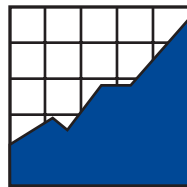**Technical Report 38**

State Literacy Standards, Practice, and Testing: Exploring Accessibility

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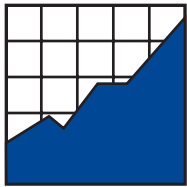
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State Literacy Standards, Practice, and Testing: Exploring Accessibility

Sandra J. Thompson • Christopher J. Johnstone • Martha L. Thurlow • Ann T. Clapper
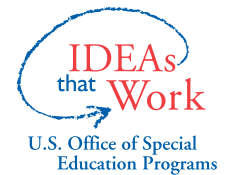
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Executive Summary

Literacy is a term that has been defined many ways, with definitions ranging from those that are very narrow to those that are very broad. Among the more wide sweeping was that of the 1991 National Literacy Act, which defined literacy as a wide range of language tasks associated with everyday life, including those "necessary to function on the job and in society, to achieve one's goals, and to develop one's knowledge and potential." Most often, however, literacy definitions have focused on the skill of decoding print and on specific reading skills. Definitions that emphasize only visual interaction with print or on specific reading skills has serious implications for students who have challenged ability to access print, creating barriers to their learning and educational growth despite the fact that there now exists a range of other ways to access the printed word.

The purpose of this paper is to explore these topics by first determining how broad or limiting states' reading standards are in coverage and whether they limit options for students to use multiple methods of interaction with print. Part I reports on this study of state standards in reading. Part II addresses alternative modes of interaction with print. Part III analyzes the correspondence between the reading standard requirements and the modes of interaction with print. Part IV identifies implications for instruction, assessment, and related issues.

Our review of K-12 reading standards indicated that states require a wide variety of activities as part of the reading process. Themes that emerged from state standards defined reading as:
- The acquisition of specific skills.
- The knowledge of the elements or conventions in language.
- An interactive, thinking activity.
- A problem-solving tool.
- A catalyst for personal growth.

These themes go well beyond definitions of reading that focus heavily on print or the need to interact visually with print on a page.

In Part II of the paper, we summarize alternative ways that students, especially those with print disabilities, can interact with print. Four modalities are discussed: visual (looking at the page), tactile (Braille), auditory (listening to a reader, book on tape, or computer screen reader), and multi-modal (any combination of the above). Non-visual approaches to reading present both opportunities and challenges. In theory, these approaches may make reading more accessible to students with disabilities that prevent them from accessing print. However, their use can also create challenges for teaching and testing.

Part III of the paper analyzes the correspondence between state standards and the modes of interaction with print to determine whether the themes that were identified really all require that

students be interacting with print through a visual mode. This analysis indicated that all but a few of the standards within the themes that we analyzed – those dealing with fluency, phonemic knowledge, and word recognition – potentially could be accomplished multi-modally. These represent a small piece of a broad definition of reading described in state standards.

Part IV of the paper addressed the implications for instruction, assessment, and related issues. It is suggested, for example, that having students with print disabilities spend large amounts of their school day reviewing and practicing phonemic approaches to reading may inhibit access to subject-matter material and decrease motivation for reading and learning. The issue is raised of whether contemporary large-scale testing is inappropriately standardized to allow only for visual, not multi-modal reading of tests, and whether the tests also measure the broader themes of reading found in state standards. Finally, several related but important issues that beg for research are identified, including the need to be able to identify those students who truly have print disabilities and the need to determine how to design reading assessments that allow for the separation of skills that require visual interaction with print from those that do not.

We consider this paper to be a first step in exploring different modes of accessing print for students with disabilities. State standards already address reading in a very broad and comprehensive way. In order to promote access to the wide range of standards that states require, innovative thinking about how students access such standards is necessary. Non-visual modes of print interaction are one mechanism for increasing access to standards, instruction, and assessment.

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Overview

Literacy is a fundamental goal of American education. Because of its importance, it has been defined in many ways and its meaning has changed over time (National Council of Teachers of English, 1996). In the 1800s, literacy was defined as recognizing and pronouncing words, whereas reading passages silently and answering comprehension questions was considered literacy in the 1920s (McCarthy & Raphael, 1992). The National Literacy Act (1991, p.2) defined literacy as a wide range of language tasks associated with everyday life, including those "necessary to function on the job and in society, to achieve one's goals, and to develop one's knowledge and potential." Most often, however, literacy has been defined as the skill of decoding print (Moats & Lyon, 1995), the act of comprehending print (Gunderson, 2000), the ability to interact with and interpret print (Gavelek & Raphael, 1996), or the ability to use print for personal purposes (Roberts, 1998). The commonality in these definitions is that they all explicitly relate to skills or relationships with *print*. Definitions of literacy that are synonymous with decoding print may have serious implications for students with challenged ability to access or interact with print, creating barriers to learning and educational growth.

Fortunately, there are other ways to access information. There is a growing literature that has suggested that student access to learning, and the assessment of that learning, can be increased through multiple methods of interaction with the printed word (Mayer & Moreno, 1989; Paivio, 1986). Modes of interaction with the printed word include visual, tactile, auditory, and multi-modal interactions. These allow readers who have difficulty accessing print in traditional ways to acquire information in ways appropriate to their needs. Although these alternative methods are effective in helping students learn, the use of non-visual modes of print interaction create challenges for both teaching and testing.

Another challenge in today's educational arena appears to exist. Despite the broadening of the definition of literacy over time, the primary emphasis in current practice for both teaching and testing appears to focus on the acquisition of specific reading skills. The purpose of this paper is to explore states' reading standards to determine how broad or limiting they are in coverage and whether they limit options for students to use multiple methods of interaction with print.

This report approaches the topic in four parts. Part I reports on a study of state standards in reading. Part II addresses alternative modes of interaction with print. Part III analyzes the correspondence between the reading standard requirements and the modes of interaction with print. Part IV identifies implications for instruction, assessment, and related issues.

The study reported in Part I was conducted to examine state standards in reading to determine whether their focus is broader than simply decoding print on a page. A finding that standards are broader than just decoding-type skills has implications for accessibility and for whether

other modes of interaction with print make sense. To the extent that there are other types of skills present in standards, other modes of interaction with print seem appropriate not just for instruction but also for assessment. These possibilities are explored as we discuss the nature of print disabilities and the four modes of interaction with print in Part II, and then in Part III we actually analyze the correspondence between the standards and the alternative modes of interaction.

We conclude in Part IV by identifying several implications for instruction and assessment and highlighting related issues. While our suggestions may be helpful to states and test developers when designing tests to assess student achievement of reading standards, we hope to open the discussion about what literacy really is, and whether literacy really requires visual interaction with print.

Part I. Study of State Reading Standards

The purpose of this study was to examine themes in states' reading and language arts standards. This analysis was designed to assist in examining both the variation in standards across grades and the possibility of access to print through different modes.

Procedure

Academic content standards in reading were retrieved from the World Wide Web for 48 states for the purpose of examining the themes present in the reading standards. (Two states were unavailable on-line at the time of data collection, which spanned from January 2002 through December 2002.) All standards in the areas of "Language Arts" and "Reading" were downloaded from state Web sites. Standards in the areas of "Writing," "Listening," and "Oral Language" were not examined because these were considered to be outside the focus of the study. Standards that specifically referred to "writing," "writing process," "listening," or "speaking" within "Language Arts" standards also were omitted from this study.

All selected academic content standards for grades 1, 2, 4, 8, and 12 were then transferred from HTML format to text format and downloaded on QSR NVivo qualitative research software. The grades selected were thought to represent a wide variety of reading requirements, from developmental stages (grades 1 & 2) through more complex requirements (grades 4 & 8). Grade 12 standards were included as a source of data that demonstrated what states required as terminal reading skills in order to proficiently pass through the K-12 educational system. States that provided standards for separate grades were downloaded by grade level, whereas PDF files were downloaded *in toto*. Standards from one grade level above or below grades 1, 2, 4, 8, and 12 were included for states that did not have standards in the target grades. This allowance was

not thought to contaminate the sample because data were examined for general concepts, not specific grade-level requirements. Upon completion of selecting, cutting, and downloading standards, over 1,500 pages of data remained.

Analysis

Qualitative content analysis was used to analyze the state academic content standards (Gall, Borg, & Gall, 2003). In the tradition of qualitative research, the standards were analyzed for their linguistic content, or the meaning communicated (Lincoln & Guba, 1985). Similar to previous reviews of content standards (see Valencia & Wixson, 2001; Wixson & Dutro, 1999), the aim of this analysis was not to single out states as exemplary or deficient; rather, the aim was to view state standards through the lens of various themes related to reading.

Each reading standard was initially coded with one or two-word codes that were determined by the researchers to capture the essence of the message provided by the standard. Twenty-seven initial codes were generated from the data (see Table 1). The standards were also color-coded to reflect grade level. Using QSR NVivo software, each standard was placed in an electronic "node" that was labeled with one of the codes found in Table 1. Codes were then stored in nodes for further analysis.

Table 1. Original Codes Prior to Organization into Themes

Compare	Personal growth
Context	Phonemic knowledge
Critical analysis	Problem solve
Expository elements	Question
Fluency	Reflection upon print
Follow instructions	Reflection: culture
Higher-order thinking	Reflection: self
Inferential comprehension	Relate to real life
Language conventions	Respond
Literal comprehension	Socialization into literary communities
Literary elements	Stamina
Meta-literacy	Strategic, non-phonemic skills
Mine information	Vocabulary development
Organize information	Word recognition

Once initial coding was completed, codes (called "Free Nodes" in QSR NVivo software) were organized into five major descriptions or themes. Themes found in the data were as follows: Acquisition of specific skills; Knowledge of conventions and elements in language; Reading as an interactive, thinking activity; Reading as a problem solving tool; and Reading as a catalyst for personal growth (organized themes are called "Trees" in NVivo software). Table 2 provides defining features of each theme.

Table 2. Features of Themes Found in State Reading Standards

Theme	Defining Features
Acquisition of Specific Skills	Reader has acquired a set of alphabetic, phonemic, and non-phonemic skills that enables the reader to translate symbols to sounds, letters to words, and words into direct meaning. Such translation leads to understanding of the printed word.
Knowledge of Conventions and Elements in Language	Reader comprehends the rules and subtleties of language, and can recognize differences in language styles and genres of writing.
Interactive, Thinking Activity	Reader interacts with literature. This relationship can be based on the reader's experiences and how he or she relates those experiences to literature. Reader reflects upon, questions, and critiques authors' messages as part of the reading process.
Problem Solving Tool	Reader uses literature as a tool. The reader can find and use information needed to solve problems.
Catalyst for Personal Growth	Reader uses literature to improve her or his own life. Reader accesses literature to learn about himself or herself and the world. A person is self-empowered when reading brings him or her enjoyment and knowledge.

Table 3 demonstrates which codes were associated with which themes. All codes were placed into the five themes except "stamina." The one state that included "stamina" as a standard or performance objective required students to read for determined amounts of time or pages, increasing with age. This requirement did not fit neatly into the thematic units of standards, but should not be ignored because it presents an important issue for students who may have difficulty reading for extended periods of time.

Themes Found in State Reading Standards

Theme 1: Acquisition of Specific Skills

The *Acquisition of specific skills* theme encompasses five groups of state standards. Fluency; literal comprehension; phonemic knowledge; strategic, non-phonemic; and word recognition skills are standards that require that students acquire specific skills in order to become proficient readers.

The alphabetic, phonemic, and non-phonemic skills encompassed in this theme enable students to translate symbols to sounds, symbols (letters) to words, and words into direct meaning. This translation leads to understanding the printed word, creating the act of reading. State standards in this theme address skills such as phonics, seeing entire words and recognizing them from memory, deciphering meaning in text and foreseeing the possible outcomes of a story. Table 4 provides specific examples of language from state standards in this theme area.

Table 3. Themes Represented by Original Codes

Acquisition of Specific Skills
Fluency
Literal comprehension
Phonemic knowledge
Strategic, non-phonemic skills
Word recognition
Knowledge of Conventions and Elements of Language
Context
Expository elements
Language Conventions
Literary Elements
Interactive, Thinking Activity
Compare
Critical analysis
Higher-order thinking
Inferential comprehension
Meta-literacy
Question
Reflection upon print
Relate to real life
Respond
Problem Solving Tool
Follow instructions
Mine information
Organize information
Problem solve
Catalyst for Personal Growth
Personal growth
Reflection: culture
Reflection: self
Socialization into literary communities
Vocabulary development

Table 5 provides a quantitative breakdown of the numbers of states with each type of standard, and the grades at which they appear. Skills like phonemic awareness and fluency are found less frequently in standards in states' upper grades. On the other hand, literal comprehension and strategic non-phonemic skills are represented more equally across grades.

Theme 2: Knowledge of Conventions and Elements in Language

The second theme derived from the analysis of state standards is the need for a proficient reader to have knowledge of conventions and elements in language. Standards in this theme include the requirement for students to demonstrate understanding of context, expository elements, language conventions, and literary elements.

Table 4. Acquisition of Specific Skills in State Standards

	Examples from State Standards
Fluency	*"read accurately by using phonics, language structure, word meaning and visual cues"*
Literal comprehension	*"demonstrate literal understanding of print material"*
Phonemic knowledge	*"decode and read meaningful sound units in words"* *"recognize short and long vowel sounds"* *"decode consonant blends"*
Strategic non-phonemic skills	*"make predictions from text clues and cite specific examples to support predictions"* *"use reading strategies such as drawing conclusions and summarizing"*
Word recognition	*"use knowledge of high-frequency words to read texts aloud with fluency, accuracy, and expression"*

Table 5. Number of States with Specific Skill Standards at Each Grade Level

Specific Skills	Grades 1 & 2	Grade 4	Grade 8	Grade 12
Fluency	39	36	30	22
Literal comprehension	46	47	42	39
Phonemic knowledge	47	44	27	15
Strategic, non-phonemic skills	44	43	42	40
Word recognition	45	41	40	34

Note: Based on standards from 48 states.

Knowledge of conventions and elements may be more simply defined as an understanding of the rules that govern printed language. State standards found in this theme require that students understand the structure and guideposts found in informational literature (e.g., indexes and tables), recognize elements of literature (e.g., plot, character, theme, author's message), possess knowledge of word relationships, and generate understanding by knowing the framework of a particular piece. Table 6 further illustrates this theme with direct quotations from state standards.

Table 7 shows the types of standards and the frequency with which they appear at each grade level. Expository elements are identified by more states after first and second grade. Based on

Table 6. Knowledge of Conventions and Elements in Language in State Standards

Examples from State Standards	
Context	*"use context to resolve ambiguities about word and sentence meanings,"* *"confirm meaning of figurative, idiomatic, and technical language using context"*
Expository elements	*"identify the components of an instructional manual (e.g., directions, tools required, parts needed, illustrations, diagram sequence, bold face for relevant steps)* *"use the elements of nonfiction to identify pertinent data"*
Language conventions	*"apply knowledge structure, language conventions (e.g., spelling and communication), media techniques, figurative language"*
Literary elements	*"identify different text genres, real and make believe, from everyday print material (storybooks, poems, newspapers, signs, labels)"* *"use the elements of narrative text to understand fiction"*

Table 7. Number of States with Knowledge of Conventions Standards at Each Grade Level

	Grades 1 & 2	Grade 4	Grade 8	Grade 12
Context	14	44	38	29
Expository elements	20	33	30	27
Language conventions	37	39	38	32
Literary elements	44	47	44	46

Note: Based on standards from 48 states.

the number of states with standards reflecting knowledge of literary elements and language conventions, these appear to be important skills across all grade levels. Finally, context is a skill found in the standards at all grade levels, but appears to be most common in the middle grades (grades 4 and 8).

Theme 3: Reading as an Interactive, Thinking Activity

The third theme encompasses standards that view reading as an active and interactive process. State standards in this theme include the ability to compare literature, critically analyze messages, use higher order thinking skills, inferentially comprehend material, think about literacy

(i.e., meta-literary knowledge), question literature, reflect upon literature, relate literature to their lives, and respond to literature in a variety of ways.

Standards in this theme reflect the desire to have students both think about and interact with print. For example, states ask students to process the meaning of and carefully examine text in order to understand it, think divergently about text, explore how reading and language are used in society, contemplate what has been learned during the reading process, identify with a character in a story, contrast different viewpoints from several sources, and question an author's message and others' interpretations of that message. Table 8 lists examples of language from state standards in this theme.

Table 8. Reading as an Interactive, Thinking Activity in State Standards

	Examples from State Standards
Compare	*"identify differences in the points of view of the authors when given more than one selection on the same topic"*
Critical analysis	*"distinguish fact from opinion or fiction"* *"analyze and evaluate the logic and use in an author's argument"*
Higher-order thinking	*"engage intellectually with texts – think divergently, visualize characters or scenes, express opinions, raise questions"*
Inferential comprehension	*"use inference and deduction to understand text"*
Meta-literacy	*"recognize the power of language and use that power ethically and creatively"*
Question	*"use language arts to formulate, explore, and analyze questions and problems relating to various topics"* *"ask questions to guide research inquiry"*
Reflection upon print	*"reflect on what has been discovered and learned while reading"*
Relate to real life	*"read, listen, and view literary texts and explain the human experiences they convey"*
Respond	*"respond in speaking and/or writing to open-ended questions requiring evaluation in all content areas"*

Table 9 is a depiction of the frequency of representation of each of the skills in the theme reflected in states' standards across grade levels. Meta-literacy and higher order thinking skills were found in fewer states overall, with only 11 to 15 states including standards reflecting these skills. Relating text to real life appears to be a skill that is somewhat more commonly reflected in states' standards in the early grades than the later grades. Conversely, critical analysis is somewhat more represented in state standards in the later grades compared to the earlier grades.

Table 9. Number of States with Reading as an Interactive, Thinking Activity Standards at Each Grade Level

	Grades 1 & 2	Grade 4	Grade 8	Grade 12
Compare	33	38	37	36
Critical analysis	36	43	43	45
Higher order thinking	11	13	11	12
Inferential comprehension	31	37	40	37
Meta-literacy	11	15	13	15
Question	33	39	33	29
Reflection upon print	32	40	40	38
Relate to real life	40	38	26	30
Respond	41	43	42	36

Note: Based on standards from 48 states.

Theme 4: Reading as a Problem Solving Tool

In this theme, reading as a problem-solving tool, reading is a tool to be used by students to address issues. State standards in this theme ask students to follow instructions, mine information, organize information, and problem solve.

In these standards, reading has utility in solving real-life problems. For example, states require that students be able to follow a set of instructions in order to complete a task, identify important knowledge and facts from informational text, and systematize that information so that it can be used to solve the problem at hand. Table 10 lists examples of state standards in this theme.

Table 11 shows the number of states that have standards across grade levels related to problem solving. About half of all states have problem-solving standards. Standards that reflect the "mine information" standard are found in nearly all states at all grade levels. These standards seem to emphasize reading as a way for students to get something they need and that it is vital to solving

Table 10. Reading as a Problem Solving Tool in State Standards

Examples from State Standards	
Follow instructions	*"follow multiple-step instructions in a basic technical manual"*
Mine information	*"extract information relevant to a specific purpose"*
Organize information	*"synthesize information from primary and secondary sources for research"*
Problem solve	*"use reading, writing, speaking, listening, and viewing skills to solve problems and answer questions"*

Table 11. Number of States with Problem Solving Standards at Each Grade Level

	Grades 1 & 2	Grade 4	Grade 8	Grade 12
Follow instructions	24	29	24	21
Mine information	44	47	47	46
Organize information	29	36	34	30
Problem solve	27	34	27	26

Note: Based on standards from 48 states.

problems. Here, as in other areas, many states have standards concentrated at the grade 4 level (note the higher numbers of states with standards in grade 4).

Theme 5: Reading as a Catalyst for Personal Growth

The fifth theme, reading as a catalyst for personal growth, contains standards that attempt to stimulate personal growth in students through the reading process. These standards include: reading for personal growth, reflecting upon self and culture, reading for socialization into literary communities, and vocabulary development.

Standards in this theme require that students use reading as a mechanism for reflecting and improving themselves and society. Specifically, states require that students read material that inspire them toward higher goals, for entertainment or to engage their curiosities; contemplate the meaning of text in their own lives as well as the lives of others; become part of a community of readers that engage via literacy experiences; and develop a wide repertoire of words to use in any situation. Table 12 provides examples of state standards that fall within this theme.

Table 12. Reading as a Catalyst for Personal Growth in State Standards

	Examples from State Standards
Personal growth	*"select books for enjoyment and knowledge"* *"use oral, written, and visual texts to identify and research issues that confront adolescents, their community, their nation, and the world"*
Reflection: culture	*"develop an understanding of and respect for diversity in language use, patterns, and dialects across cultures"*
Reflection: self	*"identify with characters or events in a story"*
Socialization into literary communities	*"students have frequent opportunities for group/whole class reading"* *"participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities"*
Vocabulary development	*"acquire an extensive vocabulary through reading and systematic word study"*

Table 13 presents the frequency with which states have these standards across grades. Vocabulary development, found in three fourths (or more, depending on grade level) of the state standards examined, was the most frequently found standard in this theme. However, many states also identify standards for student's reflection on self and reflection on cultures via reading. These standards seem to demonstrate the desire to use reading as an exercise in shaping future citizens, specifically by learning about cultures and learning about oneself through reading.

Table 13. Number of States at each Grade Level with Catalyst for Personal Growth Standards

	Grades 1 & 2	Grade 4	Grade 8	Grade 12
Personal growth	24	18	22	31
Reflection: Culture	25	30	28	25
Reflection: Self	25	30	28	25
Socialization into literary communities	13	19	22	21
Vocabulary development	38	41	39	36

Note: Based on standards from 48 states.

Summary and Conclusions

Our analysis of state reading standards produced two important findings. First, there are common themes in standards across states. This was observed despite the fact that the U.S. educational system is typically viewed as being quite decentralized. Specific standards vary from state to state, but when examined at a macro-level, the themes appear to be quite similar.

The second finding of the analysis of state reading standards is that states' views of reading extend far beyond the acquisition of specific decoding skills. While decoding skills are important, states have identified many more reading standards. States believe that reading also means having knowledge of conventions and elements in language, the ability to think and interact with text, as well as use reading as a tool for problem solving and as a catalyst for personal growth.

We also observed that while states view decoding-related skills as important, the extent to which these are viewed as important across all grade levels varies considerably across states. Thus, phonemic knowledge was identified in the standards in 47 states in grades 1 and 2, and in 44 states in grade 4, but in only 27 states in grade 8 and 15 states in grade 12. Similarly, fluency was listed as a standard in 39 states in grades 1 and 2, but in only 22 states in grade 12. On the other hand, strategic, non-phonemic skills were listed in 44 states in grades 1 and 2, in 43 states in grade 4, in 42 states in grade 8, and in 40 states in grade 12. There are definite differences in the emphasis given to standards across grades, with fewer states focusing on conventions and decoding skills at the upper grade levels.

Part II. Alternative Modes of Interaction with Print

The reading themes reflected in state standards explicitly relate to skills or relationships with *print*. For the majority of students in schools, interacting with print in order to learn is not a problem. For other students, however, accessing print in the usual way is difficult or impossible due to the presence of a "print disability."

The term "print disability" is an international term that refers to disability as an outcome-related issue, not an organic or physiological condition (McGill-Franzen, 2000; Rose, Meyer & Pisha, 1994; Royal Victorian Institute for the Blind, 2002). The Royal Victorian Institute for the Blind in Australia defines a print disability as an "inability to read standard print." This inability may be caused by blindness, visual impairment, learning disability, physical disability, concentration disability, or health impairment. The term does not appear in special education law in the United States.

Reducing the impact of a print disability can be accomplished through various means. These

additional methods are not meant to subvert traditional views of print acquisition, but to enhance opportunities for people who are unable to decode, comprehend, or relate to print. Some technologies (such as Braille) are readily accepted by most people as being equivalent to print. Other technologies, however, such as screen readers or interactive books, are more controversial. Despite the controversy, these methods increase opportunities for students with print disabilities to access reading standards. For the purpose of this paper, these methods are called "modes of interaction with print."

Modes of Interaction with Print

Four modes of interaction with the printed word are commonly recognized. Each mode of print interaction allows for the message of the original printed material to reach the reader, but has different inputs that allow easier access to the reader, who may have an impairment that makes traditional reading from print challenging. Table 14 shows examples of the four modes of print interaction.

Table 14. Modes of Print Interaction

Mode of Print Interaction	Examples
Visual (viewing print with eyes)	Print material in regular or large font
Tactile (feeling print)	Braille and Nemeth Codes
Auditory (listening to printed messages)	Books or tests on audio tape, human readers
Multi-modal (using any combination of the above modalities)	Computer-based programs where text is seen and heard simultaneously through screen readers or text readers

Visual Mode

The visual mode of print interaction is what is traditionally called "reading." In this mode, readers look at print and decipher meaning from symbols. Visual reading has dominated literature as the most accepted method of interacting with print. For people with visual impairments or learning disabilities, print is sometimes enlarged. Magnifying devices, enlarged computer monitors, and software also assist readers with disabilities to access print.

Tactile Mode

Tactile print interaction is more commonly called "Braille" and is a method of reading a raised-dot code with the fingertips. This type of reading is most common, although not limited to, people who are blind (Wilkinson, Stewart & Trantham, 2000). Tactile print interaction has long been

the primary mode of reading for people with severe visual impairments (Wilkinson et al., 2000) and can be accessed through Braille books and Braille displays for computers (Royal Victorian Institute for the Blind, 2002).

The Nemeth Braille Code is a system of Braille that makes it possible to convey technical expressions in a written medium to blind and visually impaired individuals. Although Nemeth Code uses the same set of Braille cells (dots placed on a two-column grid with three positions in each column) as literary Braille, most cells have new meanings assigned to them in order to express the numerous symbols that occur in math and science.

Auditory Mode

The auditory mode of print interaction involves the use of technology or human assistants to convert symbols into audible words and messages. This may include books on tape, talking books, scanned material that is converted to electronic speech, telephone and television information, human readers, and Internet resources that include audio (Royal Victorian Institute for the Blind, 2002). Cunningham (2000) argued that listening to literature or printed words is a different skill from listening to conversation, sounds, or music and should therefore be considered literacy. This type of literacy, according to Okolo, Cavalier, Ferrite, and MacArthur (2000) works best for readers with strong oral vocabularies but who have difficulties viewing or comprehending print on paper.

Multi-modal

Multi-modal print interaction involves using technology or human assistance to see, hear or feel printed words. Students with learning disabilities are frequent users of a multi-modal approach to literacy, which is sometimes referred to as "supported reading" (Van Daal & Reitsma, 1990; Wise & Olson, 1994). Multi-modal literacy formats may include interaction with talking books using text and scanned material, on-screen text (Royal Victorian Society for the Blind, 2002), or text with narration and video clips (Okolo et al., 2000). Often, computerized formats of multi-modal reading have buttons to click that help readers access features such as vocabulary words, short summaries, and content-enhancing videos (Center for Applied Special Technology, 2003; Okolo et al., 2000).

Other aids in comprehension that are available in the format of multi-modal reading are digitized pronunciations of words, on-screen glossary entries, comparison descriptions, visualization instructions, collaborative capabilities between or among readers and print, and instant resource connections to related items (Anderson-Inman & Horney, 1998). Each of these aids assumes a relationship between reader and print, and offers ways of overcoming difficulties with access to the printed word.

Challenges of Non-Visual Modes of Print Interaction ▬▬▬

The importance and usefulness of non-visual modes of print interaction have been hailed. For example, Shroeder (1989) found that people who use Braille have greater self-esteem, feelings of competence, and employment status than those with severe visual impairments who do not use Braille. This finding was substantiated by Ryles (1996), who also found employment cor-related with Braille reading as well as with habits of lifelong reading. For the past 15 years, a majority of states in the U.S. have had legislation that gives children who are legally blind the right to an education in Braille, even if such an education is not recommended by specialists or is costly to the district (Stephens, 1989).

While Braille and other alternative routes to interaction with print allow multiple means of ac-cessing print and have been supported by research, they are not without challenges. Even Braille, for which there seems to be no alternative, presents some issues. While many authors claim the positive results of Braille use, some worry about generalizing Braille across educational and vocational settings (Reid, 1998). Whether or not Braille is accepted as *the* form of acquir-ing information, tactile modes of print interaction appear to be an effective mode of accessing printed messages for people who cannot access print visually.

Listening as a mode of print interaction, like Braille, is controversial. Evidence of this can be found in articles about read-aloud accommodations for students with disabilities on large-scale tests. Read-aloud accommodations employ a human reader to read passages of tests to students. Barton and Huynh (2000) argued that read-aloud accommodations alter test items too much to be considered valid. Pomplun and Omar (2000), however, supported such accommodations when they do not change the *construct* of what is being tested; they simply eliminate the neces-sity of visual print interaction.

Research on the effectiveness of multi-modal methods of print interaction has also yielded mixed results. Okolo et al. (2000) found that "compensatory technology" correlated with both an increase in student desire and stamina for reading challenging materials by readers with dis-abilities. MacArthur, Ferretti, Okolo, and Cavalier (2001), however, generally found that readers did not make significant gains on standardized reading tests or comprehension questions when accessing print multi-modally.

Regardless of gains in comprehension, vocabulary, or other measured specific reading skills, multi-modal print interaction does provide students with disabilities greater access to language learning. This access is gained through the equal treatment of print and voice in the literacy process (Warschauer, 1999). Koening, Layton, and Ross (1992) lamented that without tech-nologies, many individuals with disabilities would be considered "illiterate" when the issue is simply one of access to alternative modes of print.

Part III. Analysis of Correspondence Among Requirements of Reading Standards and Modes of Interaction with Print

With the picture of standards obtained from the study of standards reported in Part I of this report, and the view of alternative modes of interaction reflected in Part II of this report, it is possible to now ask about how the two match up. Do the themes reflected in reading standards really all require that students be interacting with print through a visual mode? Or, instead, do some standards allow for several modes of interaction with print?

Recall that our analysis of standards showed that states' conceptions of reading encompass many themes: Acquisition of specific skills; Knowledge of conventions and elements of language; Interactive, thinking activity; Problem solving tool; and Catalyst for personal growth. Within those themes, 28 codes give further detail to the states' composite picture of reading. These themes and codes are listed in Table 15. For each code, we identified the possible modes of interaction with print that were consistent with the standards reflected in the code. The table was constructed based on key words and actual verbs found in coded state standards. For each code present, the question "Can standards coded be accomplished via visual, tactile, auditory, and/or multi-modal approaches?" was asked. Answers to questions were based on definitions found above and actual state standard data. Table 15 reflects the possibilities for state standards to be accomplished multi-modally; however, the table does not necessarily reflect actual state practice (this was not a field-based research endeavor). As is evident in Table 15, we found that only a few of the codes could not be assessed via multiple modalities.

For example, under the theme *Reading as acquisition of specific skills* we found that three areas (fluency, phonemic knowledge, and word recognition) required the visual mode, and perhaps allowed for the tactile mode, but no other alternative modes. Still, under this theme, there was room for multiple modes of access for skills such as literal comprehension and other strategic, non-phonemic skills. Students who cannot access print visually may have difficulty meeting standards relating to fluency, phonemic knowledge, and word recognition, but these students may comprehend and make predictions about stories that are written in print, Braille, read aloud, or accessed via multiple modalities.

Likewise, standards found in the *Knowledge of conventions and elements in language* theme are also accessible via multi-modal approaches to reading. Knowledge of language patterns, story elements, characterization, and factual information do not require that one gaze upon print and comprehend its symbols. Rather, any of these skills are accessible via any modality.

As standards move from skill and knowledge bases to *Interactive and thinking* requirements, accessibility can increase to an even greater extent using multi-modal approaches. Standards that require students to interact with and think about printed material do not require ocular reading.

Table 15. Modes of Print Interaction Allowed for Different Areas of Reading Literacy

	Visual Mode	Tactile Mode	Auditory Mode	Multi-Modes
Reading as Acquisition of Specific Skills				
Fluency	X	X		
Literal Comprehension	X	X	X	X
Phonemic Knowledge	X	X		
Strategic, Non-phonemic Skills	X	X	X	X
Word recognition	X	X		
Reading as Knowledge of Conventions				
Context	X	X	X	X
Expository Elements	X	X	X	X
Language Conventions	X	X	X	X
Literary Elements	X	X	X	X
Reading as Interactive/Thinking Activity				
Compare	X	X	X	X
Critical Analysis	X	X	X	X
Higher Order Thinking	X	X	X	X
Inferential Comprehension	X	X	X	X
Meta-literacy	X	X	X	X
Question	X	X	X	X
Reflection Upon Print	X	X	X	X
Relate to Real Life	X	X	X	X
Respond	X	X	X	X
Reading as a Problem Solving Tool				
Follow Instructions	X	X	X	X
Mine Information	X	X	X	X
Organize Information	X	X	X	X
Problem Solve	X	X	X	X
Reading as a Catalyst for personal growth				
Personal Growth	X	X	X	X
Reflection: Culture	X	X	X	X
Reflection: Self	X	X	X	X
Socialization into Literary Communities	X	X	X	X
Vocabulary Development	X	X	X	X

Standards that require students to infer or critique literature, for example, are appropriate for students who require multiple modalities to access the literature. Other issues may arise, such as the cognitive ability to meet standards, but *all* students can be provided the opportunity to infer, critique, think about, reflect on, relate to, respond to, compare, and question literature. Levels of complexity in meeting standards may be disparate, but all students can be given the opportunity to reach challenging standards via individualized methods, such as multi-modal reading.

Similarly, standards in the *Problem solving* theme can also be met multi-modally. No standard directly states that students must perform these activities via reading printed words with their eyes, which makes problem-solving standards theoretically accessible to students using multi-modal methods. The same can be said for the theme of reading as a catalyst for personal growth. All standards in this theme can be accessed via all modes, allowing for students with and without disabilities to grow through access to reading.

Part IV. Implications for Instruction, Assessment, and Related Issues

Reading standards clearly go well beyond phonemic knowledge and word recognition. Multiple modes of interaction exist for accessing the rich array of standards. Still, there are implications for both the classroom and state assessments that need to be explored as we think about the implications of a broadened definition of reading that encompasses the notion of multiple modes of interaction with print. Related issues, such as the appropriate identification of students and the redesign of reading items, also need to be addressed.

Instruction

The potential for increasing access to reading standards via multiple modes of print interaction is vast. Yet, this access is dependent upon states' and schools' willingness to allow students to use multiple modalities of print interaction during instruction and assessment. Although state standards suggest that reading is broader than decoding text on a printed page, students with disabilities typically spend a great deal of their language arts instruction in remedial programs that intend to fix decoding problems (Allington & Cunningham, 1996; Walmsley & Allington, 1995). Remediation programs are not, *per se*, harmful for students with print disabilities. Rather, the harm comes to students from opportunity lost and decreased motivation to read a variety of materials (Kamil, Intrator, & Kim, 2001).

Students who spend inordinate amounts of time on decoding remediation miss instruction and opportunities for accessing reading standards in the areas of conventions and elements in language, thinking, problem-solving, and personal growth. Many of these skills can be both met and improved by using "enhanced" reading programs that approach literacy multi-modally (Center for Applied Special Technology, 2003).

Visual reading skills are important and are addressed in virtually every state, at least in lower grades. Equally important, however, are more holistic definitions of reading that every state also addresses. If a student is unable to access *all* standards by traditional visual modes of reading,

states and schools should explore allowing students to access print and standards via alternative modalities (tactile, auditory, and multi-modal).

Assessment

Current large-scale assessments may not capture the complexities of state reading standards in their current formats. They often have disproportionately high failure rates among students with disabilities, English language learners, and students with low socioeconomic status backgrounds (Darling-Hammond, 2003). Three approaches aimed at improving testing conditions for students with disabilities reflect a move toward testing reading through multiple modalities.

First, the Commission on Instructionally Supportive Assessment (2001) recommended that states work with test design companies to ensure that standards and tests align. Generally, paper and pencil tests assess students' ability to decode and directly comprehend. Occasionally, tests will require that students comprehend inferentially (a thinking skill), but it is difficult to test standards relating to interaction with text, self-empowering activities, and problem-solving skills using literacy as a tool. Although all states have standards in these areas, traditional skill-based assessments cannot test such standards. Further research is required in this area, examining what is tested in large-scale assessments, how what is being tested relates to standards, and how expanding definitions of reading in tests will create space for diverse administration procedures.

Second, research on test accommodations is relevant to improving assessments. Currently, diverse administration of tests falls under the banner of "test accommodations." Thompson, Blount, and Thurlow (2002) synthesized accommodations research from scholarly journals from 1999 to 2001. Accommodations still have mixed reviews when it comes to outcomes, and are very controversial in the research community. Recent complaints to the U.S. Department of Education's Office of Civil Rights, however, have demonstrated that accommodations are also an important issue in practice. A group of parents recently challenged the Florida Comprehensive Assessment Test policy that requires students take tests without accommodations (Hicks, 2003). One specific challenge was Florida's unwillingness to allow students to access tests using accommodations specified in their IEPs. Clarification of standards that are tested—and whether accommodations that reflect alternative modes of interaction with print are consistent with those standards—is an essential step that must be taken in all states.

Accessing print multi-modally could also become a design feature of all tests. Thompson, Johnstone, and Thurlow (2002) discussed the use of elements of "universal design" in developing tests. One of the tenets of universal design, the third area of relevant research, is that allowances for diverse administration are built into the test design from the beginning, allowing for the "standard" administration of tests to be more receptive to the needs of all students. Although

universal design language does not yet include "multi-modal" administration of tests, the term universal design is becoming more common in educational policy, and recently was found in California's education law (State of California, 2003) and Vermont's Request for Proposals for large-scale assessments.

Universal design (Thompson, Johnstone, & Thurlow, 2002) and aligning tests to standards (Commission on Instructionally Supportive Assessment, 2001) may be starting points for addressing the needs of students with disabilities in the assessment process. Table 15, which provided a crosswalk of states' standards and alternative modes of interaction with print, revealed that most standards allow for much more than assessments currently seem to allow. Based on our analysis, it would seem that it should be possible to require students to read print using visual or tactile modes when testing phonemic skill, and to have access to auditory and multiple print interaction modes when standards in the areas of comprehension, interpretation, and catalyst for personal growth are being assessed (see Table 15). This is similar to the way that calculators are disallowed on mathematics computation items, but are allowed for assessing achievement of other mathematics standards. Aligning tests to reflect the diverse definitions of standards (Commission on Instructionally Supportive Assessment, 2001), then allowing students to access non-decoding items multi-modally, holds great promise for more valid assessment of students with disabilities.

Related Issues

There is a clear need to open up the discussion to new ways to provide access to literacy for students who have print disabilities. However, there are many underlying issues that will need to be addressed in taking this on. How will we know for sure that we have identified those students who really have print disabilities? How many are there? We do not have numbers to guide our efforts. Identifying students who need to use Braille is relatively easy compared to identifying students who are not going to learn to read the printed word but who have full sight. What procedures can be used to ensure that educators and decision-makers correctly identify which students use alternative modes to interact with print?

Broader assessment design issues will need to be addressed as well. Many reading assessments are currently designed in a way that integrates decoding measurement with the measurement of other types of skills. If test designers are committed to this approach, does it preclude the ability to allow students access to other modes of interaction with print, despite the fact that state standards allow for other modes of interaction? For example, many reading assessments are based on several reading passages that are to be read and then a set of questions to be answered. The test is set up to measure decoding-related skills as well as other interactive and

problem solving skills. Because they are all in the same items, the use of alternative modes is precluded. Should we be thinking about changing the design of our reading items to allow more accessibility in our reading assessments? The state of Maryland recently changed the way it scored its third grade reading assessment (S. Hall, personal communication, March 9, 2004) to obtain both a decoding score and a comprehension score, a reflection of this very issue: the desire to be able to separate the two scores which were previously bound together. By doing so, it acknowledges that students can interact through non-visual means with print on a reading test and still demonstrate aspects of literacy and reading – and obtain a score that counts in an accountability system.

There is much work to be done in this area. This work is at the beginning stages because it requires looking carefully at who the students are and how to make sure that they are not inappropriately shunted away from learning to read (decode print visually), nor are students inappropriately shunted away from the rich context of literacy if they have not yet or never will master the specific skills needed to decode text. The work ahead involves looking carefully at the intent of state standards and instructional practice in schools. Finally, it involves carefully examining what is happening in current assessment practice and how that can be improved to ensure the greatest access possible so that students can truly show what they know and are able to do in the area of literacy.

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