groups. In particular, specialized versions develop to represent meanings needed by participants in specific communities of practice or established activity systems,[1] ranging for instance from academic and scientific speech and writing to the *patois* of today's digital natives.

As socially invented and developed tools, the ways these conventions represent meanings have to be learned by all new participants in these communities. They can be taught and understood relatively easily when the participants already recognize and understand the meanings of the phenomena the conventions are meant to refer to (e.g., for children learning the general conventions of a first or second language—everyday objects and events in their immediate world, colors, shapes, basic human needs and actions). But, obviously, for children learning a language, or for new participants in a particular activity system, many of the meanings referenced or represented by the words and conventions of speech and text will not initially be familiar. This raises the issue of how learners come to make the connection between the meanings and the words and conventions in language and in literate representations that reference them. We will return to this question just below—it, of course, is central to understanding how the capability for literate communication advances.

Some examples of genre-related coding of meaning: Science texts use noun groups (clusters of words around a noun to give more information) in order to categorize terms and processes, construct reasoning, and connect ideas in text. Scientific texts also use specialized technical vocabulary, nominalization (turning verbs or adjectives into a noun, e.g., sensitive into sensitivity) to deal with abstraction, and dense clauses in tightly knit language. (Schleppegrell, 2004)

In expository prose, authors use titles, headings, sub-headings and sub-divisions to indicate the development of their argument. A traditional narrative structure is characterized by the three stages of action: orientation, complication or problem, and resolution.

The meanings represented by the conventions extend beyond the tangible referents of words. For instance, syntax and grammar are central to a language's ways of representing relationships, causation, timing, emphasis, degree of certainty, number, sometimes gender, etc., all of which are in turn represented by the conventions and structure of literate text. Moreover, words in a language stand for more than things, persons, and actions. They also refer to concepts and label propositions that can have many levels of complexity and abstraction, not to mention nuance and connotation. In this sense, by standing as a simple sign for their complex referents, spoken words are themselves a kind of code. Then

1. A little further on, in a sidebar, we explain more specifically what we mean by "**activity system**," but in general it refers to the many kinds of repeated situations in which human beings need to coordinate and, usually, communicate with each other. We also will use the term "**genre**" more generally than it is normally used—as a shorthand to encompass all classes of conventionalized text—not just general ones such as "narrative, exposition, and argument," but also more specialized ones particular both to more formal activities, such as disciplines, and less formal ones, such as blogs, or get well cards, with all their myriad sub-variations.

the literate representation of words and other aspects of language constitutes yet another level of coding.

We use the term "**coding**" to refer to all these ways the medium can represent the messages and meaning. We mean coding in a sense analogous to ciphers. To be clear, we do not mean to limit its meaning just to the decoding function of "breaking the alphabetic code"—i.e., "fluent decoding" — though of course that is a very important aspect of how literate communication functions.

It is unlikely that the meanings that are coded at the higher syntactical and structural levels of text would have much meaning for students, at least in their first experience of them, unless the students also had actually had some exposure in direct experience and in spoken discourse as well, to the content, relationships, propositions, or actions/activity that the textual coding is supposed to represent. So, what and how they represent cannot really be taught without simultaneous exposure to instances of those relationships, propositions, etc.

This implies that most instruction about literate communication should be carried out in the context of, and with reference to, learning and communicating about specific content and topics–involving specific genres—in science, history, stories, tales, and so on.

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The upshot is that each medium—speech and text—can represent some meaning pretty directly in a fairly finite set of ways. So, as we already suggested, understanding how they do that, and how to use them to communicate those meanings, can be taught directly to most members of a linguistic community who share that community's common experiences. But because words and linguistic conventions also can signal the existence of meanings that participants may not yet have noticed or understood, this signaling is among the ways that they can play a role in helping participants **attend to**, and begin to **understand**, the meanings that are new to them.

For example, the words "volume," "weight" (or "mass"), and "density" can help to focus attention on aspects of material objects and how they interact that would support a more grounded understanding of a complex concept like density. Or hearing English speakers use less familiar expressions like "If he were to….." a number of times in relevant contexts can alert a young listener to the possibility that another person can be uncertain or speculating about something that may or may not happen or have happened, and that this is how you talk about such things.[2]

Making these kinds of connections between meanings that may be new to learners, and

2. However, it probably isn't very helpful for children's understanding of this coding, or even for helping teachers to help children, to label this as being in the "subjunctive," or in one of the many possible "irrealis modes." We make this point to flag an issue about the need to make the technical vocabulary of linguistics more "friendly" for students and teachers. We will say more about this later.

forms for expressing those meanings that also may be unfamiliar, requires them to think and reflect in ways that go beyond what is required to make simple associations between known meanings and the conventional signs and forms available for representing them in speech and text. When speech or text refers to unfamiliar meanings, learners will either have to search their experience to identify possible referents and/or have the cognitive capacity to construct those possibilities for themselves, or they will need help from others, and from other resources like dictionaries, textbooks, and the Web, to help point them toward the relevant experiences and meanings and make the connections explicit. Recognizing the kinds of experiences students will need to have and the kinds of thinking they will have to be encouraged to practice, if they are to be able to understand messages and form representations that go beyond just comprehending the relatively direct meaning of utterances and text, has implications both for how schools should be trying to teach literacy and for how the results should be evaluated.

In what follows, we will explain these lessons learned in more detail. We will offer a relatively simple graphic model describing how literate communication seems to work, in order to identify the functions or the dimensions along which change and improvement might be observed as students become more effective and sophisticated in using the tools of literate communication. We will consider whether the idea of progressions is relevant to understanding this learning, and, if so, what that implies for instruction. And we will offer suggestions about what thinking about literate communication in the way we do may imply more generally for instruction, for education policy, and for assessment. What we offer are hypotheses based on our reading of the literature in this field. As with any other hypotheses, they will need to be tested in practice.

II. Literate Communication

We have chosen to use the term "literate communication" rather than "literacy" because it helps to make the point that we are talking about the capability to use a class of tools that enable human beings to communicate with each other across time and distance, without the label carrying all the other baggage[3] that the term "literacy" has acquired. The Common Core State Standards for English Language Arts, and Literacy in History/Social Studies, Science, and Technical Subjects (Common Core State Standards Initiative, n.d.) establish expectations for listening and speaking as well as for reading and writing. We agree with that choice, since both spoken language and text are aspects of the fundamental human practice of communication. But literate communication certainly adds an important new dimension to speaking and listening.

As we have noted, the capacity for language evolved, and languages developed in human groups and cultures, as tools for expressing needs and meanings and coordinating activities on a face-to-face basis among their members. Most societies, and/or sub-groups within them, have also developed conventionalized systems for representing language and other meanings at a distance and across time, including: writing, drawings, diagrams, graphs, mathematical symbols and expressions, to name a few. We define "literate communication" as the use of any of these culturally developed conventionalized persistent representation systems to convey meaning to others, or to interpret and use the meaning of what others have tried to communicate using such a system.

Just as in the case of spoken language, literate communication representation systems have conventions not only for representing meanings generally across all kinds of human interactions or classes of **activity system**s, they also, at least for some specialized and socially significant sorts of activity systems, have developed adaptations for expressing meanings that are more peculiar to those systems' particular communication needs. Because of the relative permanence of text, and the opportunity for reflection that permanence makes available, both the general and specific conventions of literate systems may afford the representation of more complicated meanings than, and perhaps ones that differ from, those that spoken language alone is likely to afford.

3. As we use the term, "literate communication" encompasses capability with all sorts of what now are popularly identified as hyphenated-literacies ("math-literacy," "film- or media-literacy," "art-literacy," etc.), but we would limit the meaning of those "….-literacies" to the ability to use the conventions of their respective systems of referencing meaning, and not extend it to the connotation that one necessarily knows a lot about the content of those domains. Unfortunately, the tendency to extend "….-literate" to meaning something like "an expert in …….. " has literally obscured the more precise connotation we prefer. Actually, if we were to be completely literal, we would narrow our definition of literacy even more—to include only the use of alphabetic writing systems that use "letters" to represent a language's phonemes. However, we feel that restricting the definition just to letter-sound associations would miss the many other ways that the conventions of text can express meanings in alphabetic systems, not to mention the ways that non-alphabetic systems work.

Schooling-relevant examples of these important particular classes of literate communication representation systems, and the associated general or specific activity systems that they serve, include "genre" (e.g., narrative, information, argument, etc.); disciplines (e.g., science, mathematics, history), "register" (e.g., academic, informal, home, peer, street), and even more specific forms, such as letters to the editor, book or movie reviews, recipes, emails, IMs, invitations, summer vacation or college admissions essays, and so on. **In this report we use the term "genre" as a general designation for all such specialized or semi-specialized classes of literate communication or kinds of text.**

CAN THE PROGRESSIONS IDEA BE APPLIED TO LITERATE COMMUNICATION LEARNING?

As noted in the introduction, the content of literate communication can encompass just about anything human beings may want to communicate about—certainly anything that can be put into words, and actually a good deal more.[4] For this reason, applying the progressions concept to literate communication raises questions rather different from, or additional to, those involved in its application to learning mathematics and science. Work on learning progressions in science and mathematics provides at least some reasonably validated examples of conceptual progressions, given appropriate instruction, in relatively well delineated areas or topics, such as conceptions of the composition of matter, or of number, counting, addition, and subtraction, or of rational numbers (Smith, Clements, & Sarama, 2009; Clements & Sarama, 2004; Smith, Wiser, Anderson, & Krajcik, 2006; Confrey et al., 2009). While literate communication in the form of reading and writing is very much involved in this learning of concepts and practices in science and mathematics, the focus of progressions work in those fields has mostly been on the order in which the field's content—the concepts and practices themselves—is learned, and not on the development of understanding and control of the medium of representation that helps to support the learning.

In contrast, if we instead focused on the learning of literate communication, we would be looking at how students learn to appreciate and use the meanings that the syntactical and higher level conventions of text have been culturally developed to represent. One

4. Given this vast range of potential messages, if we wanted to describe in general the way that the complexity and sophistication of the content of what students want and are able to communicate to, or understand from, others progresses or increases, we would likely find ourselves using the categories of the developmental psychology of thought and feeling, which are better designed to describe the development of concepts and emotions in general and abstract, terms rather than in terms of the development of their specific content. While there are such developmental categories—think of Piagetian developmental "stages" and other such ideas—those stages tend to be much broader, and change from one level to the next much more slowly, than is likely to make them useful for informing teachers' decisions about what to do to keep students moving during day-to-day instruction.

way to make this point is to consider the analytical distinction between the medium and the message (with apologies to McLuhan, 1964). We are suggesting that the content, the message meant to be communicated, includes objects, events, participants, actions, concepts, and feelings that are in large part represented by words. But it also includes messages about relationships among those elements, for example, about relative importance, causation, temporal sequence, other kinds of association, that are signaled by grammar, syntactical relationships, textual organization, and punctuation. In that sense, the medium of communication itself has ways of representing meaning that extend well beyond the designation of objects, participants, actions, or concepts.

If indeed the idea of learning progressions can be applied to literate communication, it is likely through (or in reference to) the order in which students learn the ways that genres represent, or share ways of representing, more complex and sophisticated meanings and relationships. Given the current state of knowledge in the field, we are not sure whether there is a clear enough understanding and a user-friendly vocabulary for talking about the ways in which the conventions of each genre represent or code the meanings at all the levels of sophistication the genre, or genre combinations, have to offer, so that teachers could in turn understand how to explain them to their students and help them progress in learning how they work (see the sidebar on page 10 for examples of current efforts to describe genre coding conventions).

While we will not be able to solve this very important practical problem, , we think it would be useful to begin to look more closely at the implications of focusing the idea of progressions on the order in which, and how, students learn the specifics of the many levels and kinds of coding through which "text" embodies and transmits meaning. These could include focusing on the grapho-phonemic code, the orthography of the language, the way a language's syntax and grammar and the textual representation of those conventions also code and represent meaning and propositions, as well as on the ways that the organization, structure, and conventions of the important genres of text code both general meanings across genres, and meanings more specific to each genre.

In the next section we propose a model of literate communication, which identifies its key elements and dimensions. Then we offer a way to think about and understand those elements and dimensions in greater detail.

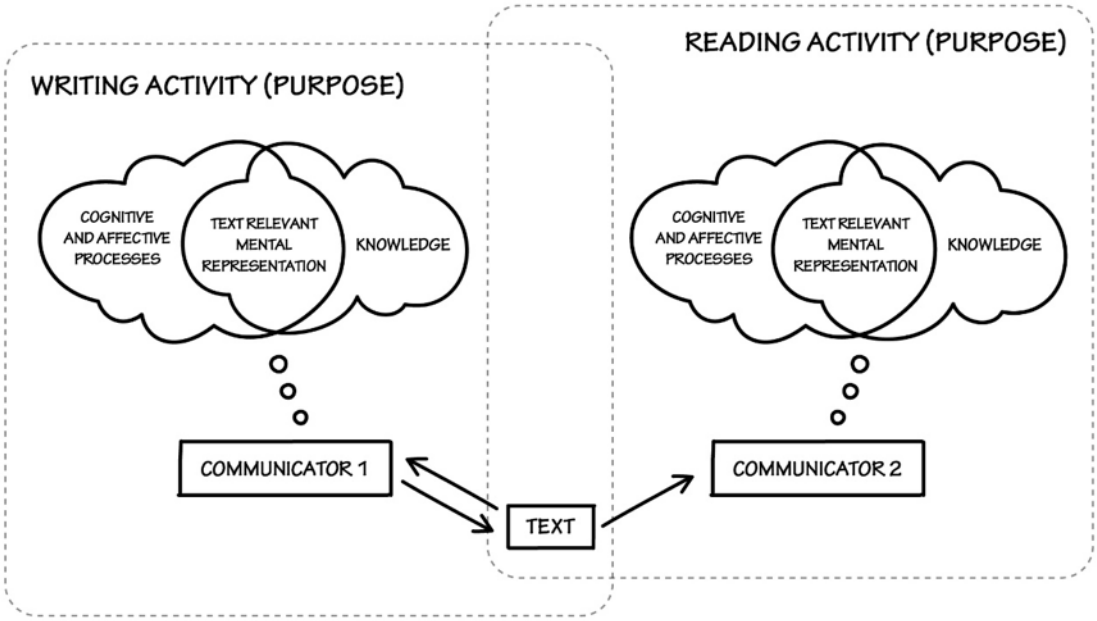
III. A Model of Literate Communication

Our simplified basic model of literate communication identifies the important elements of the ways in which literate communication works as an aspect of an activity system. In Section IV we provide more detail about each of these elements of the system and describe what changes within them, as the capability to engage in the communicative aspects of activity systems improves and becomes more sophisticated over the course of schooling.

We offer this model in the spirit of Philip Gough's and his colleagues' (Hoover & Gough, 1990) "simple model of reading," though, as with his, it won't really stay so terribly simple when examined closely. This model owes a great deal to the work of the RAND Study Group on Research on Reading Comprehension (2003) and to Walter Kintsch (Kintsch, 2004).[5]

The basic literate communication model for two persons shown in Figure 1—a writer and a reader communicating through a written "text"—stands for the more general situations of, for instance, one writer communicating with many readers, or two or more individuals who both or all are writing, and reading each other's texts.

FIGURE 1. BASIC LITERATE COMMUNICATION



5. We also have benefitted from the influential models of these processes offered by Graesser, Singer, and Trabasso, 1994; van den Broek, Young, Tzeng, & Linderholm, 1999; Bereiter, C., Scardamalia, M. 1987; Hayes & Flower, 1980; Hayes, 1996, and many others.

THE ELEMENTS OF THE MODEL

Communicator 1 refers to the writer; **Communicator 2** refers to the reader; and **Text** is the written communication produced by the writer. Above the Communicator boxes, the intersecting thought bubbles reflect the hypothesis that each **Communicator** has some amounts or levels of kinds of **Knowledge** (both knowledge and experience of the world, and knowledge specific to literate communication), and **Cognitive and Affective Processes** (an array of processes that operate, reflect on, and modify and extend the knowledge—the operations of the specific modules and general processing capabilities described in **Appendix A, The Cognitive and Developmental Roots of Human Communication).** Where the bubbles intersect, we suggest that there are one or more **Mental Representations**[6] in play. Our use of the term, mental representations, is very general. With respect to literate communication we mean it to apply most immediately to two representations:

1. The representation in the writer's mind of what he or she wishes to communicate and that he or she attempts to encode and transcribe into writing, hoping that it will be replicated in some approximately corresponding form in the mind of the reader; and

2. The representation in the reader's mind of what the text is about – is asserting, describing, asking, demanding, etc.—that the reader anticipates, builds, and revises as she or he deciphers the text.

The writer's representation can be a tentative and/or partial excerpt from a more general representation or set of representations she or he holds in mind, and, of course, it can be a knowingly imaginary, or even false, representation. It certainly does not always start out fully formed; it often becomes clearer and better defined through the process of writing itself.

The reader's representation as it builds can be adopted and adapted into representations

6. Our hypothesized mental representation here is a relative of Walter Kintsch's (2004) concept of the "situation model"—of what a text is about—which he posits that a reader builds up as he or she reads by bringing to bear background knowledge to supplement the propositions or information that are explicit in what he calls the "textbase," which seems to be a representation derived more directly from the text, either in the mind of the reader, or perhaps as hypothesized by an objective observer—what the text "says" explicitly. Our "text" is obviously a relative of his textbase. However, we place these representations in a larger context, which we think may have additional and perhaps different implications for instruction, and we would not add the kinds of normative requirements—for necessarily being coherent, for instance—that discussions of the situation model in the literature seem often to add or expect. Our hypothesis would be that the representations derived during and after reading the text could be quite vague or partial, or very coherent and complex, depending on activity and purpose and on what the reader brings to the task. It is reasonable to expect that most readers will want to make sense of what they read, but that won't always be true, and won't always apply to the whole text. That there will be some representation of what is read will be inescapable, but the internal criteria the reader will apply can change with learning, and certainly will vary with the requirements of the activity system(s) at play. Still, Kintsch's work is very rich and sophisticated. It does not ignore these considerations and we would not be here without him.

that he or she already holds, or it can be isolated and treated as, for instance, an object of analysis or of historical interest. For both the writer and the reader, the representation can be seen to be a tentative and changing creation. It is subject to reflection and modification by the writer's or reader's cognitive processing capabilities, according to the purposes for which the text is being created or read, and to the degree that it is judged by the writer or reader to meet those purposes.

The particular mental representations of **Communicator 1** and **Communicator 2** are selected, and/or activated, and constrained by the writer's and reader's purposes—in other words, the larger setting of activities and tasks they are engaged in. This setting is indicated by the larger boxes labeled "—**Activity (Purpose)**" that encompass each communicator and overlap with each other (see the sidebar above on "activity systems"). The overlap represents the assumption, not always justified, that there will be a fundamentally co-operative relationship between writer and reader in which the writer devises a text to facilitate the transfer of meaning to the reader, and the reader operates on the text so as to receive that transfer. The reader-writer relationship thus ideally resembles what Thomas Schelling called "a game of pure coordination" in which both players benefit from the successful transfer of meaning (Schelling, 1960, p. 84).[7]

Of course, at a general level, what progresses in literate communication is the sophistication, complexity, but also relevance or aptness of the representations being communicated, as well as their beauty or felicity, where such considerations are appropriate. Progress in the kinds of mental representations a reader or writer can decode and derive from text or encode and transcribe into it certainly is not something that happens only along a single dimension. As we suggested in our earlier discussion of the medium and the message, increasing complexity or sophistication of the sent or received mental representations must entail an interaction between the reader's or writer's understanding of the relevant content and relationships, and the sophistication of the meanings that the levels of coding in each genre afford to the writer or reader. In spoken language it seems that children tend to express new relationships they have come to recognize (things like "into" or "it already has happened" and so on) using old forms (in the "two word" stage—"toy-box," which can be clear only because of context and gesture), and only after that do they learn the more appropriate and complex grammatical ways of

7. Designating the area of overlap between the Knowledge and Cognitive and Affective Processes thought bubbles as "Mental Representations" relevant to the immediate literate communication activity does not imply that the other contents of Knowledge are not mental representations. On the contrary, in general we would characterize all of the contents of the mind as being mental representations of some kind, though they are not necessarily conscious, and they range all the way from motor-memories or conditioned reflexes to grand theory. We also think it is useful to consider them to be something like Lego™ blocks or modules. But they are ones that can themselves develop and change, and that also can be combined with or broken off from others in an indefinitely large number of ways. Some are relatively static images or standard reflexes; some are like plans, programs, or complex expectations, or stories, hypotheses or grand theories, as we say. They come into play, and often to consciousness, according to laws of association such as frequency, recency, and emotional salience, as well as through their relevance to what a person is trying to do—his or her social and activity settings, and purposes. They are mental objects that cognitive processes "operate" on in order to support an individual's actions, or in some cases to form new representations and new knowledge.

expressing those meanings (Slobin, 1973, p.184). Whether that order holds for literate communication is an open question, but it at least seems quite possible that the *rates* of growth of the writer's or reader's capacities for the construction of mental representations on the one hand, and their understanding of the more sophisticated affordances of a genre's coding on the other, can differ, so that one may lead the other. For example, we would not be surprised to find evidence that well-established genres could play a lead role in calling attention to, and supporting the development of, more complex mental representations in writers' and readers' minds. In any case, as capabilities for literate communication develop, a growing proportion of the representations involved become more abstract and less directly tied to immediate expectations and action.

During and after reading, the reader's experience seems to be one of continuously building a picture of (or a hypothesis about—not necessarily as visual as "picture" connotes) what is being described as the words and syntax are deciphered and the genre/setting is recognized, activating associations from experience that seem to match the situation. Unless the reader is on autopilot and just calling the words as they come, he or she is continuously testing the developing representation against the encounter with, and associations from, the next words and structures in the text. This "testing" is not necessarily a completely conscious process, but if the representation does not match, various levels of puzzlement, problem solving, and revision may ensue.[8] For example, we all have the experience of having to stop and look back a few pages or search our memory to figure out who this character is again, or why this happened, or what that word means or that concept implies.

A caution about reading comprehension "strategies"

A lot of what happens in reading depends on what the reader is attending to and reflecting on (in part, of course, this is an aspect of the relevant activity system(s) at play). Many of what are named and taught to students as "reading comprehension strategies" seem to us simply to be variants on asking students to pay attention to what they are doing, particularly to whether or not what they are reading is making sense, and then to stop to reflect, if they realize it is not. Strategies like "applying prior knowledge," "drawing inferences," and "envisioning," name processes that are always and necessarily happening to some extent, consciously or unconsciously, during reading, but naming them may help students recognize them and boost or sharpen and connect them better. Graphic organizers and "summarizing" are obviously devices for reflectively reviewing the bidding, and aiding or supplementing working memory.

8. An interesting paper by Etiemme Pelaprat and Michael Cole with the title "Minding the Gap" (2011) suggests to us that this tendency to form a moment to moment running hypothesis about what is happening or being meant by the text as one reads reflects a much more general mechanism through which human beings, and presumably other organisms, consciously and unconsciously build continuous images or models of their world and what is happening or will happen on a base of perceptions and sensations that are inherently discrete from moment to moment.

It seems to us that the positive effects of teaching these strategies may derive simply from asking students to get their heads in the game—that is, from trying to make sure they are engaging in the activity system of "school" or purposeful reading. How much time can usefully be spent on explicit teaching of these strategies will undoubtedly vary from student to student, and should be a question for empirical resolution. However, we would be surprised if the answer is "a lot," for any of the strategies, particularly if they are taught and practiced as separate skills rather than somehow being identified and encouraged during ongoing reading.

The Text

Most texts fall within the particular classes of discourse or genre that are defined within a culture or activity. For these texts, both writers and readers who have learned the norms of the discourse class or genre will use the conventionalized frameworks that define what such a text normally contains in order to build the particular mental representations they are encoding into text or generating as they read text. These conventionalized frameworks encompass how the text is normally organized and structured. They act as kinds of templates for both the writer and reader as they attempt to encode or decode a representation for the particular text they are writing or reading. And they form part of the larger code that is a fundamental aspect of literate communication and helps to give it the power to represent more than just words and syntax (and face-to-face speech) could do alone.

"READING COMPREHENSION" DEFINED

In our view, the representation or representations that the reader develops during and after reading **IS** his or her "reading comprehension." Since mental representations cannot be viewed directly, at least by anyone other than the reader, their quality has to be evaluated indirectly and relatively. That is, one has to choose a basis for characterizing the representation(s) the reader could or should have gotten from the text, Then the reasoning would go—if the reader had this expected representation, then he or she should be able to answer these sorts of questions, provide this sort of summary, talk with you in this way about it, or take action of this sort based on it. The quality of comprehension would be the degree to which the reader's responses met or exceeded those expectations. There can be many bases for defining the expected representation(s), which could include: the evaluator's own judgment of what the writer had in mind; the requirements of the activity or purpose for which the reader was reading the text; an expert's or a test maker's judgment of some kind about what a reader *ought* to get from the text; or the knowledge that the reader should or might gain for, and use in, the larger discourse associated with the activity or discipline relevant to the particular text (for instance, how does the student incorporate the information and arguments in this book into what she plans to write in a term paper about the origins of the Cold War, or what does he learn about reading and evaluating a play from reading this one, or this paper on drama criticism). Given this

view, we think that treating the ability to comprehend as being just a one-dimensional skill paints a much too impoverished picture. We will return to that point later.

Our "simple" model of these processes of course masks a great deal of underlying complexity. Next, we suggest fruitful ways to understand this complexity and elaborate the dimensions along which the elements in our model - knowledge, and cognitive and affective processes—progress as a result of instruction and experience.

Given this view, we think that treating the ability to comprehend as being just a one-dimensional skill paints a much too impoverished picture. We will return to that point later.

IV. Defining and Describing the Dimensions of Progress in Literate Communication within and across Genres

We consider the content of each of our two thought bubbles in more detail.

COGNITIVE AND AFFECTIVE PROCESSES

In our simple model, the thought bubble that designates one of the two sets or lists of factors internal to the Communicators includes both cognitive and affective processes.

In our model, cognitive processes are hypothesized mental functions – operations on mental objects. These "objects" are derived initially from and represent sensory data, such as kinaesthesis, perceptions, memories, images, experiences, feelings. Then, increasingly with an individual's development and experience they include concepts, plans, expectations, hypotheses, judgments, and what we are calling "representations," of all kinds. Taken together these mental objects make up the **knowledge** that fills, or perhaps more precisely the hypotheses that fill, the second of our two internal bubbles. These are the products of the cognitive operations, and they certainly progress, many becoming more complicated and sophisticated over time.

There is no firm agreement on a list of basic cognitive functions, but most theorists would probably include:

1. directing attention;
2. perception of figure and ground, of similarities and differences;
3. analysis—early on related to perception and attention, as in singling out (and suppressing or ignoring other) attributes or dimensions of a whole object, person, or event, etc., and then naming and generalizing those attributes as one kind of concept formation;
4. synthesizing—initially an aspect of perception and attention, seeing what goes with what;—and then abstracting and generalizing from such observations;
5. reasoning;

6. hypothesizing;
7. planning;
8. evaluating;
9. problem recognition; and
10. problem solving.

In the absence of a definitive list, we offer these to provide an intuitive sense of how some set of these functions working together over time might build up the complexity and diversity of the mental lives we see or intuit around us.

During the course of an individual's development, there is growth in the capacity of the cognitive functions to operate on themselves and each other so that they also become objects of thought. This of course is the much-discussed idea of "meta-cognition," and whether and how it may have its own stages of development or progress is a matter of ongoing study. However, it is clear that students do grow in their awareness of their own processes and their tendency or capacity to control and coordinate them. If teachers are to have any hope of helping their students to reach deeper levels of understanding and learning, it is crucial for them to attend to whether and when reflection of this sort is happening and to find ways to foster and encourage it.

We want to emphasize that these functions are operating on mental objects, on and in working short-term and long-term memory, and what they can be about and accomplish obviously is constrained both by current experience and by what is available in memory. And we also would stress that these functions are carried out in the service of human activity and purposes, however abstract those may become.

They quite literally get us moving and aim and steer our activities, providing the criteria by which outcomes are judged, while cognition serves to attend to, define, and analyze and synthesize what is happening and what may happen, so as to improve the chances that the outcomes will be satisfactory.

Our bubble also includes affective processes, which raises a question about the role of emotions, feelings, needs, desires, and values in the creation of mental representations. It is probably useful to think of them as playing signaling or guiding and motivating roles. They quite literally get us moving and aim and steer our activities, providing the criteria by which outcomes are judged, while cognition serves to attend to, define, and analyze and synthesize what is happening and what may happen, so as to improve the chances that the outcomes will be satisfactory.

From the perspective of instruction, we think it is more productive to focus the question of what progresses in capability for literate communication on "knowledge;" on the nature, complexity, and sophistication of what is being communicated and received— *i.e.* on the outcomes of the cognitive processes and motivations involved, rather than on the processes themselves, except to the extent that through metacognitive reflection those processes themselves become known, represented, and controlled.

KNOWLEDGE

The reader's and writer's **knowledge** refers both to knowledge specific to literate communication and more generally to knowledge derived from experience of the world. Knowledge increases in complexity and sophistication along the dimensions described below as a result of instruction and experience. We focus on those dimensions of knowledge which, when coordinated in the act of reading or writing, contribute to literate communication. We begin with knowledge that is language-based and peculiar to literate communication.

Knowledge Specific to Literate Communication– "The Conventions" or "Coding"

GRAPHEME/PHONEME KNOWLEDGE

In an alphabetic writing system, the basic units for representing meaning in text are letters and strings of letters representing the phonemic composition—the sounds—of individual words and morphemes. In addition to letters, there are other such "graphemes," *i.e.*, symbols such as punctuation marks, and numerals, helping to signal syntactical relationships and prosody, and making more specialized semantic references.

In addition to their repertoire of non-verbal expressions and gestures. As children learn to speak and understand their first language, they are focused initially on words—names for people and things, actions, needs, and so on—and on ways to make things happen in their immediate world using words. The big first step in learning to read involves catching on to the idea that marks on paper somehow represent words (as opposed to the things themselves that words represent, which of course can also be represented by drawings—a distinction that takes children some time to sort out). Fairly early, English speakers may also learn the conventions that the order in which words are spoken and meant to be read is represented in text from left to right and from the top of the page down, and the distinction among words in speech is represented in text by spaces between the collections of marks that represent the particular words.

Given the human proclivity for language, children are not particularly consciously aware of the processes by which their vocalizations come into alignment with the phonemic structure of their language. The alignment takes time, and as the phenomenon of "baby talk" indicates, the precision of its application to words can vary quite a bit along the way. But what children, and the people teaching and socializing them into the language, pay more conscious attention to early on are the words. They are not particularly focused on the constituent sounds in those words, even though they must engage in a lot of practice and experience a lot of feedback about how well their shaping of the sounds matches what those around them accept and understand.

However, the orthographers who determine the spelling rules of an alphabetic language do have to pay a lot of attention to the constituent sounds, so that they can be represented

by letters and letter combinations in a conventional and consistent way, making it possible for anyone who knows the alphabetic conventions to decode the pronunciation of any written word that obeys those conventions. Now, it seems to be true that the human orthographers who over time developed the conventions for English spelling faced a tough problem in mapping the 26 letters onto the language's more than 40 phonemes, and accommodating its extensive borrowing from other languages. Their spelling conventions can be pretty confusing to a new reader. Still, that is what readers of English have to deal with so that they can learn to associate letters and letter combinations with phonemes and syllables in a way that will enable them efficiently to derive the pronunciation of written words from those words' visual representations in text. Given the pronunciation, they can access the meaning(s) associated with the words that are familiar to them, and they have an additional basis for refining or learning the meaning of words that are less familiar or that they don't know.

Children do seem to differ in the extent to which they are inclined and able to notice and attend to the basic constituent sounds of their language (they exhibit differing degrees of "phonological-" and "phonemic-awareness"). That difference seems to relate to how readily they catch on to and learn the associations between letters and sounds and recognize that those sounds and combinations of sounds are the components of words that the words' spellings are referencing. However, eventually, at least with knowledgeable support, most make those connections.[9]

Certainly the processes through which these connections are made can be seen as a progression, but it is not clear how well ordered it has to be. Early on, in this country, children usually learn the names of the letters and some of their sounds. The names can be a mixed blessing, since in English they often don't correspond tightly with the sounds they represent, and letters can represent more than one sound when they appear in text (consider c, g, and so on). Still, they also can help to call children's attention to the fact that spoken words are made up of ordered sets of sounds and that those sounds can be distinguished–particularly if instruction in school or at home explicitly points that out to them.

Some form of early, explicit phonics instruction seems to be important for all children—helping them to grasp the alphabetic principle, associate letters and letter combinations with sounds. recognize those letters and the associated sounds in printed words, and begin to practice sounding out and blending to construct approximations of the words' pronunciations and recognize them as words they know (National Reading Panel, 2000). Words may be studied in isolation, particularly to provide practice in learning and recognizing particular "rules" and frequent combinations, but they also should be encountered in meaningful contexts—to ensure that children understand and keep in

9. Individual differences in phonological awareness seem to be associated with at least some forms of dyslexia. Whether this association involves differences in kind or just differences in degree—in the sense of being located toward one end of a continuous distribution—is a matter for ongoing study. (See Melby-Lervig, Lyster, and Hulme (Psychological Bulletin, 2012) *Phonological Skills and Their Role in Learning to Read: A Meta-Analytical Review* for a much more thorough discussion and review of the evidence.

mind the purpose of these processes, which is to represent and communicate meaning that is useful and interesting. Children also always should be hearing words and discourse read and spoken in class, and be given opportunities to speak and use them themselves for the same purposes, so that their spoken language develops and provides a growing set of referents for the words and discourse they will encounter in text. Much of the explicit exposure to the more elaborate phonics rules and exceptions can come in the context of learning to spell and write.

The initial explicit phonics learning and practice can serve to launch children into the ability to read, with reasonable fluency, text about familiar subjects and settings using words that play by the rules they have learned. The learning and practice also should include frequently used, syntactically functional words, many of them short and irregularly spelled, that they learn as "sight words" in almost the same way they are learning the sounds of individual letters and letter combinations.

This early experience does not, however, bring students to "automaticity" in the sense that they would be able quickly to recognize and pronounce words of reasonable length and parts of words (syllables, prefixes, suffixes, other morphemes) that play by the standard orthographic rules of English without being conscious of sounding them out–and able to do the same, almost as quickly both for unfamiliar but regular words and "nonsense" words that use orthographically standard letter combinations. Reaching that level of facility allows readers to devote much more of their attention to the meaning of what they are reading rather than to the mechanics of decoding the sounds. However, laboratory studies of word-, nonsense word-, and word part-decoding latencies show that it takes quite a lot of time beyond initial fluency—well into the school years even for many "good readers"—to reach full automaticity in this sense (Adams, 2011, pp.17-19; Maurer et al., 2006; McCandliss et al., 2003; Booth, Perfetti, & MacWhinney, 1999; Laxon, Masterson, Gallagher, & Pay, 2002; Van den Broeck, Geudens, & van den Bos, 2010; Schlaggar & McCandliss, 2007; Sandak, Menci, Frost, & Pugh, 2004; Bruno, Zumberge, Manis, Lu, & Goldman, 2008; Maurer, 2006; Shaywitz et al., 2002). How rapidly they reach this level, and the range of the specific patterns they can decode easily in this way seems to be closely associated with how much and how broadly they in fact have read (Adams, 2011, pp.17-19). There certainly is more to learn about individual differences in the need for continuing explicit phonics instruction, but it seems clear that the amount and breadth of reading play a crucial role in reaching automaticity for all students who do reach such levels.

A BRIEF LOOK UNDER THE HOOD

In recent decades, studies in cognitive neuroscience and related fields have provided evidence supporting more detailed hypotheses about what is happening in individual's brains as they learn to read and become more adept at it. New technologies and methods support near real-time and more precise tracking of where, in what order, and with what latencies, areas in the brain are activated and seem to be communicating with each

other as the letter and grapheme sequences representing syllables, words, and phrases are recognized, pronounced internally, and their meanings are apprehended. While the details of how these interactions work are still being studied and modeled, it seems likely that the advent of literacy and its affordances have led or taught the human brain to coopt or repurpose aspects and areas of more general-purpose visual and aural functioning so that they support the use of this cultural tool for coding and visually representing spoken language and meaning.

As we understand them, what the hypotheses and evidence from modern cognitive-neuroscience suggest is that the human brain is well adapted for the development of language and for learning to repurpose some of its other pre-existing structures and capabilities so that it can adopt and use the culturally invented tools of literate communication that extend language use beyond the face-to-face. And, in turn, cultures tend over time to adjust the designs of the representation systems they invent so that they are consistent with ways the brain finds it relatively easy to "see" things. Both spoken language and literate communication represent "**skills**" in the sense that they require extensive practice over significant time periods for acquiring and using the conventional associations between, for instance, words and meaning, and between graphemic groupings and words, or between text structure and the conventions of discourse, all of which involve fundamentally arbitrary coding (which of course is not to downplay the existence of onomatopoeia and more general, even visual, forms of "phenomemes").

But these "skills" aren't the whole story. There are at least two sides to any convention/meaning association. No matter how fluent you are in the use of the conventions to get to the referents they represent—to the pronunciation of a word and the general implications of a syntactical or textual structure—unless you already also have direct experience of the particular substantive meanings involved—the ideas, concepts, relationships, and implications signaled by the words and conventions—your fluency will only take you so far. If you don't recognize the substantive references, full comprehension will require that you also find a way to construe their particular meanings, or find ways to apprehend them directly (i.e., look them up, have others demonstrate them, maybe show you again and again). Taken together these processes lead to comprehension. The brain is pretty good at putting such things together, but it has to have time, repeated experience, and usually outside support and direction to pull it off.[10]

We turn now to a more concrete look at words and the relationship between the conventional and the particular aspects of their meaning.

10. For more thorough treatments of the cognitive-neuroscience evidence on learning to read, see: Marilyn Jager Adams (2011) and Stanislas Dehaene (2009). Dehaene's *Reading in the Brain: The New Science of How we Read* provides an amusing and closely argued picture of the state of the evidence from neuroscience about how reading develops and works—including a fascinating introduction to the concepts of a "Visual Word Form Area" of the brain and a higher level "Global Neuronal Workspace" (a combination of so-called "working memory" and a hypothetical place where connections are made across all kinds of inputs to mediate such "higher" functions as reflection, planning, and dreaming). Adams' 2011 book chapter is designed in part to translate the neuroscience evidence for teachers, drawing its implications for instruction clearly and compellingly without overstating them. It is just one example of our larger debt to Adams whose insights and examples we have borrowed extensively, as should be clear in all of the above and in much of what follows.

Word Knowledge and Meaning

It is highly unlikely that words are learned and stored in the brain like dictionary listings, in alphabetical order with concise preferred and alternative definitions. It is more probable that spoken words are learned and take their meaning in the first instance by being associated with the experiences, perceptions, and actions that one's language labels using those words.

Children learn that words label the real-world things or events that they encounter by hearing them in conjunction with those things and events, and often by having that connection explicitly pointed out to them by others. After some number of such encounters with, say, flowers, they begin to associate the word "flower" with similar instances of that form of plant life, and it comes to mean some amalgam of all such associations. It can generalize to other instances, even though it may not acquire a formal scientific or dictionary definition until the child actually takes botany, if ever. But note that this "amalgam" that is the referent and the meaning of the word for the individual must itself be some sum or combination of the neural representations of the experiences of the thing or concept being labeled. It certainly is not the thing itself, and because of that, it must vary in details and precision from individual to individual depending on their particular experiences, and could be quite idiosyncratic for some. Nevertheless, the existence of the label, and the social incentives for reliable communication, must serve to constrain the variation and push toward predictability and rough agreement in usage, denotation, and connotation over time. The process certainly must be aided by the cognitive capacity and bias for conceptual "invariance"—the inclination to treat instances of a concept or thing as being somehow the "same" despite wide variation in surface attributes that come to be treated as not being "essential" (as we see with the considerable variation in the visual forms of letters—for instance between upper and lower case representations and across quite widely varying fonts).

This capacity for looking for and spotting regularities in one's experience is quite remarkable, though its value for promoting survival seems obvious. Whatever makes it possible to combine relevant experiences into bundles that can be labeled and generalized, the bundling process and the process of associating the word with the bundle and ruling out other associations seems to happen pretty efficiently, at least for relatively common and concrete objects, entities, actions, and situations. It probably also is a continuing process involving updating and revision as needed.

Once the relationship between the word and the neural representation of its experiential meaning is established, the connection to that representation is then usually made quickly and seemingly automatically when the word is heard or the referent experience is perceived (though the latter direction may be less reliable). Experimental evidence and modeling suggest that this speed is possible in part because of largely unconscious mechanisms that are sensitive to contingent probabilities—the more likely next words or experiences seem to be queued up or "primed" so that they are more accessible to consciousness, and we don't have to sort through everything we know each time. These mechanisms carry over to literate communication, but in text the context for associations

is even more to, and through, other words, as well as to the experiences and meanings they represent. Because, unlike spoken words, written words persist on the page, there is the possibility of more complex associations among the words, and more chance to practice and review those associations. Still, the way meaning is built up must be fundamentally the same.

However, in focusing on the meaning of words and vocabulary, we are moving into the domain of knowledge in general, rather than just the knowledge of the linguistic conventions that are directly associated with words and that do help to carry part of their meanings. We will get back to vocabulary-as-part-of-world-knowledge below, but now we want to acknowledge the significance of bound and free morphemes, prefixes, suffixes, inflections, etc.

Some of them, like -ly, -ing, -s, or -es, serve grammatical functions and add or change meaning in that way, some like un-, or trans- or, say, circum- have their own semantic significance and often are borrowed from other or earlier languages. The website PrefixSuffix.com has a wonderful list of a large sample of the 2000 or so English language prefixes and suffixes they have identified, organized alphabetically with their meanings and examples (PrefixSuffix, n.d.). What one realizes in looking at it, aside from how many there are, is how recognizable and understandable they are—even if you hadn't thought about many of them as being prefixes and suffixes before and hadn't spotted their repetition in many words you know. A relatively new reader of English would probably not have the same impression. The point is that anyone who has read a lot will have developed some sense of the meaning of these affixes even without paying explicit attention to them. And that sense then makes it easier to recognize and strengthen the association between the affix and its meaning when it is explicitly pointed out. That doesn't suggest that it would not be useful to call early readers' attention to such things and to give them explicit practice in recognizing and interpreting them. But it does suggest a kind of chicken and egg issue about the timing of such instruction—too much too soon may be both puzzling and boring, since the more general context that helps to make the particular meanings meaningful may be missing. However, not drawing explicit attention to the affixes (and other such semantic and grammatical codings) may mean that some students will miss the full benefit of their experience with them, and may miss the point for much too long. How to strike the balance is a problem for curriculum research and development, but it is a good example of our basic point—there may be no particular best order and timing for explicitly introducing the conventions and practicing them, but it certainly is important consciously to choose an order and pay attention to how it works out.

Knowledge of Syntax

Syntax is generally defined as being the set of rules which structure the combination of words into phrases, clauses and sentences. In written text, syntactic structures are demarcated by punctuation.

Syntactic knowledge shapes the way the reader parses texts into meaning units, signaling what kinds of words and clauses go where in a sentence and the general meaning of how they relate to each other. Understanding the implications of those relationships helps readers to develop a mental representation of the text's meaning. It may help them notice some kinds of decoding errors when they realize a word they thought they saw is syntactically inappropriate for its location in a sentence. Of course it also can cause errors for children who are anticipating and guessing about words that would make syntactic, and even semantic, sense but happen not to be the word that actually is there (Vellutino, 2003).

Syntactic knowledge progresses with exposure to clause structures as they increase in complexity (Based on Bailey & Blackstock-Bernstein, 2014). Beginning with simple declarative sentences containing one independent clause with a main verb (I went to the store), children become knowledgeable about simple negative sentences (I did not go to the store), simple interrogative sentences (Is he going to the store?) and Wh- interrogative sentences (What did he buy?).

Syntactic knowledge progresses to compound sentences where two or more independent clauses are joined, usually by a conjunction or by punctuation such as a semicolon or dash (I went to the store, and I bought a candy bar). More complex syntax includes one or more independent clauses and one or more dependent clauses. A dependent clause usually functions within the sentence as a noun or adjective or adverb, and it is often signaled by a word that indicates its dependent status, for example: when; that; because; though; if (I had to go to the store when I came home from school). Types of dependent clauses include relative (adjectival) clauses (The candy bar that he bought cost $1.50), adverbial clauses that give information about time, circumstance, manner, and condition (If he sells all his candy bars, he will have $20), and noun clauses, functioning as subjects or objects of other clauses or phrases (I would tell her that she should not buy candy bars) (Vellutino, 2003; Bailey & Blackstock-Bernstein, 2014). A further expansion of syntactic knowledge involves compound-complex sentences, which contain one or more dependent clauses and two or more independent clauses (Once you're done, you can eat your candy bar, but remember to brush your teeth later).

Syntactic knowledge increases, particularly with instructional support, as readers encounter more syntactically complex text, and as they realize they have more complex things to say and write, and come to appreciate that the language offers ways to do that.

Knowledge of Discourse

Discourse is any piece of oral or written language that extends beyond the sentence. Although the term *discourse* can apply to dialogue as well as monologue, our focus here is primarily on how monologic oral or written discourse acquires unity, meaning and purpose. Cohesion in discourse is dependent on an orientation to contiguity—in other words, connecting what is spoken or written with what came before.

Contiguity is a fundamental principle in organizing spoken discourse (Sacks, 1987),

and may derive from quite elementary stages in the development of children's social life (Bruner, 1975, 1983). Contiguity is so basic to the coherence of spoken discourse that participants will make every effort to make sense of apparently discontinuous talk. If A says, "Where's Bill?" and B replies, "There's a yellow VW outside Sue's apartment", A will work hard to find that this is an answer to his question. Similarly, in written texts, this same principle applies, and, as in the spoken case, it will need to be supplemented by other kinds of knowledge that are both linguistic and extralinguistic. Consider the following two-sentence story from a young child: "The baby cried. The Mommy picked it up." (Sacks, 1972; Pitcher & Prelinger, 1963). Here the contiguity of the two sentences suggests their relatedness, their ordering suggests a real world sequence of events, and the terms "Mommy" and "baby" are drawn from categories of people who are tied together in family relationships and obligations. The coordination of sentence contiguity and ordering, with real world and lexical knowledge are the resources through which the reader represents a possible world from these two sentences. Written discourse differs from oral discourse in that it is generally more compact, and uses a number of formal linguistic devices to express relationships between ideas (propositions) and achieve overall cohesion. Readers' comprehension of discourse depends on their ability to recognize how these devices signal connections and help to establish coherence (Graesser, McNamara, & Louwerse, 2003, p.89).

The fundamental role of contiguity in written discourse is supplemented by a wide variety of linguistic resources that refine coherence relations. They are essential for text comprehension, and they tend to be acquired progressively. These include:

1. Complete sentences: discourse is normally composed of syntactically complete sentences.

2. Cohesive ties: e.g., pronominal references that, for example, link the subjects of two clauses, e.g., "The cat curled up, and then he went to sleep."

3. Conjunctions: link adjacent clauses or sentences—additive (and, plus, in addition to); temporal (first, next, then, finally); causal (because, consequently); intentional (in order to); adversative (but, although, however); and logical (therefore, so) (Halliday & Hasan, 1976).

4. Ellipsis: omitting words that grammatically do not need to be repeated, such as a verb or noun appearing in a prior clause (e.g., "I clean my teeth by brushing them, by washing them, and by rinsing them"). More elaborate is the following: "When Molly had rinsed her toothbrush, she put it back where it belonged." After that, she went to bed." In this instance, "that" refers to the contingently prior sentence (and action) of cleaning the brush and putting it back where it belonged).

5. Substitutions: replacing a noun or a pronoun with another word, such as a synonym or a super-ordinate category term ("Robins, like most other birds, sleep at night.").

6. Topic sentences: complete sentences expressing an idea about a limited topic (e.g., the topic of a paragraph) that, especially in expository texts, focus readers' attention on the points the writer wants to make ("People can avoid accidents in the kitchen by taking certain precautions").

7. Embedded clauses—relative clauses, noun clauses and adverb clauses: one clause is used as a constituent part of another clause ("The girls who came to her party were her friends; my mother opened the door my brother had closed.").

8. Nominalizations: verbs or adjectives are turned into nouns (discover, discovery; resist, resistance) and used for the construction of long noun phrases, condensing information or re-presenting information.

9. Deictic reference: words that point to characters, locations, points in time in communication (the face with the scar and the glasses located next to the kid with the red hair) (Graesser, McNamara, & Louwerse, 2003).

10. Inference markers: indicate that the next sentence follows as a consequence or implication of the previous one (he lost his phone so he could not make any calls).

11. Signaling devices in expository text: headings that reveal the purpose and organization of the text (Based on Bailey & Blackstock-Bernstein, 2014).

Different genres are characterized by different discourse structures involving, for example, distinctive choices of clause structures and text-organizational patterns. Arguments, for instance, often include logical (therefore) and adversative connectives (however, nevertheless) that the author is using to make the argument, while procedures frequently incorporate temporal markers (first, then, next, after) to realize a set of steps or instructions (Martin, 1989: Schleppegrell, 2001).

Progression in discourse comprehension is characterized by increased sophistication in managing coherence relations, as propositions, and the real-world relations and structures they depict, become more complex. For example, beginning readers' understanding of clause chaining or sentence connecting with the use of "and" (which often characterizes young children's writing) progressively develops to a point where they are able to process cohesive devices such as nominalizations and the use of embedded clauses and logical connectors. Progression will be dependent on the degree to which the reader is aware of the different types of coherence relations signaled in a range of text types (narrative, expository, informational, argumentation) and experiences interpreting and using them until processing becomes automatic.

Knowledge of Text

Written discourse is organized in recognizably similar patterns depending on the genre and purpose of the communication. Genres are identified by recurrent patterns. For example: story genres can be identified by the presence or absence of time sequences, and by the presence or absence of complicating events; factual genres, such as explanation

or report, can be distinguished by whether they explain processes or describe events or phenomena; argument genres, such as "exposition" or "discussion" are divided according to whether they present one point of view or discuss two or more points of view (Rose, 2012).

Different genres utilize features that can help the reader appreciate genre relevant meanings. For example, in a piece of expository prose the author can signal the development of an argument for the reader through the use of titles, headings, sub-headings and sub-divisions., which all provide clues about how the argument will be chunked (Brown & Yule, 1993). In the case of digital text, which may to some degree challenge conventional notions about discourse boundaries, for example with the use of hyperlinks, a regular consumer of web-based information can develop an understanding of how such text is typically organized and of the features used to guide the user in accessing content.

As van Dijk & Kintsch (1983) point out, for text structure to convey meaning, it must exist not only in the text, but in some sense also in the reader's mind. Children as young as four years have some knowledge of the conventions of narrative and can employ this knowledge in understanding and telling stories. As children develop as readers and have opportunities to read a wide range of texts, from that familiarity they build and generalize knowledge of the structures and features of different genres and are increasingly able to use this knowledge in creating a mental representation of the author's communicative intent.

To summarize, language knowledge is foundational to reading. Attending to the kinds of language knowledge described here is an essential part of instruction for literate communication. Beyond developing grapheme/phoneme knowledge, which has long been a staple of reading instruction, we suggest that teachers would do well explicitly to help their students acquire knowledge of how language works. In addition to learning vocabulary, which also has always occupied an important role in reading instruction (See, for example, National Reading Panel, 2000) students can be exposed to the ways syntax and discourse structures can themselves express progressively more sophisticated meanings in tandem with their constituent words, giving them access to increasingly complex representations of ideas and relationships as they read and as they write.

"World Knowledge:" General Background Knowledge and Knowledge Relevant to a Specific Topic, Setting, or Discipline.

Consider William Brown's (2011) description of the evolution of language:

"Language—as with most communication systems—likely evolved by means of natural selection. Accounts for the genetical (*sic*) selection of language can usually be divided into two scenarios, either of which used in isolation of the other appear insufficient to explain the phenomena: (1) there are group benefits from communicating, and (2) there

are individual benefits from being a better communicator. In contrast, it is hypothesized that language phenotypes emerged during a coevolutionary struggle between parental genomes via genomic imprinting, which is differential gene expression depending on parental origin of the genetic element. It is hypothesized that relatedness asymmetries differentially selected for patrigene—caused language phenotypes to extract resources from mother (early in development) and matrigene—caused language phenotypes to influence degree of cooperativeness among asymmetric kin (later in development)." (Human Biology, 2011)

People with specialized knowledge of evolutionary and genetic theories of the capacity for, and origins of, language will likely access the meaning of this text (and be able to form a judgment of whether it makes any sense) more easily than those without such knowledge, even if they have all the knowledge discussed earlier. As this example illustrates, the role of world knowledge is a significant factor in the reader's capacity to make meaning from text. By the term *world knowledge* we mean what a reader knows about the states of affairs referred to in a text. For example, a reader of George Eliot's *Middlemarch* will benefit from knowing something about contemporary social expectations with respect to marriage and social position, just as a reader of text on biogenetics will be advantaged if he or she has deep knowledge of biology, or a reader of a newspaper article on a country's fiscal collapse who has some knowledge of economics.

Clearly, there are implications for teaching and learning here beyond developing knowledge of syntax and features of text. If students are going to become sophisticated readers, over time they also need to acquire relevant disciplinary and general knowledge. But by itself that seems fairly obvious. What needs more attention is how the growth of domain knowledge and linguistic knowledge interact.

World knowledge is salient for all readers. Take for example, a young child at the beginning stages of reading who is reading a text about fish. The text says, "Fish swim in the sea." The child reads, "Fish swim in the water." While the child does not read the word "sea" correctly, he preserves the meaning of the text with the word "water." He knows something about fish and, therefore, while not paying attention to the visual cues that differentiate "sea" from "water," he makes a prediction of the word based on that knowledge, and of course, on his knowledge of syntax as well.

When text complexity increases, however, world knowledge becomes even more salient because the two are so closely related. As Marilyn Jager Adams (2015) observes, "texts that are more complex in vocabulary and syntax also tend to be more presumptuous of readers' background knowledge…texts that strive to present more precise argument or more specific information on a topic are unavoidably more complex in vocabulary and syntax (Adams, 2015)."

Clearly, there are implications for teaching and learning here beyond developing knowledge of syntax and features of text. If students are going to become sophisticated readers, over time they also need to acquire relevant disciplinary and general knowledge. But by itself that seems fairly obvious. What needs more attention is how the growth of domain knowledge and linguistic knowledge interact.

In what follows we offer our suggestions on what we think our description of literate communication implies: for instruction, and how it can better support students' progress; for the design and uses of assessment and assessment systems; for education policy more generally; and for the kinds of research, design, and development, and strategies for funding them, that could over time provide the knowledge and tools needed to help more students meet the lofty goals now being asked of them. Along the way we will supplement our general discussion with examples of current approaches to instruction and to providing tools to support it that seem to us to hold promise and/or at least partially illustrate what we would recommend doing.

V. Implications and Recommendations

INSTRUCTION AND PROGRESSIONS

If they are to meet the ambitious, high level "literacy" goals that schools and society expect of them, students' knowledge of the conventions of literate communication should develop progressively in tandem with their cognitive processing capabilities and the sophistication of the subjects and thoughts they want to communicate about. However, it is not clear that we can identify levels of progress on these dimensions that are strictly ordered, in the sense that a student has to pass through or "master" one level as a pre-requisite for moving on to the next. While, as we have noted, there is some evidence for such dependencies in some of the knowledge domains related to what literate communication intends to communicate *about*, as in science and mathematics (Daro, Mosher, & Corcoran, 2011; Corcoran, Mosher, & Rogat, 2009; Mosher, 2011), we cannot cite clear evidence for them in the domains of knowledge specific to literate communication.

However, these issues of order are not trivial or unimportant. On the contrary. It would make good pedagogical sense for educators to agree on and make explicit choices about the order in which they will teach the elements of literate communication, whether that choice involves a strict serial ordering, or parallel exposure in some way, or even a cyclical revisiting of some of the elements in a "spiral" way.

Yet, it seems reasonable to think it is likely that the knowledge of how text codes and conveys meaning will be learned in some order of smaller to larger "grain sizes" of text structure, from the grapho-phonemic components of word representation, through growing syntactical complexity, to the encoding embodied in whole-text structure and discourse conventions. But within each of those levels the order of likely learning may vary widely, perhaps even randomly, so the choice of an order in which to teach them may be relatively arbitrary.

However, these issues of order are not trivial or unimportant. On the contrary. It would make good pedagogical sense for educators to agree on and make explicit choices about the order in which they will teach the elements of literate communication, whether that choice involves a strict serial ordering, or parallel exposure in some way, or even a cyclical revisiting of some of the elements in a "spiral" way. If new students come to class having learned them in a different order because of other exposure and opportunities, an ordered plan for introducing the elements of literate communication and associated tasks and assessments should make it easier for teachers to recognize what students have, and have not, already learned and respond to it contingently. The point would be to have an agreement on the order, at least among the educators in a school or district, and preferably

across a wider set of jurisdictions. Such agreement could secure the benefits of stable expectations in a mobile society, and provide a clear base for evaluating the results and revising the order if the results were not satisfactory. In other words, we would argue for the value of a common curriculum.

WHAT DO WE MEAN BY CURRICULUM?

The term "curriculum" has a variety of connotations. We use it in a general way to refer to a specified "course of study" for a school subject, or for all of what a school or school system wishes children to learn. It involves a choice of the order or orders in which the content of subjects—knowledge, skills, and practices—should be taught, along with standards for the levels of performance, understanding, and other outcomes desired (and from whom they are expected). When those designing the curriculum believe it is warranted, they may also specify the pedagogical approaches to be used and the experiences to be offered to students. The specifications may be rigid or flexible. Clearly, **a dynamic or adaptive instructional regime** would expect variation in the rate at which students might progress through the curricular order, and perhaps it also would specify alternative orders or approaches to meeting the same ends when necessary to adapt to students' needs. We use "curriculum" as a broader term for what we also refer to as "**teaching progressions**." Of course where there is evidence that some teaching progressions are more likely than others to be associated with successful student "learning progressions," it would make sense to take that evidence into account when designing a curriculum.

WHAT SHOULD A CURRICULUM INCLUDE?

Conventions and Content

We would not presume to recommend the full details of a curriculum for instruction in literate communication. Instead, we suggest some general hypotheses about what effective curriculum designs should include. We argue that teaching about the ways that language and text code and carry meaning and the ways they express increasing complexity and sophistication should be tied closely to the learning of specific content and ideas and to the experience of reading, speaking, and writing about them. We also argue for the necessity of explicit discussion and feedback about whether students have understood what they have read or heard, and whether they have succeeded in communicating to others what they think and understand about what they are learning.

In Section IV, we offered a fairly detailed look at the ways—the "conventions"—through which text codes language and meaning. When we turn attention to the actual messages—the knowledge and meaning being communicated—we cross an analytical

border into a potentially vast territory. Given our definition of reading comprehension, we are *not* surprised that there is a strong correlation between measures of students' prior general or subject matter knowledge, or general vocabulary knowledge, and measures of reading comprehension "ability." If it weren't for the possibility of some dissociation between levels of general and specific knowledge (consider the effects of early dinosaur fascination), it seems to us that both correlations should rise to the level of tautology—how could it be otherwise? But just because it is blindingly obvious doesn't mean it isn't important. How should instruction in literate communication take differences in general knowledge into account?

We would not presume to recommend the full details of a curriculum for instruction in literate communication. Instead, we suggest some general hypotheses about what effective curriculum designs should include. We argue that teaching about the ways that language and text code and carry meaning and the ways they express increasing complexity and sophistication should be tied closely to the learning of specific content and ideas and to the experience of reading, speaking, and writing about them. We also argue for the necessity of explicit discussion and feedback about whether students have understood what they have read or heard, and whether they have succeeded in communicating to others what they think and understand about what they are learning.

Individual, and class and background, differences in vocabulary size—in prior opportunity to learn and exposure to language and experience—are very great (Hart & Risley, 1995). They translate directly into "gaps" in levels and ease of comprehension that are very difficult, perhaps impossible in terms of group mean differences, for schools to eliminate *on their own*. We should not promise, or hold people accountable for, things we know we or they cannot do, but as a society, we should pursue policies that reduce the inequities outside of school that limit opportunities to learn. Within school, we can make a good faith effort to identify the kinds and levels of common knowledge and skills that every individual should acquire in order to be able to function in contemporary society, and then, as we learn over time what works, we can try to provide the time, resources, and experiences necessary to enable substantially every student at least to reach, or exceed, those levels. Of course these are moving targets. Pretending that they are precisely measurable will lead to grief, but it is reasonable to frame the goal in these general terms and to make pursuing it transparently a norm that individual educators accept and that the system is designed to expect and support.

To be sure, "standards," including the Common Core, represent an American approach to setting goals of this sort, but diffidence about impinging on local control means that they tend to fall short of specifying either the required content or the expected performance levels in ways that would support actual teaching and learning. Absent the specification that a defined curriculum would provide, the responsibility for specification devolves by default onto assessments, which provide indirect and rather imprecise instructional guidance at best.

Next we take a somewhat closer look at ideas about how instruction should handle the interaction between 1) a focus on knowledge of the conventions, and 2) a focus on the particular knowledge or meaning that text is trying to communicate, and the prior knowledge, associations, and experience that are necessary for a full or relevant understanding of what a text means.

CURRICULUM PROGRESSIONS

There now are quite a number of literacy curricula, state and national standards, and assessment frameworks that characterize themselves as being based on learning progressions. For the most part, we think it would be more appropriate to call them "teaching progressions" or "standards progressions." While they do focus on the order in which aspects of literacy should be taught, and set expectations for when, in terms of ages and grade levels, they should have been learned, they tend to be based on expert and experienced practitioner judgment and consensus rather than on a detailed empirical look at the way students' understanding and skill actually develop.

While we have absolutely no quarrel with any well-reasoned effort to define teaching progressions for literate communication, we believe they should be recognized for what they are: **reasonable hypotheses**. As such, they entail an obligation to carry out empirical observations of how they work out in practice, and to make evidence-based revisions as necessary. In fact, we think that is the only way that real progress is likely to occur in the short term. There of course will be progress at a more fundamental level—in cognitive science, linguistics and socio-linguistics, and neurology—but that too will have to be applied and worked out through the trials of practice before it can make a real difference.

Some current literacy curricula and assessment programs that have adopted the progressions label have in fact moved in the direction of incorporating empirical evidence of the ways students' performance changes as they learn. A number of the progressions or "continua" used in writing instruction are based in part on a qualitative analysis of collections of actual student work, written in response to prompts for stories, exposition, and arguments or opinions. They are descriptions of levels of sophistication or quality in this work, identifying some number of sub-dimensions of progress such as organization, style, details and evidence, craft, conventions, etc. Then, based on a rough association between age or grade and improved work, sometimes these qualitative judgments of degrees of progress are turned into grade-level expectations, with or without caveats about how wide the range of performance at any one grade is actually likely to be.

Descriptions of this sort are descriptions of the complexity and sophistication of the texts students produce and the dimensions along which texts become more of both, with age, experience, and instruction. Aside from occasional speculation, they are not hypotheses about how students' thinking or understanding is organized "in their heads" to produce texts at the various levels, or what changes enable them to move to subsequent levels.

Still, the close look at the actual performances adds a healthy empirical and concrete grounding for teachers' expectations, and it provides a body of evidence against which more direct hypotheses about the nature of students' learning and thinking could be developed and tested in the future.

In reading, quantitative measures of "text complexity" such as the average length of a text's sentences or clauses and the relative unfamiliarity of the words it uses, or the average number of syllables in those words, do correlate pretty strongly with relative text difficulty[11]. In that way they can seem to provide a kind of natural backbone or ordering of texts against which the development of students' reading comprehension ability can be described and assessed. The Common Core ELA standards take full advantage of that aspect of language. And there are other attempts to look closely at what makes reading or writing assessment items more or less "difficult" for students at different grades, and to turn those observations into a quasi-empirical description of the ways in which students progress.

SOME EXAMPLES OF CURRENT LITERACY PROGRESSIONS

We will look a bit more closely now at two examples of more qualitative continua or "progressions," one from the U.S. and one from New Zealand (an example of an official "national" curriculum progression), both of which place a more explicit emphasis on the conventions of literate communication than they do on the content being communicated. Then we consider two curricular approaches that much more clearly emphasize the need to pay explicit attention to the substantive content students need to learn, and to how that understanding increases in sophistication along with growth in their understanding of the ways in which text codes and communicates those understandings or meanings.

Finally, we turn to a discussion of the implications of our understanding of literate communication for issues of assessment and assessment policy. To pin that down a bit, we review two approaches to describing and understanding students' progress in reading and writing by using assessment data or designing new assessments to track that progress —one of them primarily quantitative and inductive, the other more theoretical and exploratory, though also quite empirical in its intentions.

11. It is obvious that some texts are more difficult to read than others, when "difficulty" is measured by such things as time to read, fluency, numbers of errors, or the readers' ability to answer various kinds of questions about the text. It would help the clarity of the discussion if we could restrict the use of the term "difficulty" to refer to empirical values—for instance the relative standing of a particular text compared to other texts in terms of the proportions of defined or comparable student populations who can read the texts fluently, answer the questions correctly, and so on. The lower the proportion the higher the difficulty of the text. Then concepts such as "text complexity" should be thought of as identifying variables that might explain or be correlated with difficulty.

EXAMPLES OF QUALITATIVE PROGRESSIONS

Teachers College Reading and Writing Project

One of the best current examples of a literacy curriculum with an explicit grounding in ideas about progressions is provided by Lucy Calkins and her colleagues at the Teachers College, Columbia University, Reading and Writing Project (TCRWP). The project has evolved over many years and now is a very complex enterprise, involving thousands of schools and many thousands of teachers in New York and around the country in an ongoing multi-faceted in-service community of practitioners engaged in the application and continual refinement of approaches to helping children become effective writers and readers. For our purposes, we will focus briefly on the project's approach to writing and reading, as described in *Writing Pathways: Performance Assessments and Learning Progressions, Grades K-8* (Calkins, Hohne, & Robb, 2015) and the recently released companion volume *Reading Pathways, Performance Assessments and Learning Progressions: Grades 3-5* (Calkins, 2015).

Writing Pathways offers tables of learning progressions for students' writing in three school-type genres: argument/opinion, information, and narrative, from pre-kindergarten through grade 9. There also is a more briefly treated progression for "the writing process." These are based in part on an analysis of student writing over those grades produced "on demand" in response to open-ended prompts such as: "Think of a topic or issue that you know and care about …write an opinion or argument text in which you state your opinion or claim, and tell reasons why you feel that way."

For each genre the growth in quality and sophistication of the texts is described analytically as occurring along a standard set of what we would call progress dimensions or "progress variables;" grouped under "Structure, "Development," and "Language Conventions".

I. **Structure:**
   - **A. Overall:** A description/judgment of the text
   - **B. Lead:** How the topic is introduced:
   - **C. Transitions:**
   - **D. Overall Organization:**
   - **E. Ending:**

II. **Development:**
   - **A. Elaboration:**
   - **B. Craft:**

III. **Language Conventions:**
   - **A. Spelling:**
   - **B. Punctuation:**

For each of these dimensions, at each grade level, there is a brief description of what the student's writing did or looks like with respect to that dimension at that age/grade level. For instance: **transitions** at the kindergarten level says: "The writer wrote his idea and then said more. He used words such as *because*." At fourth grade: "The writer used words and phrases to glue parts of her piece together. She used phrases such as *for example*, *another example, one time,* and *for instance* to show when she wanted to shift from saying reasons to giving evidence, and *in addition to, also,* and *another*, to show when she wanted to make a new point." The language throughout is designed to be student, and teacher, friendly, in effect pointing pretty concretely to how text carries meaning and directs attention, and how that can get more complicated.

The progressions are accompanied by a quite marvelous set of "checklists" which describe and, literally, picture what an **opening**, for instance, or a **conclusion**, and so on at each level should look like, asking the students to rate their own versions as whether they are "not yet," "starting to," or "yes,"—done "like a ----th grader?" This is just one among many devices through which the curriculum is designed to lead students to focus and reflect on their own work and to support them in moving to the next level.

The curriculum materials are quite careful to make clear to teachers that these devices should not be expected to be self-explanatory. Rather, their use should be actively taught and practiced. They also provide students with tools for self-monitoring, accompanied by lots of advice about how to help students to take this work seriously – almost forms of cheerleading—designed to engage them in this activity system, with a clear bias toward preparing students to think of themselves as "Writers" in a nearly pre-professional way.

Calkins points out that being asked to think about one's own writing in these ways certainly gives students a more concrete idea of what they are being asked to do by the Common Core standards when those standards talk about reading *closely* to identify, for instance, how authors are choosing their words to set a particular mood or tone.

There are a couple of notable aspects of this curriculum and its approach to progressions. Looking across the grades on each of these dimensions, the complexity ratchets up: for instance, in the number of examples or arguments given, the number of logical connections made, number and sophistication of the words used, increasing self-consciousness about craft and audience, and so on. As with many other sets of standards there is no real justification for tying this particular rate of improvement to the grade levels. Unlike the Common Core and many other state standards, however, this curriculum pays much closer attention to what the steps are along the way and what would support students in moving along them. Nevertheless, the progressions are organized by grade levels, signaling that all students should be moving roughly together to reach the levels of competence delineated at each specific grade level. While it may be the case that many students will achieve the desired competencies at each level, and, no doubt, a number will surpass them, a real progressions approach would focus on the order in which understanding and skill develop but would expect the timing of those developments to vary quite widely across individual students.

The source of this problem likely lies in the policy pressure to set grade-level standards for all students. We suspect that these authors might agree that the result of having to tie progressions to grade levels in this way should be called "reluctantly Procrustean progressions."

We also think this curriculum as presented in *Writing Pathways* is an almost pure example of what we were leaning toward recommending earlier, because of its focus on how a writing student learns the conventions, structure, and organization through which text carries meaning in genres important to schooling. Still, with this focus on conventions, there is much less emphasis here on content—on the particular messages or representations—and how students learn how those interact with form in communication. Or rather, the content is left to the students' choices, and they then are supported in learning how to communicate what they have to say, and in reflecting on that process. This curriculum is complex and extensive, and we cannot say that it does not address these content questions more directly elsewhere. However, in these writing progressions there are no examples of taking a particular subject, or discipline, and looking closely at how a growing understanding of it might interact with how one communicates that understanding (a two-directional interaction, presumably). We will touch further on that issue below, but now we just want to note that this curriculum could be seen as a pretty good example of at least half of what we are inclined to preach.

As we were finishing this report, Lucy Calkins and her colleagues published a companion volume to *Writing Pathways* titled: *Reading Pathways, Performance Assessments and Learning Progressions: Grades 3-5* (Calkins, 2015). The similarities and differences between the two are instructive.

The progressions in *Reading Pathways* have a general structure similar to the ones in writing. They are offered for fiction/narrative and informational/non-fiction text from grades 2 through 6, and they are framed in the same way as though in the voice of the student, saying what "I" am doing or able to do at each grade level in terms of "my" understanding of, what I notice in, and how I think about, the text I am reading, in terms of steps along a number of dimensions of reading "skill" or "strategy" as these become more complex or sophisticated in conjunction with the increasing complexity and sophistication of the texts themselves, as required by grade-level expectations and standards.

The progressions are accompanied by the same kinds of check lists and illustrative drawings as there were in the writing continua, designed to call students' and teachers' attention to the nature of the steps of progress the students are being expected to take in as friendly and accessible way as possible. The intention to encourage students' reflection and self-regulation in support of learning progress is clear. The problem they face, however, is that in the case of writing, both the teacher and the student can look at the student's work and consider where it stands with respect to all of the dimensions of progress that TCRWP has identified—the work product persists and can be viewed and reviewed in all its dimensions as an object of joint reflection. In the case of reading, however, the

products— comprehension, understanding, and reflection—are in the students' heads and, as in the case of comprehension assessment, their quality and qualities have to be inferred as hypotheses from what the students say and do with them, and students have to be encouraged to pay attention to what is going on in their own heads so that they can take responsibility for improving what happens there. Teachers are not directly privy to the product in the ways they can at least feel they are with writing.

TCRWP's attempt to address this problem is grounded first in an analysis of what makes the fiction and non-fiction texts students are asked to read and respond to more, or less, difficult (or "complex") to read and understand. For fiction/narrative they use a version of the informal, multifaceted, A to Z "leveling" system that has been a staple of book classification for elementary school reading instruction, but one additionally informed by the kinds of considerations of "text complexity" that the Common Core takes into account—and they apply similar considerations in an even less formal way to non-fiction texts. This leads them to identify a set of dimensions for the ways in which texts become more difficult and sophisticated, for example for fiction, having to do with plot and character complexity, explicitness or implicitness of characterization and message, familiarity of vocabulary, syntactical or text structural complexity, and so on.

The progressions are referenced to these dimensions and additionally involve a specification of what students should notice or do in response to the interaction between the texts' progress on each of these dimensions and the particular tasks the students are asked to do in reaction to the more complex texts (such as: "Find the 'main idea,' or identify a character's motives or traits, and show what in the text provides evidence for your conclusions."), and to demonstrate their own increasing "skill" and their use of "strategies" to support their understanding of the more difficult texts and, at higher levels of the progressions, of the relations among texts, in the sense of "compare and contrast" and more extended forms of disciplinary discourse.

The progression dimensions are grouped into sets having to do with: "Literal Comprehension," "Interpretive Reading," and "Analytic Reading," with sub-categories such as, for instance under Literal Comprehension: "Orienting, Envisioning and Predicting, Monitoring for Sense, Story Elements—time, plot, setting, Establishing Point of View, Fluency (the sound of my voice), Punctuation and Sentence Complexity, Word Work (Word Solving), Building Vocabulary, Retelling/Summary/Synthesis (written responses)," and providing evidence for most of these.

The TCRWP commentary on these progressions suggests that teachers may find it easier and more appropriate to focus instruction on these dimensions separately, rather than trying to deal with their full interaction in the process of reading. In contrast, they suggest that dealing with the interactions may be easier and more appropriate, or even necessary, in helping children to look at progress on all of the dimensions of their written work. Whether that is the best way to focus instruction is not completely clear, but it does call attention to an important practical difference between reading and writing instruction.

These progress dimensions represent a mix of focusing on: 1) What we would call general

and genre-specific (particularly literary genres) conventions for coding levels and kinds of meaning (for many of which **skills** might be an appropriate label); 2) **Cognitive practices**, which we consider always to be active in any communication situation, such as Envisioning, Predicting, Monitoring for Sense, etc., but which can be made the explicit focus of the reader's attention and can, by virtue of that, become more effective in supporting comprehension of more sophisticated and complex text (these seem to be what often is meant by the term **comprehension strategies**); and 3) What we might call "test prep" —highlighting the kinds of tasks like determining the main idea or moral of the story that turn up as items on standardized tests of reading comprehension.

To be clear, we consider these to be teaching progressions, rather than empirically grounded direct descriptions of, or hypotheses about, how students' comprehension *of text* actually develops, but, we consider them to be a careful and serious effort to design ways to draw students' and their teachers' explicit attention to the means through which literate communication systems represent language and meaning.

We find it interesting that *Reading Pathways* seems much more complicated than *Writing Pathways*—that it seems to expect teachers to find it more daunting. We think that this may be, as they suggest, that the writing, at least in elementary school, can be more circumscribed, and it is limited to what the students can produce, while reading involves being prepared to deal with the wider array of meanings that the world may serve up to them. And we do think there is a lot more to be learned about how to understand and explain, and to find accessible labels for, the ways that general and genre-specific conventions code higher levels of meaning in text, and how the meanings coded by the "medium" interact with the particular messages and content that a writer is trying to convey. But as we all learn more about how to do these things, we are pretty certain that the answers will owe a lot to, and build on, the paths that these *Pathways* volumes have begun to lay out.

New Zealand Literacy Learning Progressions

A number of countries frame their national curriculum in terms of learning progressions. New Zealand provides a good example. The New Zealand Ministry of Education has produced Literacy Learning Progressions for reading and writing that "describe the specific literacy knowledge, skills, and attitudes that students draw on in order to meet the reading and writing demands of the curriculum" at increasing levels of complexity (Ministry of Education, 2010, p. 2). The progressions are explicitly for teachers, and intended as a "reference point" for teachers to use when they gather information about their students' literacy strengths and needs so that they can plan effective literacy instruction.

A brief for the draft of literacy learning progressions was developed by the Ministry of Education after consultation with its National Literacy Reference Group. The progressions developers engaged in an iterative process where feedback on drafts was sought from teachers and other educators who would be key users of the progressions.

The progressions are described in terms of how literacy enables students to engage with the New Zealand Curriculum. This focus is useful as it supports teachers to consider the purposes of reading and writing in the context of a broader curriculum, rather than on reading and writing as somehow ends in themselves.

Organized as expectations at the end of successive two grade-level periods, the literacy progressions specify the demands of the texts and tasks of the New Zealand Curriculum, the expertise and attitudes that students demonstrate when they read and write texts associated with the particular grade level, and the significant transitions that students experience in reading and writing as they move from the prior grade level. Interestingly, oral language is a specific focus of the first year of school and is then omitted in the remaining years, which address reading and writing only.

The progression is organized in two-year phases, linked to levels of the New Zealand Curriculum and indicates that "most students will be working towards" a specific curriculum level at the end of the first year of the two-year phase, and will be "working at" a specific level by the end of the second year of the phase. At each phase of the progression, the demands of the curriculum levels in terms of the requirements of reading and writing are described. Throughout the progression, the requirements for reading are organized into two categories: reading, responding and thinking critically about texts; and drawing on knowledge and skills that are included in a listing of the skills needed at that particular phase of the progression. The requirements for writing are categorized as "when students at this level create texts, they…" and, as for reading, "they draw on knowledge and skills that include…"

In terms of what progresses in the New Zealand progression, many of the elements we have identified are referenced. There is an emphasis on knowledge of the conventions of literate communication, specifically grapheme/phoneme knowledge, knowledge of the morphological signals of word meanings, knowledge of increasingly complex syntax, and discourse knowledge both to engage in and express learning. Students are also expected to broaden their repertoire of genres, including expanding their knowledge of text structure and digital media, reading more text within disciplinary contexts, and progressively comprehending longer and increasingly complex texts. The elements are described in considerable detail only at specific levels of the progression, although their development can be traced relatively easily through its various phases. This organization would seemingly make the progression very usable to teachers for planning and assessing literacy learning and for supporting instruction, since students' learning levels with respect to various elements can be located at differential points along the progression. This has the added advantage of bringing curricular coherence to literacy learning. As opposed to the "laundry list" of things students should know and be able to do at the end of a grade level that characterize some efforts at progressions, the New Zealand effort provides a coherent organizational framework for curriculum that incorporates a progression in the acquisition of the knowledge, skills and understanding that promote literacy across the period of compulsory schooling.

However, it is important to take a closer look at the levels in the New Zealand progression. There is "simply" getting an idea of the message, building a representation of what the text may be trying to communicate. This involves both decoding the text at all of the levels the reader appreciates, and understanding the specific content by bringing to bear prior knowledge, for instance, vocabulary and the concepts it activates, and using the inferences that associations with the described or referenced situation provoke to help the reader "read between the lines." But then the progression goes on to expect students to appreciate the higher levels of coding in the text by "reflecting on the author's purpose and how he or she expresses it"—trying to make explicit the conventions or techniques of writing in that genre.

And the progression goes still further, expecting the student to learn how to put the particular representation derived from the text into the context of other representations that the student holds, for example, to compare, evaluate, analyze, and synthesize them. The latter is something more than just communicating—getting the intended message—it is meta-communication, reflection, and extrapolation, or, simply put, "thinking" in general. Of course, if it is to go very far, this kind of thinking requires literate communication to make it possible, but it is more than that (or it is a quite different level, or set of levels, of that).

We think that treating these requirements for "higher level" thinking—for reflecting on representations, comparing and contrasting them, and even extending them to the point of developing new knowledge, as simply being aspects of "literacy" is a mistake.

This is a "shift" that also happens in many of U.S. states' college and career ready standards, including the Common Core, and in the NAEP literacy framework. We think that treating these requirements for "higher level" thinking—for reflecting on representations, comparing and contrasting them, and even extending them to the point of developing new knowledge, as simply being aspects of "literacy" is a mistake. We suspect that by seemingly treating them as being teachable in ways similar to the ways that the coding conventions at the various levels of literate communication can be taught, educators' attention can be diverted from trying to understand whether and how most students' thinking might move to these other levels and what would be involved in helping them to do that. We doubt that is so well understood now, and acting as though it is, and basing policy on that assumption, is likely to have perverse effects and certainly lead to disappointing results.

PLACING A MORE EXPLICIT AND SYSTEMATIC CURRICULAR EMPHASIS ON VOCABULARY AND KNOWLEDGE

There is growing recognition of the fundamental role that prior knowledge and vocabulary play in shaping comprehension of text. Because of this, there has been an expansion in the number of efforts to devise ways of helping students acquire at least the core vocabulary and common knowledge that they may not have brought with them

from home—to provide all students with opportunities to learn the kinds of language and knowledge that they will need to be able to understand the texts, and do the kinds of thinking they will be asked to do with them, that they will encounter in their further education and future careers.

It has seemed pretty obvious that students who start school knowing only a small fraction of the words their peers know are not likely to be able to make up such a gap through explicit word by word in-school vocabulary instruction, even if that were desirable pedagogy. Research on learning word meanings makes it clear that vocabularies are not simply, or even mainly built in this way but rather can grow by association through exposure to spoken language and reading, with feedback from the linguistic context as well as from direct experience).[12] But for students on the wrong end of the gap, that's the catch, since the efficacy of reading for vocabulary building is a function of prior vocabulary (one of many "Matthew effects" (Stanovich, 1986) at play here). The question becomes whether there is some way in school to stage students' exposure to content and vocabulary in what they read that will be more efficient and more strategic than the un-systematic, but extensive, exposure their more advantaged peers have had outside of school—so that they are at least close enough to be able to take advantage of continuing opportunities to learn. For such an ethically desirable strategy to work, the hope is that linguistic reality is structured such that a smaller set of words can be identified—words that are somehow centrally functioning, high-leverage widely used words and/or words that are more narrowly used but which are central to particular, important genres, as well as central bodies of knowledge that are somehow key to learning most of the other important things one might want to learn. Finding that curricular sweet spot, if it exists, has become a central concern for educators and developers who would like to combine a commitment to higher standards for all with a commitment to greater equity in the actual attainment of those standards.

12. There have been many estimates of the average size of the reading vocabulary of American high school graduates, ranging from 20,000 "word families," or fewer, to as many as 40,000 to 60,000 words. These estimates seem to us to be inherently ambiguous, and therefore they should not be taken literally. What counts as a "word," for instance, is uncertain—should it be just the base meaning, if that can be determined, or should you count separately the base plus each of its affixes (pre- and suf-) and inflections, etc.? And what does it mean to know a word, and how would you tell for each individual sampled? Do you have to ask them in these terms about every word there is? If not, from what evidence can you estimate one's total? Or do you do something like looking at, or sampling, all of the text such students would have been expected to read and counting the number of different words you find there, assuming that if they graduated they must have understood at least N% of those word, or ….? We think it is sufficient to say that the average number, or the median, is "a lot"—and it almost certainly is a great many more than you are likely to build up to just by being explicitly taught, and learning, any reasonable number of new words each day in school from kindergarten to 12th grade. So that big number must also be learned in other ways—probably mainly by listening and reading—a lot. For a very useful discussion of how to think about vocabulary size, see Adams (2015), and for examples of the estimates see Aitcheson (2012), Nagy and Anderson (1984), and Anderson and Nagy(1992). However, Andrew Biemiller (2001) makes a strong case for the need and usefulness of explicit and targeted in-school vocabulary instruction rather than simply relying on exposure through reading a lot.

Strategic Education Research Partnership's Work in Boston

A prominent example of this search can be found in the work of the Strategic Education Research Partnership's (SERP) Boston project focused on "Word Generation." This work is led by Catherine Snow at Harvard's Graduate School of Education, who is a leading figure in research on, and public and policy discourse about, reading and reading comprehension. Snow and her colleagues' initial focus was on helping the Boston Public School System find ways to help strengthen underserved middle school students' vocabularies, but it soon broadened into a concern with how students can acquire facility with "**core academic language**."

The concept of core academic language represents the hypothesis that it is possible to identify a kind of hybrid genre of more abstract, formal, and precise language that could be used in school as a sort of sandbox, preparing children to participate in the specialized genres of the various academic disciplines or in the community of "educated" laypersons. The point is that the language of school already has the attributes of such a genre, but instruction that identifies the genre explicitly and explains how it works could help more children grasp the meanings, and use the conventions, of more "formal" language.

With regard to vocabulary, among the kinds of words that make text difficult for students, there are some that are not particularly highly frequent in day-to-day speech but which show up quite often across a number of more formal text genres, and function, for instance, to signal the meaning of the ways various dependent clauses in a sentence relate to each other and help to establish the coherence of what the text is saying. In addition, there are words that signify relatively complex concepts that in some form are used in most disciplines (for example, words like "strategic" or "leverage" as we have used them here). Then there are other words that are not common in general discourse or texts but which play central, often technical, roles in particular genres or disciplines and are key to understanding text in those fields. (Some reading researchers call words of the first two sorts "Tier 2" words, and the specialized and technical words "Tier 3." "Tier 1" words, in contrast are those which are relatively common in everyday speech. (Beck & McKeown, 2002; 2007).

The question becomes whether there is some way in school to stage students' exposure to content and vocabulary in what they read that will be more efficient and more strategic than the unsystematic, but extensive, exposure their more advantaged peers have had outside of school – so that they are at least close enough to be able to take advantage of continuing opportunities to learn... Finding that curricular sweet spot, if it exists, has become a central concern for educators and developers who would like to combine a commitment to higher standards for all with a commitment to greater equity in the actual attainment of those standards.

While not treating these word groups as designating well defined and distinguishable lists, the Word Generation designers seem to have found the rough distinctions useful for guiding a strategy designed to give students some leverage for entering the world of academic language. The idea is that students need to get deeply enough into at least some of these disciplines or specialized topics so that they begin to build a more general or transferrable sense of how more specialized and complex communication works,

making them better prepared to navigate and persevere when they encounter text in a new discipline at those levels of complexity. Picking and calling attention to a relatively small but key set of functional and specialized technical vocabulary relevant to a chosen set of focal topics is a key aspect of their strategy.

The Word Generation middle grades program provides a large number of supplementary week-long curriculum units for grades 6,7, and 8, focused on civic and social "dilemmas" of high interest to young adolescents, which are taken up in class for 15-20 minutes each day alternating across the students' ELA, science, social studies, and mathematics periods. The units engage them in outside reading of a variety of sources, and in discussion, argument, debate, and, at the end of the week, writing about the week's issue. Five focal Tier 2 type words are introduced and used throughout the week, along with a few topic relevant Tier 3 words, in such a way as to introduce students systematically to a substantial corpus of academic vocabulary over the course of the year or years. But the point is that the vocabulary is introduced and functions in context, and the context has the added virtue of introducing students to topics and relevant knowledge that are salient in the wider society and that they will continue to confront in the news, and need in later learning.

The activities also are designed to provide the student with an explicit introduction to the genre conventions of academic talk and writing, argument and exposition, in ways that draw their attention to the meanings carried by those conventions.

Begun first in Boston's schools, the program has subsequently been implemented and evaluated in three other Massachusetts districts and one in Maryland, and it has been adopted in a number of other schools. It also has been extended to the elementary grades (4 and 5) in a similar form (somewhat longer periods, associated more with the elementary social studies curriculum).

This program is an example of a serious effort to help schools and teachers begin to find more systematic ways to introduce high-leverage vocabulary and couple it with experiences designed to give students concrete exposure to the ways language and text genres code and carry higher levels of meaning, by engaging them in activities that lead them for themselves to apprehend such meanings and to want to express them to others.

While some positive impacts on academic language, perspective taking and "deep" reading comprehension are emerging (Snow, 2015; La Russo et al., 2015; Lawrence, Crosson, Paré-Blagoev, & Snow, 2015; Uccelli et al., in press), the developers are very clear that there is still a great deal to learn about how much and what kind of explicit exposure to vocabulary and linguistic forms and their functions may be sufficient to enable most students to participate effectively in the school level precursors to academic discourse, and to access the more complex texts they will encounter in further education. The developers of Word Generation are engaged in a wider program of research designed to find even better answers to these questions. That work includes the development of assessments of core academic language skills (CALS) led by Paola Uccelli at Harvard (also see Snow, 2015) that may prove useful both for evaluating the effects of this program, and also for use by other developers working on related problems.

World Knowledge as a Central Focus

"Core Knowledge," a curriculum approach originally developed by the scholar and literary critic J.D. Hirsch, has a more explicit focus than the Word Generation program on trying to ensure that all students have common access to the kinds of knowledge that serious writers in many fields assume their readers will already know, but which all too large a proportion of the student population will not have been exposed to either at home or school. The Core Knowledge Language Arts (CKLA) curriculum extends from Pre-K through grade 5. Through third grade it has two strands: "Skills" and "Listening and Learning" reflecting the CKLA emphasis on two fundamental insights— "decoding (and encoding) must become automatic and fluent, and broad background knowledge and vocabulary are essential to comprehension." (CKLA, n.d).

Their definition of coding parallels our extension of the term to all levels of text conventions, though of course the early focus of the skills strand is on the alphabetic code and spelling. Listening and learning starts with various routines, engaging children with attention to, and discussion of, teacher-read or otherwise spoken text, to give them access to content and vocabulary that they would not yet be able to read independently. The content is organized and presented in a series of "topical units" that treat material from literature, science, social studies, and the arts—each unit picking a particular topic and sticking with it in daily sixty-minute sessions over a roughly two-week period. The units use a number of different texts and genres focused on the same topic, sometimes zeroing in on particular aspects of it, sometimes broadening, but always working toward increasing the complexity of the ideas and text, and stressing the relevant vocabulary, words both of general relevance to understanding more sophisticated text and words relevant to the particular topic.

The curriculum for 4th and 5th grade has only one strand, which combines emphases on continuing to build students' reading and writing skills and extending their knowledge and vocabulary through study of six to nine content/topic focused units (ninety-minutes a day). It includes material from literature, history, and science and pays explicit attention to building vocabulary and handling increasingly complex text.[13]

These materials represent an embodiment of the argument Hirsch has made over the years: all students should have studied a common core of knowledge and texts which will provide them with a shared level of "cultural literacy." He contends that this kind of cultural literacy is essential for all students, if they are to have the background knowledge necessary to support effective comprehension of more advanced and ambitious text.

Core Knowledge has come under criticism over the years for promoting what some would

13. It looks as though the 4th -and 5th-grade units are still under development—the pre-K to 2 materials are now available free online because they were adopted by the NY State Department of Education as part of its Race to the Top funded EngageNY initiative to make a full Common Core aligned curriculum available to teachers and schools–everywhere, not just NY. The later grade materials are being developed in collaboration with Amplify Education, Inc. and some at least can be accessed on their website. All grades also can be accessed through the Core Knowledge Foundation's own site.

claim is a kind of cultural imperialism, but the role of prior knowledge and vocabulary in comprehension is undeniable, and we accept the idea that simple equity argues in favor of making at least some substantial body of common knowledge available to all. Hirsch and his colleagues have been quite responsive to the need to diversify the content of such common knowledge, and they seem to have been very serious about trying to monitor the results of the program and to modify it to make it more effective, and more inclusive and accessible, both to students and teachers.

We certainly need more such examples of principled efforts to develop ordered approaches to helping students learn the conventions through which literate communication systems code increasingly complicated and important meaning, and we also think that such learning has to be grounded in direct attention to the meanings—the knowledge being coded—and to ways of thinking and reasoning about such knowledge that go beyond just understanding the particular messages encoded in specific texts.

There simply is a dismaying dearth of high-quality, accessible, and ordered materials—not enough in enough substantive areas to be able to give students choices and maintain interest (and have some place to go to have the kinds of replicated experience across different specific content that ultimately may support the development of capability for more general transfer). Wider recognition of this shortage might shift the balance of investment and development effort away from the current heavy focus on assessment toward the production of more and better instructional materials.

Other efforts are under way to produce curriculum or curricular units and materials focused on helping students learn to communicate with increasing effectiveness and sophistication in genres associated with school subjects and academic disciplines. Two notable examples are the materials in science literacy being developed by David Pearson and his colleagues in the U.C. Berkeley based "Seeds of Science, Roots of Reading" program (Seeds of Science/Roots of Reading, n.d.), and work at the University of Michigan led by Annemarie Sullivan Palincsar, Shirley Magnusson and others "Guided Inquiry supporting Multiple Literacies" (GIsML) (The GIsML Project, n.d.), which focused on the kinds of discourse and text that support the development of scientific thinking and concepts.

We don't mean to hold any of these examples of curricula with a greater focus on content and vocabulary as being perfect, but what seems to characterizes all of them is that they are undertaken with a commitment to empirical inquiry and an emphasis, with quite varying degrees of balance between the two aspects, on explicit attention to the conventions of literate communication and an orderly introduction both to those conventions, and to the core vocabulary and knowledge needed by all participants in a society to support their mutual understanding and as a basis for further learning.

They all also wrestle with the problem of providing the kinds of text and other materials needed to support these approaches to ordered, systematic instruction. There simply is a dismaying dearth of high-quality, accessible, and ordered materials—not enough in enough substantive areas to be able to give students choices and maintain interest (and have some place to go to have the kinds of replicated experience across different specific content that ultimately may support the development of capability for more general

transfer). Wider recognition of this shortage might shift the balance of investment and development effort away from the current heavy focus on assessment toward the production of more and better instructional materials.

Nevertheless, we ought also to look more closely at current approaches to assessment.

ASSESSMENT

Two of the fundamental questions that should be asked of any attempt to design an assessment are: 1) What is it you think you are assessing or measuring? 2) What do you want to do with the information you get—*i.e.,* what inferences do you want to make, and decisions take? (NRC, 2001). And then, of course, you have to figure out how to get that information in a form that would justify such inferences and decisions.

With respect to literate communication, our discussion suggests that what you might want to assess is whether students are able to decode and use the conventions of text genres to access the meanings of, or form representations from, texts that exemplify particular genres, and/or whether they can use them to encode and transcribe representations into text. In both cases you might want to know how *well* they are using both cross- genre general and genre-specific conventions. Or you might want somehow to assess the quality or complexity of the best message or representation they could encode or decode given specified, perhaps ideal, conditions of time, available additional resources, activity or purpose, and genre. That is, you might be interested not only in their capability to use the identified conventions to encode or decode meaning, but also in the quality of those meanings–the best they could do—to the extent that such a thing could be disentangled from the meanings carried by the conventions *per se*. Or you could be assessing both in some combination (and perhaps realize that you can't fully escape doing that).

An Aside on Ethics and Equity

We feel it is important to say something here that is as much about ethics and equity as it is about science. It is our hypothesis that most students can learn the conventions of literate communication to encode and decode the meanings that they already have some experience with and conception of. Within that range, what they can read or write ought not to be particularly distinguishable from what the most capable of their reader or writer peers can do. What is being learned is quite teachable with time, practice, and effective instruction. It is not a unitary trait but rather a teachable set of capabilities. If a student fails, it is because the student has not had the time or the opportunity to learn—or for some reason has not engaged with learning.

Still, this does not mean that the quality of particular mental representations and students' work related to those representations, will necessarily rise to the same high level for all students given more time and instruction. Meaning, content, and thinking extend well beyond the meanings that the general and specific conventions have developed or

evolved to carry, and they are affected by individual differences and influences that go beyond what schools and instruction can do. There always will be individual differences, but that observation should be irrelevant from the perspective of instruction. Instruction should deal with specific goals and expectations for each individual and should bring them to the point where they can meet the requirements for what they themselves want to do next, and for functioning well in their lives. A society's institutions may have legitimate reasons to want to select among individuals on the basis of assessments of some kind. It is reasonable for instruction to anticipate selection of that sort and, if the criteria being used are justified and teachable, to focus on students' learning to meet those criteria as part of its responsibility. But the job of instruction itself is to teach not to select.

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Just to be clear: slogans of the form "every child should have the opportunity to learn up to his or her potential" are well meaning, but we think they are misguided. "Potential" has the connotation of a particular limit, even if it means something higher than what is normally expected of children who have not been served well by society. We see no justification for thinking that there are any particular limits. People always can learn more. So the goals of instruction should always be framed as "at least" and that least should always be enough to be in the game—to be a participant and a contender. Goals like that don't need to be, and probably shouldn't be, precise, and they also will inevitably be a moving, improving target, but they definitely would benefit by being framed in concrete, curricular terms.

One other clarification that we wish weren't necessary: We are talking about individual differences not group differences. Equity does demand recognizing that group membership deeply affects individual group members' opportunities to learn in many ways that must be taken into account, and we do see "gaps" in group performance as being indicators of differential opportunity. But we see no scientific basis for considering group differences in performance as reflecting group "traits" of any kind. That is not a useful hypothesis, and holding it can itself cause harm. We would not wish to debate that point.

"Formative" "Assessment"

In any case, more immediately and practically, what is there to say about using assessment during instruction to inform the teacher of what the student has learned so far, alert him or her to any problems, and to suggest what needs to happen next to keep the student moving toward the goals of instruction?

Our view is that "formative assessment" of this sort is most usefully done by teachers in the course of day-to-day instruction and close to the time when the actual learning is

taking place. It requires teachers to have a clear idea of what students are supposed to be learning and how to tell where they are in the process of doing so. Since we are skeptical about the likelihood of identifying any single developmentally necessary progression in the learning of capability for literate communication, we suggest that understanding of the order in-, and level to-, which students should learn, and indications of problems they might have, should be built into the curriculum teachers are, or will be, using, and into the supports available to them for learning to use and refine that curriculum. Such a curriculum ought to provide opportunities to make students' learning progress visible to their teachers. The examples we have touched on above fit this description in varying degrees. The argument for using a common curriculum of this sort across a wide set of jurisdictions seems strong. Among other considerations it could act as a kind of stand-in for a natural progression, or set of progressions.

In a way the analytic distinction we were making above between the coding conventions and the quality of the particular messages being coded could be rather crudely characterized as a focus on skills *vs.* concepts. Certainly there is a strong case to be made for the value of using quasi-standardized formal and informal "diagnostic" assessments that are not necessarily developed as part of the regular curriculum, to gather evidence about where students stand with respect to the earlier stages of skill development, such as fluent decoding at the word level and perhaps spelling. At those levels there are many steps involved—probably too many for a teacher to keep in mind and check efficiently on his or her own. And we certainly accept the value and importance of screening for possible disabilities. But there is a legitimate question whether the information gained from administering external standardized assessments is worth the disruption and time involved—especially given the imprecision of the discriminations the assessments can make among the levels of coding and the quality of the representations that students can understand or produce in what they read and write, particularly at the lower and the higher levels, compared to what the teacher can gather from direct contact with the children themselves and their ongoing work.

The question of the use of "performance assessments" is more complicated. They involve asking students to produce work of complexity comparable to the things they would be asked to do in settings in the real world, so they carry a kind of face validity, as well as the potential to demonstrate students' "deeper learning" and/or "21st Century Skills" in ways that are arguably harder for standardized, particularly multiple-choice, tests to approximate. If the use of such performances is part of the ongoing activities in the regular curriculum, and students have a reasonable opportunity to learn and practice what is expected, then asking them to take on-demand assessment versions of the same performances is not unreasonable and could give teachers a better idea of how students may do on their own, and even whether they might be able to transfer to some non-school settings. Whether this needs to be done by people other than the students' teachers, and particularly on a system or state-wide basis, is a different question, one we will say more about below.

TWO PROGRESSIONS-ORIENTED APPROACHES TO ASSESSMENT

There are two interestingly contrasting approaches to designing assessments that report results in terms referenced to learning progressions, and that are intended to be used to support both formative and summative inferences. The first is Renaissance Learning's "Core Progress™ for Reading" assessments that take advantage of the vast amount of test item data available from the widespread use across the country of the company's computer adaptive standardized achievement tests (Renaissance Learning, 2013). The second is the set of research- and theory-based literacy assessments and progressions frameworks developed by the Educational Testing Service's (ETS) "Cognitively Based Assessment *of*, *for*, and *as* Learning" (*CBAL*™) project (ETS, n.d.).

Renaissance Learning's Core Progress for Reading

Renaissance Learning developed their "empirically validated learning progression" for reading in a couple of phases. First, their staff conducted a content analysis of research literature on reading and all of the existing state, NAEP, and international standards and developed a kind of consensus description of what students were expected to learn and be able to do in English Language Arts/Reading Comprehension across the school grades, specifying year-by-year expectations. Their description was carefully vetted by outside experts and educators. They identified five major domains of progress, aligned with college and career ready standards: 1) word knowledge and skills; 2) comprehension strategies and constructing meaning; 3) analyzing literary text; 4) understanding author's craft; and 5) analyzing argument and evaluating text. These in turn were decomposed into 36 skill areas, and 650 grade-level skill statements (the specific level of performance or understanding of a skill expected at that grade). The relationships among the skills were considered, and a sub-set of focus skills that were seen as being more central, or as being pre-requisites for others, were also identified. Then the thousands of items from Renaissance's STAR assessments administered to millions of students over the years were searched for items that could be classified as measuring the identified skills, and many new items were written for the skills, as needed, and included for calibration in ongoing administrations of STAR.

To simplify description of the process, the basic approach then was psychometrically to estimate the (average) difficulty of the sets of items that were judged to measure specific grade-level skills and then to compare (roughly, by using correlation methods) the relationship between the expected order in which the skills should be learned with the order of average difficulty levels of the sets of items determined to be assessing those skills. As reported, the correlations were really quite strikingly high— ranging closely around .90 for the five domains. Renaissance argues that this makes a strong case that their theoretical- and consensus-based progression expectations are empirically confirmed.

Since the skill items were calibrated in terms of their relationship to the general STAR reading scale (using Rasch style modeling), Renaissance suggests that it should be

possible to reason from students' STAR scale scores to a prediction about where they are likely to stand with respect to the skills in the progressions for the five domains. That extrapolation seems vulnerable to the phenomenon of ecological correlation, which might make specific predictions uncertain, and Renaissance does not push this last step too strongly. Renaissance does say that teachers or schools might use these empirical associations to suggest the areas of reading skills that might be the focus of attention for students or classes given where they perform on the STAR scale. In this sense they are suggesting a formative use for their assessment information based on these progressions. They also stress the value of looking more closely now at the skills they have identified and located, and their relationships to each other, as a basis for refining and extending our understanding of how reading is learned. There are of course some anomalies and discrepancies in their data, and they rightly suggest that those too may teach lessons on a closer look.

There is no denying that the statistical results are quite impressive, and, while from our perspective of literate communication, the domains and skills appear somewhat incomplete because they focus primarily in a literary direction, we look forward to learning more about what teachers make of this information, and what they do with it when they see it.

ETS's Cognitively Based Assessment *of, for,* and *as* Learning

ETS's project on Cognitively Based Assessment *of*, *for*, and *as* Learning (*CBAL*™) is a long-term research and development effort to design assessments based on evidence and theory from the learning sciences about how particular subjects and skills are learned, so that the assessments will report where students' learning stands in terms defined by that evidence and theory, rather than simply where they stand relative to their age or grade peers. Such assessments should define what students know and can do in more substantive terms ("of learning"), but they also can guide both teachers and the students themselves more specifically on problems the students may be having and on what they need to do next ("for learning"). Additionally, the assessments have been designed to offer substantively relevant experiences that could themselves be instructive ("as learning").

Pursuant to CBAL's goals, the team responsible for the English Language Arts assessment designs carried out a comprehensive review of the literacy literature and developed a quite detailed "ELA Competency Model" as a framework for specifying the targets of the assessments they are designing (Deane et al., 2013) They divide the cognitive domain into three "Modes of Thought"—**Interpretation**, **Deliberation**, and **Expression**. They say that, roughly speaking, these three correspond to reading, (critical and reflective) thinking, and writing, but they stress both that these are fundamental functions that are not limited to literacy, and that reading, writing, and thinking all can involve aspects of each of the three more general functions. Then, with respect to literacy, they crosscut these modes of thought with five "modes of cognitive representation": **Social**, which deals with people

and their communicative purposes; **Conceptual**, mental models of the world; **Discourse,** the purpose and forms of texts and spoken communication; **Verbal**, the structure and meaning communicated by language; and **Print**, orthography and other modes by which language and text are embodied in physical form (Deane et al., 2013).

"The CBAL learning progressions are organized into skills foci. Each skills focus has three interrelated progressions associated with it, one for each mode of thought: interpretation, deliberation, and expression.

The provisional learning progressions are intended to provide guidance in the construction of assessment tasks and in the scaffolding of skills and strategies for instruction. However, these sequences are not intended to offer a strict scope-and-sequence for instruction. The skills and strategies identified in these progressions are normally highly interconnected and best learned together in coordinated tasks and contexts. The progressions we have proposed are intended primarily as an analytic tool. Given a particular skills focus, which typically involves a characteristic task (such as telling a story), the learning progressions provide ways to scaffold the task (for instructional purposes) and to identify sources of evidence that can help to pin down what students need to learn. However, any realistic literacy task typically requires many skills to be integrated and applied, and so we recommend that these progressions be used to inform instruction, not to define a curriculum." (ETS, 2012)

While we find this way of slicing up the domain of literate communication a bit confusing, we appreciate the focus on "representations" and communication. Our confusion comes from treating the substance of communication, the "message," as reflected in the social and cognitive modes, as somehow being on the same continuum, or as categories of the same kind, as discourse, verbal, and print, which all are more closely tied to the conventions of spoken and literate communication *per se*, *i.e.* the "medium. We do appreciate the focus on both spoken language and literate communication, although they sometimes seem to be treating it all as being literacy, whereas we prefer to recognize the relationship but to distinguish them from one another.

Crossing the three modes of thought with the five modes of cognitive representation produces 15 cells, each designating a particular literacy skill, and which, taken together, "represent the entire range of skills that readers and writers must exercise, often simultaneously, or in rapid succession" (ETS, 2012, parag. 1). They provide—an appropriately descriptive label for the skills at each of the 15 intersections—for instance, "decode" at print and interpretation; "situate" at social and deliberation, and "structure" at discourse and expression.

CBAL's literacy learning progressions seem to be aimed at the component skills required for carrying out common and important literacy tasks or activities—"skills foci" (the sidebar provides a description of the learning progressions in the words of the CBAL team). They are "provisional," and certainly hypothetical, since most of the ones the team lists have not actually been observed in studies of students' work and performance over time, although use is made of other scholars' empirical work when that is available and relevant. The progressions tables consist of thumbnail descriptions of what students "can do" at each of five levels of sophistication as they become more competent in the particular skill focus as it is applied to the relevant literacy task. There also are descriptions at each level for how the skill is deployed for each of the three modes of thought—interpretation, deliberation,

and expression. The five levels of competence or sophistication are the same across all of the progressions and take the form of rubric-like (or "achievement levels" in standards-speak) labels: "**Preliminary**, **Foundational**, **Basic**, **Intermediate**, and **Advanced**".

For reasons that are unclear in the wiki presentation of this framework, each of these levels comes with a somewhat varying parenthetical label, usually tying the level to some level or levels of language, text, or discourse. For example, in the description of a progression for "hypothesis testing" skills, the levels—"preliminary, foundational," and so on–are parenthetically labeled: "oral to sentence, sentence to paragraph, paragraph to text, text to context, and text and context to discourse." There is no explanation provided that we could see, and it is hard to say what these connections add to understanding—though in some cases we sense that there may be some parallel to what we refer to as conventions for the ways different levels of a text code different levels of meaning (if that were so, it would be a very interesting contribution, but to be useful it would have to be spelled out explicitly and in more detail).

We have a few reservations about some aspects of the CBAL work, which, no doubt, stem from its preliminary nature. The first is the use of rubric-style labels across the board for levels of progressions. These seem to lose or mask all of the substantive information that ought to be a benefit of having progressions, if they actually can be identified. The second is that CBAL's descriptions of the "Preliminary" levels in their provisional progressions almost always sound rather far along, giving the sense that students who can do what is called preliminary must already have gone through quite a number of prior steps. Despite these reservations, we recognize that where CBAL seems really to have worked out a progression in detail, as for instance with respect to assessing students' progress in learning "argument," the relevant progressions have helped to inform the development of assessment activities that are designed to reveal where students are, both in their control of important preliminary and component skills and understandings of argument, and their ability to put them together in the context of more complex simulations that give them a chance to engage in "real" argument.

CBAL researchers say that their progressions should not be seen as defining a curriculum but rather as analytic tools to inform instructional "scaffolding" and to guide the development of assessments. We think they should reconsider that limitation. If assessments are seen as standing outside regular instruction, no matter how substantively informative and educative they are—and if the categorical framework they use is not also deeply familiar to teachers—they are very unlikely to be incorporated into and have a beneficial effect on teaching[14].

14. In a more recent paper, Paul Dean and his CBAL colleagues (Dean et al., 2015) (ETS RR-15-17 Dec. 2015) offer the idea of "Key Practices" in English Language Arts (ELA) as a kind of bridging concept that might help to ameliorate a problem CBAL sees in helping teachers to appreciate the instructional relevance of their ELA competency model, with its complex set of crosscutting categories that generates a large number of specific skill dimensions and hypothetical learning progressions associated with each of those skills.

In terms of assessment design, if the Key Practices and their component skills are well described at a fairly general level, they then can constitute definitions of important task domains from which CBAL could draw samples of particular assessment tasks and support an argument that students' performance on those

CBAL's framework makes a very useful beginning to identifying the ways and levels through which text codes meaning. If those fairly complex, and sometimes technical and obscure, understandings are to become accessible and useful to teachers and students, they will have to be embodied in curriculum materials that make the connections between meaning and coding concrete and explicit, and provide the levels of repetition, variation, interest, and substance necessary to make them stick. Guiding the development of such materials and experiences is a task worthy of the efforts and thought CBAL has devoted to this framework.

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tasks might represent what they could do in the domain more generally. CBAL makes a case for the use of what they call "Scenario-based Assessments" (SBAs), which ask students to perform a complex quasi-real-world exercise but also, in leading up to that, to answer a number of more specific test items that are designed to tap their understanding of the component (in this case literacy-related) skills that the "capstone" performance requires them to integrate.

We recognize the Key Practices idea as a relative of our variously used terms— activity situation, activity system, genre, context, purpose, and, probably discipline or subject. These are all attempts to find a heuristically useful way to "carve nature at its joints" (thank you Plato) for purposes of choosing units of analysis or curricular focus that are recognizable and likely to help teachers and students understand what they are trying to teach and learn.

We would, however, make two critical observations about the CBAL approach, seen from the perspective of our own paper.

First, it is important to notice that CBAL is talking about "English Language Arts" in general, and not just literacy per se, though their language often slips into calling the whole enterprise literacy and literacy skills. While we appreciate the recognition of the inherent connection between spoken language and literate communication, we think it may be clearer and more productive to treat both spoken language and systems of literate communication as analytically separable tools that function, and of course interact, in the context of supporting the communication needs of human activities. The conventionalized forms (what we call coding) through which both kinds of tools convey meaning can be taught to, and learned by, all participants in the activities these communication practices support, in relatively straightforward ways, but they are not the whole story. We think the processes of thinking, reasoning, problem-solving, evaluating, concept formation, analyzing, synthesizing, and so on deserve analytically separate attention and should be recognized as practices in their own right, also central to human activities, even as we also recognize that they and their meanings are identified and communicated about in speech and writing. But whether that observation is right or constructive deserves a longer conversation.

Second, we think that CBAL's fundamental orientation toward assessment and particularly "measurement" imposes a serious distortion on their analysis that, as we argue in our paper, makes it difficult for them to be really helpful to instruction—even as they struggle to identify instructional foci like Key Practices that ought to be more recognizable to teachers. Where CBAL is coming from, "assessment" tries to identify characteristics that are relatively stable over periods of time. That is not the first issue in the midst of instruction. The CBAL ELA group has done such good work in scoping out the important dimensions of what should be learned. We think this group really would do education a service if they could turn it all directly to instructional design, to curriculum, and worry about assessing the results in that more immediate context, in its own terms—and leave generalization for later, down the line. That would represent an institutional and organizational challenge, of course, but ETS is certainly one of the institutions that obviously has the resources and talent to take on such a challenge.

ASSESSMENT POLICY

Thinking about assessment and these examples leads us to argue that for purposes either of informing instruction or targeting accountability, it is unwise to try to develop large-scale assessments that are intended to be administered to widespread student populations during some common time period of necessarily limited duration, in the hopes of producing "scores" that will be both comparable across jurisdictions and useful for guiding instructional decisions. This is because the goal of comparability, along with time and cost constraints, drives one toward using psychometric models that are more appropriate for measuring presumably relatively stable traits, like IQ and aptitudes. But the purpose of instruction is to *change* knowledge and skill, so using measures that tend to be weighted toward relatively unchanging attributes to assess the outcomes of instruction is inappropriate. Assessing whether particular things that are instruction's goals have in fact been learned, especially if those goals are complex and ambitious, requires looking at specific, often complex and extended, performances, which can take more, and more varying, time than large-scale testing is likely to afford.

This kind of ambitious assessment is best done using materials related to students' specific classroom and learning experience. Children first learn to apply higher-level cognitive processes in the context of work with familiar material. They are not likely to demonstrate such skills in new situations, even if they were able to when the material was something they have worked with before. Assessments that try to accommodate to this by using material that is supposed either to be equally familiar or unfamiliar to all students are likely to be unfair, since such suppositions are almost sure to be wrong.

However, it is true that contemporary standards also expect students to be able to apply what they have learned to new situations. If the goal is also to assess and hold students and their schools accountable for that sort of transfer of knowledge and skills, fairness would require making a compelling argument that there are accepted and warranted ways to teach transfer that school professionals should know, and that they also have agreed-upon and widely available ways of telling whether or not opportunities of that sort had been provided. Otherwise, again, really just I.Q., or family resources are being measured.

We do not believe that the current state of knowledge about the pedagogy needed to enable the bulk of students to attain high levels of transfer is sufficient to justify making achieving this goal a matter subject to high-stakes accountability, though there is no reason not to try to strive for such a goal, to assess for it if possible, and to report progress, as a basis for learning how to do it better.

The point should be to expect schools to try to teach *all* of their students both specific and more ambitious or general capabilities, and hold them accountable for taking responsibility for gathering evidence of whether students are succeeding, and for trying

to respond to them in an appropriate and timely manner when they are not. That is more likely to happen if "assessment" occurs much closer to day-to-day practice. It probably also would help if the process were called something other than formative *assessment*, because for teachers "assessment" seems often to carry "testing" and "grading" connotations and can divert attention from seeking evidence of students' progress that can be used constructively to inform the next steps in instruction.

CONCLUDING THOUGHTS FOR POLICYMAKERS, WITH IMPLICATIONS FOR RESEARCH AND DEVELOPMENT

We might hope that the general advice we would offer to education policymakers based on what we think we've learned about literate communication should by now be pretty clear. Unfortunately, even if the general outline is clear, it is likely to be hard to accept and act on. American tradition in most states, and in all states *vis a vis* the federal government, stresses local control in matters like school curriculum. Current "reform" ideology stresses a "loose/tight" approach—hold schools strictly accountable for their students' outcomes, but leave them free to determine how to teach to achieve those outcomes (at least up to the point where they fail, in which case more restrictions may be placed on the choice of inputs).

In the face both of tradition and ideology, our recommendation that as wide a range of jurisdictions as possible develop, or make a reasoned choice of, a common (albeit "dynamic") curriculum to support students' learning of core capabilities for literate communication will be a hard sell.

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In addition, since we do not believe that we collectively know enough to design a perfect curriculum right now, our recommendation treats any such choice as being a hypothesis about what will be effective and implies that it should be implemented along with new organizational infrastructure designed to capture and share what does and doesn't seem to be working, and to feed that information back into a continuing design process which provides for revisions on some reasonable periodic basis. Learning to do a lot better will take time, a lot of time, and will require a combination of commitment and tentativeness. Politics and policy do not provide a lot of incentives either for patience or for a committed but experimental and tentative style.

So the odds against anything like this happening on a wide scale in any near future are really pretty high. And we have to admit that no one who looks at contemporary American politics, or the level of its civic discourse, can avoid the feeling that the choice of a common curriculum could go terribly wrong, or be driven toward mediocrity, or some mix of both.

Still, while a common curriculum is really not likely to happen at scale in any foreseeable near-term American future, we nevertheless are convinced that high-level performance for a much larger proportion of the student population is also not going to happen *unless* curricula of the sort we describe are designed, tested, and widely implemented. Given that dilemma, the only reasonable hope is that some jurisdictions and some cooperating researchers, teachers, designers, and developers will find ways to work in this direction, and that, as their efforts succeed in contrast with the status quo or other "reform" doctrines, their example may spread (O'Day & Smith, 2016). This of course is what all reformers hope, and hopes are often dashed. But not always—and what else is to be done?

For jurisdictions and partnerships that might wish to develop or adopt instructional programs and policies of the sort we recommend, below we offer a few more specific arguments and suggestions that could be supportive.

For Building Capability, the Curriculum Itself Can Help to Provide and Define "Scaffolding"

While higher common standards, complexity, and challenge can be useful for defining goals "for all," they obviously will not by themselves increase performance or reduce "gaps." The Common Core ELA standards set distinctly higher expectations for the complexity or difficulty of the texts students should be asked, and be able, to read by the end of each school grade. The rationale for this escalation is that the texts that students will be asked to read when they reach college (and the workforce) are much more complex than those they have faced during their secondary schooling. Unless the challenge to students is ramped up over the school years, they will not be ready for the college texts.

Learning to do a lot better will take time, a lot of time, and will require a combination of commitment and tentativeness. Politics and policy do not provide a lot of incentives either for patience or for a committed but experimental and tentative style.

However, confronting increasingly challenging or complex text is not strictly analogous to weight training. With the latter, growth is a direct product of doing more of what you already can do. Text difficulty (at least for text that plays by the rules) is a function of what you don't know. In text that is hard to read and understand, both some of the meanings or content and/or the ways some of the meaning is coded are unfamiliar. Students can't get the meaning just by straining a little harder. They have to find a way to make connections between what they know and the new concepts or relationships, or find a person or other resource to help them do that. Just advising teachers to "scaffold" for the students who are having difficulty with the new, more "complex" texts is not enough specification for what might help a given student.

Our contention is that for a substantial portion of school time the curriculum itself should be designed and ordered so that its materials and experiences try to ensure that, as each student encounters more and more difficult text, they will have access to the substantive and linguistic background knowledge that will help them understand it.

We cannot specify just how such designs would work, but it is not likely that students will only need to climb such ramps just once. Instead, they will need to experience building up understanding in specific subjects or topics a number of times before they acquire a more general facility with new texts of difficulty comparable to the more difficult ones they have previously experienced. Even then, difficult texts in a new subject will require some learning curve. And students are likely to differ in when they can climb such ramps and how many times they will need to make such climbs. This kind of curricular "scaffolding" should be designed to help teachers identify and adapt constructively to these differences.

Thinking and Understanding Involve More than "Literacy" —Try to be clear about what you are trying to teach and assess.

We make an analytic distinction between substantive knowledge and skill, and linguistic knowledge and skill—between knowing what you want to say to others or understand from them and knowing how to say it. Young minds don't make this distinction. They learn how to say things by trying to say particular things, and they learn how others say things by hearing them say particular things. Their initial learning of grammar and syntax and other levels of coding is acquired tacitly and in specific contexts, but it does seem to generalize beyond specific content, whereas new content is new each time. Since text persists and can be reflected on, in contrast to the spoken word, literacy of course makes it possible to focus more explicitly on how things are said or written, and the "rules" can be formalized and taught. We think that almost everyone can learn to understand and use the conventions of literate communication, at least for meanings up to the level of sophistication or complexity of the meanings they otherwise themselves understand. But if they are asked to read and understand text that uses the conventions they know to communicate about unfamiliar topics, they still will find those texts to be difficult to comprehend. That will be reflected in their inability to give correct answers to some questions about the text. If they are asked to reason about the text or make comparisons or to do other things that go beyond direct understanding of the text, whether it concerns familiar or unfamiliar content, that too may be difficult.

We argue that for purposes of assessment it is important to be clear about whether you are trying to assess students' capability for literacy *per se* or whether you also are interested in assessing substantive knowledge and/or reasoning and thinking capability. Of course all such things may be goals of instruction and should be assessed, but capability with the conventions is probably easier to learn, and we likely know more about how to teach that than we do about teaching thinking in general. It would be really important to be as clear as possible about such distinctions in designing assessments and making inferences about what students know and are able to do.

Fair and Valid Assessment of Higher-Level Knowledge and Understanding Cannot be Curriculum-Neutral or –Independent.

You can't fairly and validly assess students' capabilities for "higher level" thinking and understanding unless you have a good approximate idea of the terms in which they have, or should have, learned such things. You can't fairly or validly assess teachers' effectiveness in teaching these more ambitious things based on their students' assessment performances unless you can design the assessments using the terms in which the teachers taught or should have taught them. On the latter, fairness in holding teachers accountable for their students' meeting ambitious standards requires that there really is evidence that teachers ought to be aware of and know concerning what approaches are generally effective, and how well and over how much time and exposure they "work," for comparable students using comparable school resources.

Time to Consider Syllabus-based Examinations?

What we have just asserted about the need to be able to tie assessment design closely to assumptions about what and how students should have been taught would sound familiar to educators in other advanced societies that have national or regional syllabus-based examination systems. Aside from some aspects of Advanced Placement and International Baccalaureate assessments, and the older New York Regents exams, these ideas have not taken hold in America[15].

15. Our recommendation here parallels arguments that Marc Tucker, President of the National Center on Education and the Economy (NCEE) has long made concerning the role that syllabus-based examination systems play as part of the more coherent instructional systems in some of America's high-performing competitors. He contends such systems are responsible for enabling larger shares of those countries' school age populations to meet high standards of knowledge and skill than the proportion of American students who do so—see NCEE/CoIEB report, *Fixing our National Accountability System* (2014), for a recent example. Tucker's thinking has some of its roots in the important background paper that Lauren and Daniel Resnick wrote for the classic 1983 report *A Nation at Risk*. That paper—"*Standards, Curriculum, and Performance: A Historical and Comparative Perspective*" (1982)—made a fundamental distinction between tests and examinations—"tests" being the kinds of standardized, curriculum-agnostic devices used here, and "examinations" meaning the kinds of curriculum or syllabus grounded longer form exam items and papers used then in the U.K., France, and elsewhere—and argued that tests of the sort we use really could not be used to assess and encourage higher level thinking and performance. We can't help but feel that if the Commission that produced *A Nation at Risk*, and American education more generally, had paid more attention to the Resnicks' argument, our schools and students would have had a much better chance of meeting the Nation's Goals 2000 dreams.

Support Strategic Research, Design, Development, and Continual Improvement of the Knowledge Instruction Requires, and the Institutional Infrastructure Necessary to do that.

However, all we have said is hypothetical. As we wrote this review, we often found ourselves at a loss for clear, specific words and for compelling evidence. We speak generally about "the conventions through which literate communication systems express aspects of higher levels of meaning in text," but the categories used in linguistics (psycho- and socio-), in discourse and conversation analysis, and in related fields that might attach more concrete meaning and examples to our general allusions are obscure and technical and not very friendly for teachers and students to use.

We call for much more sustained and systematic efforts to "translate" these disciplinary findings and vocabulary into forms usable by practitioners.

We also call for the use of curricula and materials that provide a systematic and extended focus on developing understanding of, and ability to read and communicate about, important topics and subjects of school-related, long-term value, along with exposure both to the relevant subject-specific vocabulary and the necessary general-function, "academic" words and registers. But we can only point to the beginnings of efforts to define and develop such things, which so far have made only a small dent in the severe lack of relevant high-quality materials. We cite the efforts of SERP (Word Generation and CALS), TCRWP, CKLA, and CBAL, along with others, to map this territory and its categories and begin to develop and deploy usable materials. We want particularly to acknowledge the importance of TCRWP's example in developing a motivational and organizational structure that demonstrates how to get teachers focused and working together in a professional way to continue to refine and improve their practice, coupled with serious attention to finding ways to make some of the more arcane technical terms and concepts practically accessible to them and to their students.

Institutions responsible for setting and funding research, design, and development agendas—federal agencies such as IES and NSF, private foundations, commercial developers and publishers, universities, professional organizations, academic and disciplinary associations, all will have to recognize the need for finding ways to organize, legitimate, and support more strategic approaches to developing, deploying, testing, and refining the required knowledge, infrastructure, and materials. Others have written well about these issues (Donovan, Wigdor, & Snow, 2003: Burkhardt & Schoenfeld, 2013; Bryk & Gomez, 2008; Ball, 2003; Snow, 2015), but if we are seriously concerned that all students have an equitable opportunity to learn what they will need to know in the 21st Century, it really is time to go beyond reports and actually develop the knowledge and resources we need to get on with the job.

References

Adams, M.J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: Massachusetts Institute of Technology Press.

Adams, M.J. (2011). The relation between alphabetic basics, word recognition, and reading. In S.J. Samuels & A.E. Farstrup (Eds.), *What research has to say about reading instruction* (pp. 4-24). Newark, DE: International Reading Association.

Adams, M.J. (May 14, 2015). *Knowledge for literacy*. Albert Shanker Institute (blog post). Retrieved from http://www.shankerinstitute.org/blog/knowledge-literacy

Aitchison, J. (2012). *Words in the Mind: An Introduction to the Mental Lexicon 4th Edition*. Hoboken, NJ: Wiley-Blackwell Press.

Anderson, R. C., & Nagy, W. E. (1992, Winter). The vocabulary conundrum. *American Educator*, *16*(4), 14–18, 44-47.

Bailey, A.L., & Blackstock-Bernstein, A. (2014). *Dynamic Language Learning Progressions (DLLP) features analysis protocol*. DLLP Project: University of California, Los Angeles.

Ball, D. (2003). *Mathematical proficiency for all students toward a strategic research and development program in mathematics education*. Santa Monica, CA: RAND.

Bereiter, C., & Scardamalia, M. (1987). *The Psychology of written composition*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Biemiller, A. (2001, Spring). Teaching vocabulary: Early, direct, and sequential. *American Educator*.

Brown, W.M. (2011). The parental antagonism theory of language evolution: preliminary evidence for the proposal. *Human Biology*, 83(2):213-45. DOI: 10.3378/027.083.0205.

Brown, G., & Yule, G. (1983). *Discourse analysis*. Cambridge: Cambridge University Press.

Bruner, J. (1966). *Studies in cognitive growth*. Hoboken, NJ: Wiley.

Bruno, J.L., Zumberge, A., Manis, F.R., Lu, Z-L., & Goldman, J.G. (2008). Sensitivity to orthographic familiarity in the occipito-temporal region. *NeuroImage*, *39*, 1988-2001.

Bryk, A. S., & Gomez, L. M. (2008). Ruminations on Reinventing an R&D Capacity for Educational Improvement. In F.M. Hess (Ed.), *The future of educational entrepreneurship: Possibilities of school reform* (pp. 181-206). Cambridge: Harvard Education Press.

Burkhardt, H., & Schoenfeld, A.H. (2003). Improving educational research: Toward a more useful, more influential, and better-funded enterprise. *Educational Researcher*, *32* (9), 3-14.

Beck, I.L., McKeown, M.G., & Kucan, L. (2002). *Bringing words to life*. New York, NY: The Guilford Press.

Beck, I. L., & McKeown, M. G. (2007). Increasing young low-income children's oral vocabulary repertoires through rich and focused instruction. *The Elementary School Journal*, 107, 251–271.

Booth, J.R., Perfetti, C.A., & MacWhinney, B. (1999). Quick, automatic, and general activation of orthographic and phonological representations in young readers. *Developmental Psychology*, *35*(1), 3-19.

Calkins, L. (2015). *Reading Pathways, performance assessments and learning progressions: Grades 3-5*. Portsmouth, NH: Heinemann.

Calkins, L. (with Hohne, K.B. and Robb, A.K.) (2014). *Writing Pathways: Performance assessments and learning progressions, grades K–8*. Portsmouth, NH: Heinemann.

Clements, D., & Sarama, J. (2004). Learning trajectories in mathematics education. *Mathematical Thinking and Learning*, *6*(2), 81-89.

Clements, D., & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach* (Studies in mathematical thinking and learning series). New York: Routledge.

Common Core State Standards Initiative (n.d.). English Language Arts Standards, Introduction, Key Design Consideration. Retrieved from http://www.corestandards.org/ELA-Literacy/introduction/key-design-consideration/

Confrey J., Maloney A., Nguyen K., Mojica G., & Myers M. (2009). *Equipartitioning/splitting as a foundation of rational number reasoning using learning trajectories*. Proceedings of the 33rd Conference of the International Group for the Psychology of Mathematics Education (pp. 345–353). Thessaloniki, Greece.

Corcoran, T., Mosher, F., & Rogat, A. (2009). *Learning progressions in science: An evidence-based approach to reform*. CPRE Research Report#RR-63. Philadelphia: Consortium for Policy Research in Education. DOI: 10.12698/cpre.2009.rr63

Core knowledge (n.d.). *FAQ: Core knowledge Language Arts K-5 answers*. Retrieved from http://www.coreknowledge.org/mimik/mimik_live_data/view.php?id=1833&record_id=271p?id=1833&record_id=271#ATA

Daro, P., Mosher, F., & Corcoran, T. (2011). *Learning trajectories in mathematics: A foundation for standards, curriculum, assessment, and instruction*. CPRE Research Report #RR-68. Philadelphia: Consortium for Policy Research in Education. DOI:10.12698/cpre.2011.rr68

Deane, P., Sabatini, J., Feng, G., Sparks, J., Song, Y., Fowles, M., O'Reilly, T., Jueds, K., Krovetz, R., & Foley, C. (2015). *Key practices in the English Language Arts (ELA): Linking learning theory, assessment, and instruction* (RR-15-17). Princeton, NJ: Educational Testing

Service. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/ets2.12063/pdf

Dehaene, S. (2009). *Reading in the brain: The new science of how we read*. London: Penguin Books.

Demetriou, A., Makris, N., Kazi, S., & Spanoudis, G. (under review). The Developmental trinity of mind: Cognizance, executive control, and reasoning. The Wiley Interdisciplinary Reviews (WIREs).

Donovan, M.S., Wigdor, A.K., & Snow, C.E. (Eds.) (2003). *Strategic Education Research Partnership*. Division of Behavioral and Social Sciences and Education: National Research Council. Washington, DC: National Academies Press.

ETS (2012). *The CBAL English Language Arts Competency Model and Provisional Learning Progressions: Classes of literacy activities*. Retrieved from http://elalp.cbalwiki.ets.org/Classes+of+literacy+activities

ETS (n.d.).*The* CBAL™ *Initiative*. Retrieved from http://www.ets.org/cbal.

Francis, D. J., Rivera, M., Lesaux, N., Kieffer, M., & Rivera, H. (2006). Practical guidelines for the education of English language learners: Research-based recommendations for instruction and academic interventions. Center on Instruction.

Graesser, A.C., McNamara, D.S., & Louwerse, M.M., & Cai, Z. (2004). Coh-Metric: Analysis of text on cohesion and language. *Behavioral Research Methods, Instruments, and Computers*, *36*, 193-202.

Graesser, A.C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. Psychological Review, 101(3), 371-395.

Guided Inquiry supporting Multiple Literacies (GIsML) Project.(n.d.). Retrieved from http://www.umich.edu/~gisml/

Halliday, M.A.K., & Hasan, R. (1976). *Cohesion in English*. London: Longman Press.

Hart, B., & Risley, T. (1995). Meaningful differences in the everyday experience of young American children. Baltimore, MD: Brookes Publishing.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3-30). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. E. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1-27). Mahwah: New Jersey: Lawrence Erlbaum Associates.

Hoover, W.A., & Gough, P.B. (1990). The simple view of reading. *Reading and Writing*, *2*(2), 127-160.

Kintsch, W. (2004). The Construction-Integration model of text comprehension and its implications for instruction. In R. Ruddell & N. Unrau (Eds.) *Theoretical models and Processes of Reading,* 5th Edition. International Reading Association.

La Russo M., Kim H-Y, Uccelli P., Selman R., Dawson T., Jones S., . . . Snow C. (2015). *Beyond the simple view: Contributions of academic language, perspective taking, and complex reasoning to deep reading comprehension*. Manuscript submitted for publication.

Lawrence J., Crosson A., Paré-Blagoev J., & Snow C. (2015). Word Generation randomized trial: Discussion mediates the impact of program treatment on academic word learning. *American Educational Research Journal*, *2*, 750–786.

Laxon, V., Gallagher, A., Masterson, J. (2002). The effects of familiarity, orthographic neighbourhood density, letter-length and graphemic complexity on children's reading accuracy. *British Journal of Psychology*, *93*(2), 269-287.

Martin, J., R. (1989). *Factual writing*. Oxford, England: Oxford University Press.

Maurer, U., Brem, S., Kranz, F., Bucher, K., Benz, R., et al. (2006). Coarse neural tuning for print peaks when children learn to read. *Neuroimage*, *33*, 749-758.

McLuhan, M. (1964). *Understanding media: The extensions of man*. New York: McGraw-Hill.

Melby-Lervåg, M., Lyster, S.H, & Hulme, C. (2012, March). Phonological skills and their role in learning to read: a meta-analytic review. *Psychological Bulletin*, *138*(2):322-52. doi: 10.1037/a0026744.

Ministry of Education (2010). *The literacy learning progressions: Meeting the reading and writing demands of the curriculum* (p.2). NZ: Learning Media Limited.

Mosher, F. (2011). *The Role of learning progressions in standards-based education reform*. CPRE Policy Brief #RB-52. Philadelphia: Consortium for Policy Research in Education. DOI: 10.12698/cpre.2011.rb52

Nagy, W., & Anderson, R. C. (1984). How many words are there in printed school English? *Reading Research Quarterly*, *19*, 304-330.

National Governors Association Center for Best Practices and Council for Chief State School Officers. (2010). *Common Core State Standards Initiative*. Retrieved from http://www.corestandards.org/ELA-Literacy/

National Reading Panel (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Bethesda, MD: National Institutes of Health.

National Research Council (2001). *Knowing what students know: The science and design of educational assessment*. Committee on the Foundations of Assessment. Pelligrino, J., Chudowsky, N., and Glaser, R., (Eds.). Board on Testing and Assessment, Center for

Education. Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

National Research Council (2003b). *Strategic Education Research Partnership*. National Academies Press; Washington, DC: 2003b. Available at http://www.nap.edu/catalog/10670.html.

O'Day, J., & Smith, M. (2016). Quality and Equality in American Education: Systemic Problems, Systemic Solutions. In I. Kirsch and H. Braun (Eds.) *The Dynamics of Opportunity in America: Evidence and Perspectives. Princeton, NJ:* Educational Testing Service.

Pelaprat, E., & Cole, M. (December, 2011). Minding the gap: Imagination, creativity and human cognition. *Integrative Psychological and Behavioral Science, 45*(4):397-418. doi: 10.1007/s12124-011-9176-5.

Piaget, J. (1983). Piaget's theory. In P. Mussen (ed), *Handbook of child psychology*. 4th edition. Vol. 1. New York: Wiley.

Pitcher, E. G., & Prelinger, E. (1963). *Children Tell Stories: An Analysis of Fantasy*. Madison, CT: International Universities Press.

PrefixSuffix (n.d.). *Chart of English Language Roots*. Retrieved from http://www.prefixsuffix.com/rootchart.php?navblks=1011000

Renaissance Learning. (2013). *Core Progress™ for Reading: Empirically validated learning progressions*. Wisconsin Rapids, WI: Renaissance Learning. Retrieved from http://doc.renlearn.com/KMNet/R0053985FA6D567F.pdf

Rose, D. (2012). Genre in the Sydney school. In J. P. Gee and M. Handford (Eds.), *The Routledge Handbook of Discourse Analysis* (pp. 209-225). London and New York: Routledge (Taylor and Francis).

Sacks, H. (1987). On the preferences for agreement and contiguity in sequences in conversation. In G. Button and J.R.E. Lee (Eds.), *Talk and social organisation*. Clevedon, UK: Multilingual Matters.

Sacks, H. (1972). An initial investigation of the usability of conversational path for doing sociology. In D. Sudnow (Ed.), *Studies in social interaction* (pp. 31-74). New York: The Free Press.

Sandak, R., Menci, W.E., Frost, S.J., & Pugh, K.R. (2004). The neurobiological basis of skilled and impaired reading. Recent findings and new directions. *Scientific Studies of Reading*, *8*(3), 273-292.

Schelling, T. (1960). *The strategy of conflict.* Cambridge, MA: Harvard University Press.

Schlaggar, B. L., & McCandliss, B.D. (2007). Development of neural systems for reading. *Annual Review of Neuroscience*, *30*, 475-503.

Schleppegrell, M.J. (2001). Linguistic features of the language of schooling. *Linguistics and Education*, *12*(4), 431-459.

Schleppegrell, M.J. (2004). *The language of schooling: A functional linguistics perspective*. New York: Routledge.

Seeds of Science/Roots of Reading (n.d.). Retrieved from www.scienceandliteracy.org

Shaywitz, B.A., Shaywitz, S.E., Pugh, K.R., Mencl, W.E., Fulbright, R.K., Skudlarksi, P., Constable, R.T., Marchione, K.E., Fletcher, J.M., Lyon, G.R., & Gore, J.C., et al. (2002). Disruption of posterior brain systems for reading in children with developmental dyslexia. *Biological Psychiatry*, 52, 101-110.

Slobin, D. (1973). Cognitive prerequisites for the development of grammar. In C. A. Ferguson and D. I. Slobin (Eds.), *Studies of child language development* (pp. 175-208). New York: Holt, Rinehart & Winston.

Smith, C., Clements, D., & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach*. New York: Routledge.

Smith, C., Wiser, M., Anderson, C.W, & Krajcik, J. (2006). Implications of research on children's learning for standards and assessment: A proposed learning progression for matter and the atomic molecular theory. *Measurement: Interdisciplinary Research and Perspectives*, *14*(1&2), 1-98.

Snow, C. (2002). *Reading for understanding: Toward an R&D Program in Reading Comprehension*. Santa Monica, CA: RAND

Snow, C. (2015). *Rigor and realism: Doing educational science in the real world* (2014 Wallace Foundation Distinguished Lecture). *Educational Researcher*, *44*(9), 460-466.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 22,* 360-407.

Tucker, M. (2014). *Fixing our national accountability system*. Washington, D.C.: The National Center on Education and the Economy.

Uccelli, P., Barr, C. D., Dobbs, C. L., Galloway, E. P., Meneses, A., & Sánchez, E. *(2014).* Core academic language skills: An expanded operational construct and a novel instrument to chart school-relevant language proficiency in preadolescent and adolescent learners. *Applied Psycholinguistics,* 1-33.

Uccelli P., Phillips Galloway E., Barr C., Meneses A., Sánchez E., & Dobbs C. (in press). Beyond vocabulary: Core Academic Language Skills (CALS) that support text comprehension. *Reading Research Quarterly*.

van den Broek, P., Young, M., Tzeng, Y., & Linderholm, T. (1999). The landscape model of reading. In H. van Oostendorp and S. R. Goldman (Eds.), *The construction of mental representations during reading* (pp. 71-98). Mahwah, NJ: Erlbaum.

van den Broeck, W., Geudens, A., & van den Bos, K.P. (2010). The nonword-reading deficit of disabled readers. A developmental interpretation. *Developmental Psychology*, *46*(3), 717-734.

van Dijk, T.A., & Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Vellutino, F., R. (2003). Individual differences as sources of variability in reading comprehension in elementary school children. In A.P. Sweet and C. E. Snow (Eds.), *Rethinking reading comprehension* (pp. 51-82). New York, NY: The Guildford Press

Vellutino, F.R. (2014). Theory and Research in the Study of early Reading Difficulties: A Personal Odyssey. In K. Chung, K. Yuen and D. McInerny (Eds.), *Understanding Developmental Disorders of Auditory Processing, Language, and Literacy Across Languages* (pp. 113-145): International perspectives. Information Age Press: Greenwich, CT.

APPENDIX A

THE COGNITIVE AND DEVELOPMENTAL ROOTS OF HUMAN COMMUNICATION

Within the fields of cognitive and developmental psychology there are differing views concerning the details of how the human mind works and is structured, and how that relates to the brain; about which aspects of cognition and perception seem to be built in by evolution; and about the ways that experience and maturation shape the subsequent development of cognitive content and capability. Nevertheless, at the level of analysis relevant to day-to-day instruction, and for providing teachers with an understanding of some of the ways their students may differ, there are some generalizations that most theorists other than those at the extremes would agree on:

- There is evidence that human infants are primed from the beginning to attend to, and in effect to define, some particular aspects of their experience – though various observers differ on the specifics of what that catalog or list of predispositions contains. For most it includes: a proclivity to single out objects on a figure/ground basis; to perceive something about distance and spatial relations; to distinguish animate from inanimate (or perhaps entities with agency versus those without it); to have a sense of some kinds of causal relationships or events; to have a sense of, and to attend to, quantity *per se* (big, small, more than, less than, and about the same as); and to have a rudimentary sense of number (distinguishing one from two, maybe from three, and from many, meaning more than those few). There seems to be some special status for faces, and for human or social interactions, and for speech sounds. Gathering evidence about these "primitives"–these early concepts and tendencies–and sorting them out is an active field of ongoing research, but that something of this sort happens, and is an important ground on which further development is based, is widely accepted.
- From infancy on, human beings (at least when awake) are actively engaged with their world, seeking to attain good things and experiences and to avoid negative ones, and to make sense of their experience, in terms of anticipating what may happen next and what may result in good or bad. When these anticipations work routinely, many of them function relatively automatically without a lot of conscious attention; when they run into problems, or encounter new and unfamiliar situations, these experiences trigger attention, puzzlement, trial and error, and problem solving.
- There are many views about the nature of these "anticipations," but there must be some kind or kinds of internal representations of an experienced or assumed and construed external reality, and also expectations of what may happen in that reality and how that reality may be affected by one's own actions.

» Most views hold that the nature of these representations develops and changes over time and becomes more complex and precise. They start, in infants, as some kind of replicated units of interaction among sensations and sensory input and the experience of one's own actions and responses (for instance, for Piaget, the "sensorimotor" stage; for Bruner, "enactive" representations (Piaget, 1983). They then move to some kind of episodic blueprints of their actions and the episodes they observe ("Iconic" for Bruner–something like possible pictures of the world); later, in primary school they become better defined and organized ("concrete operations" for Piaget), and from early on they are heavily influenced by the individual's language and culture, and the way those define what is important to recognize and attend to. In interaction with language and culture in adolescence they become more formal, abstract, and symbolic—representations in effect operating on representations to multiple levels of removal from direct, concrete experience.

» Given the total dependence of human infants on the care of others, much of the content of infants' earliest representations and intentions must have to do with the interaction between their needs and the responses of their immediate social world, particularly those of their family. Certainly what they seem to be primed to attend to suggests that is so. And it is easy to see how the need to make one's needs known, to enlist the help of others, and also to understand others' intentions, likely responses, and, yes, their incentives, must make it crucial to focus on refining the ability to communicate and to understand the communication of others. Out of the inherent ability to squawk, smile, and charm, and to mimic, to follow what others are attending to, and to listen, children assimilate and build the tools of language and gesture, both to give and receive meaning and, with luck, to make their world work for them.

» Many theories about the structure of the mind and cognition picture that structure as having multiple (three or more) levels. There is evidence that there seems to be a set of specific cognitive systems that deal with reasoning and functioning in distinct domains of phenomena that seem to be related to the aspects of attention built-in in infancy already mentioned – *i.e.* spatial/visual, causal, social, verbal/propositional, quantitative, etc. (see Figure below from Demetriou et al. 2017, under review at WIREs)[16] (Demetriou, Christou, Spanoudis, & Platsidou, 2002). Again, the particular catalog that theorists

16. We are very grateful to Andreas Demetriou at the University of Nicosia for permission to use this figure, but we are even more grateful for his gracious willingness to make some very useful editorial suggestions designed to bring our brief description of central tendencies in the field's view of the structure of the mind and its development more in line with current thinking. We recommend a close reading of the referenced paper and look forward to the authors forthcoming book on these topics. We think they suggest important ways of thinking about the relationship between stages of cognitive development (what they prefer to call "cycles," with each cycle having two "phases"), and our emphasis on the kinds of instruction that might help to focus students' attention on the ways that levels of representation and meaning are "coded" in the conventions of spoken language and text (in general and in specialize discourse, genres, registers, etc.), and how that might support movement through the phases and cycles. They, as the saying goes, "give us a lot to think about."

identify varies, but these systems are mentioned by all traditions of research. While they clearly interact, they are seen as being somewhat autonomous in their focus and ways of processing or reasoning, and in different individuals they may develop and become more sophisticated at rates that differ across the domains.

» Then there usually is hypothesized to be a more general level of awareness of mental functions that organizes and reflects on operations in these specific areas. As such it allows "executive" control, the goal-oriented handling of the individual's functioning in the world–weighing and setting goals, planning how to attain goals, monitoring whether plans are working, evaluating and revising, searching for alternatives (in memory and through trial and error, etc.), and so on.

» And there also are assumed to be some kinds of central capabilities for processing (or thinking about) the elements in the specialized domains and relating them–some kind of "working memory" that sets limits on the number of things that can be actively focused on or thought about and compared at one time, and "short term" and "long term" memory capabilities or storage (Miller, 1955). Some would suggest that there may be two or more different memory systems and kinds of processing – a "fast" system, based on automatic associative and probabilistic mechanisms, and a "slow" system that is more conscious, rational, deliberative, and systematic, perhaps that comes into play when the fast system doesn't work as expected – but these are matters for ongoing study.

FIGURE 2. STRUCTURE OF THE MIND