Second Graders' Reading Behaviors: A Study of Variety, Complexity, and Change

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ABSTRACT

This qualitative inquiry examined second graders' literacy learning by observing acts of processing on continuous text. Specifically, this study explored the variety, complexity, and change in second graders' *on-the-run* reading behaviors at three points in time across an academic year. Systematic observation and the analysis of more than 2,500 text reading behaviors from running records of 21 proficient readers revealed more than 100 unique behaviors in six major categories (*substitution, overt solving, repetition, omission, insertion*, and *other*). Substitutions occurred most frequently and reflected students' attention to multiple sources of information concurrently. Second graders demonstrated more than 60 different ways to overtly solve words, usually working with large, sub-word level units. They never appealed for help without initiating attempts to work out difficulty and never articulated words phoneme-by-phoneme. Findings revealed general patterns of change and constancy across time as well as a variety of idiosyncratic behaviors particular to individual children. Discussion highlights readers' flexible control of a broad range of literacy processing behaviors and their vast repertoire of ways to problem solve new and unknown words.

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Three proficient second-grade readers may make three unique responses while reading a slightly challenging text, as illustrated in the following example. The internal decision making that led to their responses is not accessible to the observer, but the observable verbal behaviors exhibited by reading aloud shed light on the children's problem solving actions. Literacy processing refers to this "decision-making about what a text says" (Clay, 2001, p. 103).

Text: Peter tried to establish modern industries although he was not very successful in doing this.

Suzette: Peter tried to *es–tablish, establish* modern industries although he was not very successful in doing this.

Burt: Peter tried to establish modern *industries* (rereads) Peter tried to establish modern industries although he was not very successful in doing this.

Aaron: Peter tried to establish modern *in, in–dustries* although he was not very *su, successful* in doing this.

The children's ability to read this junior high-level passage from the *Qualitative Reading Inventory–3* (Leslie & Caldwell, 2001) indicates they were proficient readers, but what does proficiency really mean? There are several explorations of beginning readers' decision making on continuous text (Biemiller, 1970; Clay, 1966; Weber, 1970), but what do we actually know about the processing systems of proficient second-grade readers? By examining oral reading of texts of appropriate difficulty, we can get a glimpse of reading processes from children's hesitations, approximations, and unexpected responses (Goodman, 1982; Johnston, 1997; Leu, 1982).

Recent demands for accountability in children's learning have brought a renewed focus to reading proficiency. Teachers labor to give kindergarten and first-grade children a good start in reading, and most children are successful. Second grade is a time of transitions and new challenges, with the third- or fourth-grade proficiency test looming on the horizon. Children transition to longer and more complex texts, to silent reading, and to more content area reading. Educators face the challenge of getting all students reading *on grade level*, or proficient, by the designated benchmark grade, but often teachers have only cloudy ideas of what on grade level actually looks like in terms of what students can do as readers.

Research in emergent literacy learning has provided descriptive accounts of children's routes to early reading and writing, informing teachers who work with 5- and 6-year-old students (Biemiller, 1970; Clay, 1966, 1975; Dyson, 1994; Harste, Burke, & Woodward, 1994; Ruddell & Ruddell, 1994; Sulzby,

1994; Teale, 1986). Understanding the reading process beyond Grade 1 is problematic. Studies of second graders often focus on isolated elements of the reading process (e.g., comprehension, phonemic awareness, fluency), but virtually nothing is documented about the behaviors exhibited as children read aloud *on-the-run* or the way the reading process changes over time for second graders. How can educators help students succeed in second grade and beyond without a description of proficient reading? Detailed analyses of problem solving in competent second-grade readers reveal the complex, productive actions children employ while reading.

The purpose of this study was to describe the variety, complexity, and change in reading behaviors of proficient second-grade students across the year, with particular emphasis on the visible information in print. One question guided the study: What reading behaviors do second-grade students exhibit on continuous text?

THEORETICAL FRAMEWORK

The Reading Process

This study is based on a complex view of literacy learning in which reading is a problem-solving process (Clay, 2001). Clay's theory draws upon Singer's (1994) idea of flexibly assembling systems for particular tasks, Rumelhart's (1994) concept of interactive processing with multiple knowledge sources, and her own work with young learners.

Building on the work of J.A. Holmes, Singer (1994) conceptualized a dynamic system wherein individuals flexibly mobilize a variety of working systems to solve a particular problem while reading. As the reader's purpose changes or the text demands change, working systems are activated and reorganized. Singer argued that an experienced reader mobilizes working systems fluently, but a young reader's mobilization is hesitant and less flexible.

Rumelhart's (1994) interactive model describes reading as both a perceptual and cognitive process. He conceptualized a "message center" which receives, sorts, and processes hypotheses from various knowledge sources. The knowledge sources are vehicles for scanning, generating hypotheses, and testing hypotheses while reading. Knowledge sources are activated simultaneously and continuously during reading, and each knowledge source contributes to decision making.

The theories and models proposed by Rumelhart, Singer, and Holmes are helpful in conceptualizing the reading process of experienced readers, but they do not address the earliest phases of literacy learning. Clay (2001) theorized that children begin to read and write with very simple working systems that are adapted from other kinds of learning before school. Young readers draw upon

their oral language systems, knowledge of the world, knowledge of stories, and knowledge of print. As beginning readers, they make a string of decisions, assembling a variety of processes as they go, to problem solve text. Clay (2001) links Rumelhart's (1994) message center and Singer's (1994) idea of assembling working systems to the strategic actions young readers take when attending to several knowledge sources to find a solution as they are reading.

> "Any correct word in a text fits a matrix of relationships like a piece in a jigsaw puzzle, and any kind of information which is dissonant with a selected response will potentially trigger an awareness of an error." (Clay, 2001, p. 120)

The opening example of Suzette's reading represents the result of her internal decision making as she attends to multiple knowledge sources to produce a response: "Peter tried to *es–tablish, establish* modern industries although he was not very successful in doing this." She fluently reads and quickly problem solves *establish* by breaking the word after the first syllable, an indication of her attention to orthographic and phonological information while maintaining the meaning of the sentence. Achieving a good "fit" with the word *establish*, she confirms her meaningful response by repeating *establish* and continues reading the passage.

Clay (2001) suggests that early processing systems must be flexible and tentative. Children work slowly at first, gradually becoming quicker and learning to use more complex networks of information. As young readers' competency increases, their processing becomes more "economical"; they can attend quickly to large units of information or make very fine discriminations (Gibson & Levin, 1975, p. 43). When economy of processing increases, children regulate their behavior and learn how to learn on their own. Clay describes these phenomena as the development of inner control and the acquisition of a *self-extending-system* (1991, p. 317). The self-extending-system, like a *bootstrapping* process (Stanovich, 1986), enables children to become more proficient readers as they continue to read. With growing experience over several years, children "construct a vast range of complex processing activities, finely tuned to the requirements of literacy learning" (Clay, 2001, p. 96).

A literacy processing theory goes beyond a theory of word reading, incorporating word reading as one part of reading continuous text. The literature contains several reports hypothesizing about the internal processes readers use at different phases of word-reading expertise (Ehri, 1994, 1995; Henderson, 1982). It is commonly accepted that readers follow a general progression of development in which they become more adept at using their increasing orthographic and phonological knowledge (Calhoon & Leslie, 2002; Ehri, 1995; Samuels, LaBerge, & Bremer, 1978).

According to Ehri (1991, 1994), five different ways of reading words may be used based upon the reader's current phase of development. Words stored in

a reader's lexicon from previous experiences may be accessed by sight. Words may also be read by going from the spelling to the pronunciation (phonological recoding), then searching the lexicon for a meaningful word that fits the pronunciation. Analogizing occurs when readers search their lexical memories for known words sharing the same part or parts as the target word. In addition, readers may process spelling patterns that are stored in memory; rimes appear to be the most likely patterns to be used. Ehri discusses contextual guessing as the fifth way to read words. Contextual guessing, as the name implies, refers to the prediction of a word in continuous text based upon the text preceding the word.

In studies involving word recognition students generally read real words or pseudo-words, words that are phonetically regular or irregular, and words in isolation or primed with clue words. Researchers use results to formulate or refine theoretical models of word reading, to comment upon the development of word recognition, or to describe the relationship of word recognition to other reading skills.

Attempting to clarify the processes behind word reading, researchers have looked at various aspects of the process. Some searched for evidence of phonological recoding of syllables (Tousman & Inhoff, 1992) or for a scanning mechanism that works with structural components of words (Mewhort & Beal, 1977). Others examined the role of orthographic rime and analogy (Bowey, Vaughan, & Hansen, 1998; Calhoon & Leslie, 2002; Goswami, 1998). Many studies (see Henderson, 1982) examined the smooth-running process in proficient adult readers. Henderson acknowledges that it is difficult to teach beginners without understanding the strategies behind fluent reading. However, research on fluent adult readers may not be directly applicable to proficient *young* readers. Word solving traditionally has been examined with a word list or pseudoword-reading task rather than continuous text. Although conclusions often are drawn based upon measured response latencies or readers' responses to primed target words, children's problem-solving attempts are rarely examined on-the-run in the context of continuous text.

With a view toward examining what occurs on-the-run with continuous text, a tool that captures responses as they occur in real time is critical. In contrast to a one-time test yielding only a score or reading level, systematic observation has the unique advantage of capturing readers' distinct actions at many points in time. The following discussion provides a rationale for systematic observation.

Systematic Observation

Systematic observation requires an *unusual lens*, a methodology that captures detailed data about changes in young children's literacy behaviors over time as they read or write continuous text (Clay, 2001, p.42). Bakeman and Gottman (1986) define systematic observation as an approach to quantifying naturally

occurring behavior observed in naturalistic contexts; they contend that observational procedures more effectively capture the dynamic nature of behavior sequences than other inquiry methods. Systematic observation permits researchers to arrive at a description of the reading process based upon data collected over time with children engaged in reading acts. In fact, two properly trained observers, witnessing the same series of actions, should produce identical protocols.

A running record is a systematic observation tool. When used as a research tool, a running record makes it possible to systematically observe and code details of reading behavior while the reader is engaged with a text. A running record paired with an audio recording of the reading helps the researcher capture and analyze the more rapid problem-solving actions of quite proficient readers. Students' imperfect performances and unexpected responses "suggest the kind of mental processing taking place and allow us to examine the leading edge of a learner's development" (Johnston, 1997, p.192). Gathering this detailed behavior over time creates the unusual lens that captures progress or change.

Literacy development in young children has been studied in varied ways. Studies of 5-year-old (Clay, 1966) and 6-year-old readers (Biemiller, 1970; Weber, 1970) revealed some early decision-making actions of beginning readers. Clay documented the complex, varied progressions of early literacy learning through weekly observations of 100 children from age 5 to age 6. Biemiller studied oral reading errors of 42 first graders across a school year and reported a three-phase description of reading acquisition. Weber's study of first graders' reading errors across a 7-month period revealed insight into word-reading strategies and highlighted differences between weaker readers and stronger readers as well as differences in performance early and late in the year. Children in these studies read continuous text, but they were not followed into their second year of instruction.

Several studies of 7- and 8-year-olds used oral reading of continuous text to understand more about literacy learning (Blaxall & Willows, 1984; Goodman & Burke, 1969; Pumfrey & Fletcher, 1989; Williams & Clay, 1982). Although these studies revealed some qualitative differences in reading behavior for the more proficient and less proficient readers, they only provided a snapshot of the reader at one point in time during the year. Most reported miscues or error behavior rather than the multi-step processes children use to problem solve as they read.

Additional systematic observations of text reading are needed to describe the reading behaviors of second graders. This exploration requires a detailed, year-long investigation of on-the-run actions initiated by children as they read continuous text with specific attention to the visible information in print.

METHOD

This inquiry was particularly suited to qualitative study (Merriam, 1998) because the extant literature about the reading process fails to provide an adequate description of the complexity of children's reading behavior and its change over time. This descriptive study is part of a larger project in which I collected and analyzed data gathered through intense, systematic observation of children involved with six different reading and writing tasks (Kaye, 2002). The design uses an unusual lens, which Clay (2001) described as a methodology for gathering detailed data at frequent intervals about literacy processing while reading or writing. Students provided the data through the act of oral reading while I recorded and interpreted the data through this unusual lens.

Researcher's Role

The researcher is the key instrument for collecting and analyzing descriptive data that have been gathered through intense observation in a natural setting (Bogdan & Bicklen, 1998; Merriam, 1998). My stance as a neutral observer facilitated taking detailed accounts of students' literacy behaviors as they read passages aloud. As the investigator, I endeavored to maintain objectivity and focus during the reading task while building the rapport and trust that is essential to the inquiry (Erlandson, Harris, Skipper, & Allen, 1993). Because I was not employed as a teacher in the schools, rapport with students was established early and maintained throughout the study by engaging the children in conversation before and after our sessions together.

Setting and Participants

A focus on proficient readers is critical in producing a model of what must happen to read well (Clay, 2001). A purposeful sample of proficient readers ensured that information-rich cases (Patton, 1990) of capable readers would be selected for study. Data from these students were essential for developing detailed descriptions of the way reading behaviors change over time in able readers.

Forty-five second graders from nine classrooms in three suburban north Texas elementary schools took part in the study. In Phase 1 of selection, teachers identified children performing at or above grade-level expectations in their literacy achievement. Teachers listed the students who met three criteria for participation: (a) the student could read on or above a beginning second-grade level according to classroom assessment measures, (b) the student did not receive reading instruction in a supplemental program, and (c) the student did not receive instruction in a bilingual class or English as a second language class. Parental permission was received for 50 of the 73 children who met Phase 1 selection criteria.

During Phase 2 of the selection process, these 50 students individually read a second-grade level text to me. Forty-seven students read the passage with at least 90% accuracy and began the study in September. Two students moved during the school year; thus 45 students remained at the end of the year.

To record and describe text reading behaviors that reflect effective processing, it was imperative to choose texts at an appropriate level of difficulty. Very easy texts do not afford many opportunities to observe overt reading work, and difficult texts reveal the reading process breaking down rather than functioning effectively. Therefore, instructional level texts (90–94% accuracy) were used in analysis at three points across the year. Many of the children read the highest-available text at an *easy* level in one or more of the 3 months; therefore, they had no instructional level text available and could not be included in the analysis. As a result, data were analyzed for the 21 participants who read instructional level texts at all three points in time (September, January, and April). The intent was to describe proficient readers' problem solving on a slightly challenging text, an instructional level passage.

Students' ages ranged from 7–0 to 8–8 in September, with a mean age of 7–7. There were 7 males and 14 females. Twelve students were White, 5 were Hispanic/Latino, 2 were Black/African American, 1 was Asian, and 1 was multi-ethnic.

Data Collection

Data were collected monthly from September to April. Although six different tasks comprised the larger exploration, one task is reported here: text reading. The children met with me individually, in an empty classroom or conference room within the school. To systematically observe and capture reading behaviors on continuous text, I took running records while students orally read narrative passages from the *Qualitative Reading Inventory–II* (Leslie & Caldwell, 1995) and *Qualitative Reading Inventory–3* (Leslie & Caldwell, 2001). I analyzed records of instructional level texts (90–94% accuracy) from September, January, and April. Many of these passages were above the second-grade level because proficient readers needed to encounter enough challenge to show what actions they took when meeting new or unusual words.

Students' reading was audiotaped to check for accuracy of the running records. I scored the running records immediately and checked them against the audiotapes within 1 month of taking the records.

Data Analysis

The research question guided the qualitative analysis of text reading: What reading behaviors do second-grade students exhibit on continuous text? Behaviors were defined as children's observable actions or responses during

text reading. Verbal behaviors provided the preponderance of data used in the analysis. Students' spontaneous comments about the story content or about their performances were recorded but not analyzed. Nonverbal behaviors, such as pointing to words, were also noted but excluded from the analysis.

To develop an initial framework for data analysis, five students' instructional level running records for September and April were analyzed. Running records were examined word-by-word, essentially replaying students' responses, to log and describe each behavior. Data were analyzed with a recursive process of examining, sorting, and grouping units of data to devise categories and establish the framework for analysis. This process of "emergent category designation" (Erlandson, et al., 1993, p. 118) yielded six behavior categories. An agreement of .96 was reached for categorizing reading behaviors with an interrater.

A working document, *A Guide to Reading Behaviors,* was constructed as a reference containing definitions, codes, and examples of each of the 109 unique reading behaviors observed. (See Kaye, 2002, for the complete guide.) Each behavior was also recorded and tallied on an analysis grid. This matrix served as a massive repository of the 2,539 analyzed text reading behaviors, sorted by month, child, category, and subcategory. An analysis of behaviors over time in addition to analyses within and among the categories yielded several discernable patterns that are described in the following section.

FINDINGS

Analysis of the 2,539 text reading behaviors showed that they clustered into six major categories. Yet within each category differences were noted among children and across text levels. Additional analysis of behaviors over time uncovered patterns of change and constancy. Therefore, findings are organized into four areas: behaviors, text level, patterns over time, and individuality.

Behaviors

Resultant categories from the running record data collected at three points in time included six main types of behavior: *substitution, solving, repetition, omission, insertion*, and *other*. Subcategories also emerged within three of the categories. Categories, subcategories, and definitions are presented in Table 1 on the following page. Self-corrections were observed as well, but do not appear as a main category of behavior. Self-corrections can only occur following an error, and I wanted to be able to trace them back to the child's error response. Therefore, self-corrections were recorded and analyzed in connection to the six primary behavior categories. For example, if a child substituted the word *coming* for *common* and then self-corrected, the behavior was recorded as a substitution and a self-correction was noted as the follow-up action.

Table 1. Categories, Subcategories, and Definitions of Observed Text Reading Behaviors

Category	Definition	Subcategory
Substitution	One-step action in which the student gave an incorrect response for the word in text and the response was pronounced as a whole unit	Real word Nonword
Overt solving	Action in which the student attempted to read a word aloud by any of three ways: (a) worked at the subword level, (b) combined subword level work with reading whole words, and/or (c) made multiple substitutions for the word in text	One-step Multi-step
Repetition	Action in which the student reread one or more words (excluding repetitions which occurred during an overt solving attempt)	With error Without error
Omission	Action in which the student omitted one or more words	
Insertion	Action in which the student added one or more words	
Other	Action which did not fit into the above categories and primarily reflected mumbled or unintelligible responses	

Altogether, more than 2,500 behaviors were analyzed and categorized from students' oral reading of instructional level texts across three points in time. Table 2 presents the frequency of behaviors within each major category. A discussion of patterns within each behavior category follows.

Substitution behaviors

Substitution behaviors occurred with the greatest frequency, representing 44–52% of the observable behaviors each month. Most substitutions (66–76%, depending on the month) were real words (e.g., *coming* for *common*) rather than nonwords (e.g., *empaniss* for *emphasize*). Analysis indicated that children drew on multiple sources of information to make the real-word substitution at least 80% of the time (see Table 3). Substitutions used meaning, structure, and

Table 2. Frequency of Text Reading Behaviors

	September		January		April	
	N	Col. %	N	Col. %	N	Col. %
Substitution	334	44.1%	469	52.3%	457	51.5%
Overt solving	195	25.6%	181	20.2%	233	26.2%
Repetition	158	20.8%	177	19.8%	141	15.9%
Omission	45	5.6%	38	4.2%	34	3.8%
Insertion	19	2.5%	24	2.7%	20	2.3%
Other	7	0.9%	7	0.8%	3	0.3%
TOTAL	757		896		888	

Table 3. Single and Multiple Information Sources in Real-Word Substitutions

	September		January		April	
	N	Col. %	N	Col. %	N	Col. %
Multiple sources	203	80.2%	259	83.5%	265	81.3%
Single source	39	15.4%	27	8.7%	32	9.8%
Undetermined	11	4.3%	24	7.7%	29	8.9%
TOTAL	253		310		326	

visual information in combination more than any other single or combined information source. Children self-corrected more real-word substitutions (26–33%) than nonword substitutions (5–10%); however, the majority of substitutions remained uncorrected.

Overt solving behaviors

Overt solving was the second most frequently observed behavior in text reading, with 606 occurrences. Overt solving behaviors were further divided into two subcategories: one-step solving and multi-step solving. In one-step solving, students overtly worked on a word in sequence by elongating sounds or dividing the word without starting the word over again (e.g., *re–garding* for *regarding* and *chimmmmps* for *chimps*). In multi-step solving, students made

multiple attempts to read the word, returning to the beginning of the word at some point in the solving (e.g., *affec, affection* for *affection* and *var, varitty* for *variety*). Both subcategories of overt solving included correct and incorrect responses. In September, 40% of the overt solving attempts resulted in correct responses. The incidence of correct solving rose to 53% in January and remained relatively stable (52%) in the April recording period. Few solving attempts (2–12%) were self-corrected.

Students produced more than 60 different overt solving behaviors over the year, with 74–86% falling in the multi-step category and 14–26% falling in the one-step category. Two behaviors represented the most common multi-step and one-step overt solving behaviors: (a) isolating or elongating the first part of the word (e.g., *skir–mish* for *skirmish* and *int, interesting* for *interesting*, and (b) isolating or elongating the first sound or consonant cluster of the word before completing the word (e.g., /f/–*eat* for *feat* and /w/*, washer* for *washer*).

Overt solving behaviors were also sorted to determine the linguistic units the reader appeared to use. Responses were analyzed to see how many contained an isolated phoneme or consonant cluster, a word part (syllable, rime, half of a compound word, or any part larger than an isolated phoneme or consonant cluster), a whole word, or a combination of these units. Word parts were used in 64–76% of overt solving attempts across the year, and they were usually combined with the pronunciation of a whole word.

The analysis of overt solving behaviors focuses specifically on the observed word- and subword-level solving. In other words, the descriptions of individual solving behaviors and the subsequent analyses centered upon the phonological and orthographic elements of the word. It must be acknowledged that students were reading these words in continuous text and could access meaning and syntax as resources; however, analysis did not include attention to meaning and syntax.

More than 600 overt solving attempts were recorded and analyzed across the year. In those attempts, these proficient second-grade readers *never* engaged in isolated phoneme-by-phoneme or letter-by-letter solving attempts across an entire word. When children did articulate individual phonemes in isolation, the sound primarily occurred in the initial position and was used in combination with larger word parts or whole words (e.g., /s/*, signal* for *single* and /k/*, Cap, Capman* for *Chapman*).

Repetition behaviors

Repetition behaviors represented approximately 20% of text reading behaviors. Students were four to five times more likely to repeat a single word or short part of a sentence rather than a full line or complete sentence. They reread correct portions of text and text containing errors; however, when they repeated

a portion of text containing an error, the error was self-corrected more than 60% of the time. Incidence of this type of self-correction increased across the year.

Other behaviors

Instances of omission, insertion, and other behaviors rarely occurred. Omissions and insertions were usually one word in length and were seldom self-corrected regardless of the semantic and syntactic acceptability of the resulting sentence. Omissions and insertions resulted in semantically and syntactically appropriate sentences approximately half of the time. The virtual absence of other behaviors indicated that students had the means to initiate attempts while reading; they rarely made no attempt, appealed for help, or mumbled a response.

Text Level

Text reading data were also analyzed according to instructional text levels. Grade 2 and 3 texts were considered on-level texts, and texts at Grade 4 and above were considered above-level texts. Overt solving behaviors were more common with above-level texts than with on-level texts. Overt solving accounted for 31% of the behaviors exhibited on above-level texts compared with 11% of on-level text behaviors, with little change across the year. When overtly solving a word in one step, students reading above-level texts were most likely to produce responses in which they separated or elongated the first part of word then finished the word (e.g., *inten–tion* for *intention* and *reeegarding* for *regarding*). This one-step solving behavior remained prominent across the school year for students reading above-level texts and almost always occurred on multi-syllable words.

Students reading above-level passages used a combination of word parts and whole words in most multi-step solving attempts, while those reading on-level texts usually combined consonant clusters or individual phonemes with whole words. The use of word parts with whole words increased across the year for the children reading on-level texts.

Patterns Over Time

When examining patterns of behavior over time, it is customary to think of patterns of change or difference. However, patterns of constancy are just as valid. This investigation of reading behaviors over time revealed both patterns of change and patterns of constancy. (See Table 4 on the following page.) As children read progressively more difficult texts across the year, the proportion of behaviors in each major category remained fairly stable. Additionally, substitutions continued to reflect readers' use of multiple cue sources.

Table 4. Patterns Over Time

Pattern type	Pattern observed
Change	• Students consistently read more difficult texts as the year progressed. • Second graders became more successful at solving words using a variety of subword parts over the course of the year.
Constancy	• The proportion of reading behaviors exhibited in each major category remained relatively stable from month to month. • Students regularly used multiple sources of information in their substitutions. • Inflectional and derivational endings were a constant source of difficulty in substitution errors. • Students reading above-level texts engaged in more overt solving behavior than those reading on-level texts. • Self-corrections were prominent throughout the year. • Some behaviors were virtually *absent* throughout the year: letter-by-letter solving, appealing for help, skipping difficult words and reading to the end of the sentence, and making no attempt.

Individuality

Systematic and sequential observations reveal patterns across records (Bakeman & Gottman, 1986), and those patterns can contribute to a description of the general progressions of literacy learning. Although this study examined on-the-run behaviors of individuals, data were aggregated for reporting. However, homogenized descriptions of an "average child" can neither accurately describe an individual's progress nor inform the teaching of an individual student.

An example of students' solving behaviors illustrates the way aggregated data mask individual differences. The third most prevalent multi-step solving behavior for the year was an action in which students made four or more consecutive attempts at a word (e.g., *pair, pairlem, pairle, pairliement* for *parliament*). More than half of the occurrences of this behavior can be attributed to two students, and those two students exhibited the behavior only in September. In fact, half of the children in the study never exhibited this behavior.

Children demonstrated 109 unique reading behaviors, many of which were idiosyncratic to particular children at a single point in time. These diverse and

distinctive behaviors reinforce the notion of individuality. Six students' attempts at reading the word *industries* illustrate the variety of overt solving behaviors employed:

Sara: *in–dus–tr, industries*

Greta: *intri, industries*

Ana: *inderstrees*

Jasmine: *indu, industries*

Steven: *in, industries*

Ben: *iss, id, indussstries, industries*

Systematic observation reveals useful descriptions of children's progressions in literacy learning; however, it also presents challenges. Although generalizations about trends over time may appear, the description that emerges may obscure the complex and varied paths individuals take in their literacy learning.

DISCUSSION

The purpose of this study was to describe the variety, complexity, and change in reading behaviors of proficient second-grade students across the year, with a specific emphasis on the visible information in print. One question guided the study: What reading behaviors do second-grade students exhibit on continuous text? A complex picture emerged as observational data were gathered over time. Lincoln and Guba (1985) spoke of lessons to be learned from qualitative inquiry. In this case, the lessons are about readers' flexible control of processing behaviors and their extensive repertoire of ways to problem solve words. Each of these areas is discussed relative to the present study and the literature in the field.

Proficient Readers Flexibly Control a Range of Processing Behaviors

The present research examined second graders' literacy learning by observing reading behaviors, or acts of processing, on continuous text. Reading is a continual decision-making process across phrases, sentences, and passages (Clay, 1991, 2001; Rumelhart, 1994; Singer, 1994); therefore, readers can exercise the full range of acts required in reading only when working on continuous text.

A theory of literacy processing suggests that children actively assemble a variety of systems to tackle challenges as they read. Assembling working systems

(Singer, 1994) requires flexible, moment-by-moment mobilization and reorganization of different systems to deal with different problems. Thus, children must develop a repertoire of ways of processing text, integrating information from various knowledge sources to solve words, phrases, and messages.

Processing behaviors

Studies of 5-year-old (Clay, 1966) and 6-year-old readers (Biemiller, 1970; Weber, 1970) revealed some of the early decision-making actions of beginning readers. The present study extended the inquiry by examining reading behaviors of proficient second graders over an academic year. These readers displayed a varied repertoire of responses that indicate they are assembling working systems and making rapid decisions to effectively process text. The behaviors that signal their efficient processing are listed in Table 5.

Table 5. Repertoire of Responses

Behavior	Explanations and comments
Large amounts of correct reading	Instructional-level text provides opportunities for successful reading, smooth integration of processing behaviors, and rapid problem solving.
Substitutions close to the text	Errors reflect attention to multiple information sources (semantic, syntactic, visual, and phonological). Approximately one-fourth are spontaneously corrected.
Helpful repetitions	Short repetitions (one to three words) are used to confirm reading or correct errors. Repetitions following errors usually result in self-corrections.
Self-corrections	Students are aware of mismatches between text and take actions to eliminate the dissonance.
Repertoire of word-level solving behaviors	Students can shift attention to word and subword levels as needed, using a wide variety of larger, efficient units.
Few omissions and insertions	Omissions and insertions are rare and usually involve single words.
Initiative in problem solving on continuous text	Students do not stop or appeal for help when confronted with difficulties in text. They make multiple attempts at problem solving.

A striking finding in the text reading analysis was that children *always* initiated problem solving. The virtual absence of appeals and non-responses stands in stark contrast to studies of younger readers that found beginners likely to give no response (Biemiller, 1970) or wait until prompted at difficulty (Clay, 1966). Despite the fact that texts were sometimes about unfamiliar subject matter and contained unusual words and concepts, these second graders consistently worked toward solutions. These findings provide strong evidence that proficient second graders are assembling systems to deal with the challenges they face in text reading.

When reading is accurate, responses neatly fit a matrix of relationships (Rumelhart, 1994). If readers are assembling efficient working systems, their errors show a search for this convergence of information. In this study, the overwhelming majority of substitutions occurred rapidly and incorporated multiple sources of information. The following example illustrates the sophisticated nature of this problem solving.

Text: Magellan defeated the rebels and left two of them on shore to die.

Ana: Magellan *defied* the rebels and left two of them on shore to die.

Ana's substitution, *defied*, contains the same clusters of letters at the beginning and end as the word in text. It fits the sentence syntactically and, like *defeated*, is a past tense verb. *Defied* is meaningful in the context of the sentence and the passage. In the story, resentful ship captains were turning back for home and rebelling against Magellan who was determined to find a passage to the Pacific despite extreme hardships. Thus Ana's approximation incorporates multiple sources of information, and she made the substitution on-the-run as she fluently read a somewhat demanding text containing subject matter that may have been unfamiliar.

The pattern of searching for responses that fit the text along several dimensions is not unique to this investigation. Other studies have reported the same behavior in 7- and 8-year-olds; students frequently exhibited substitutions, and the errors often indicated that readers were drawing upon semantic, syntactic, and visual knowledge (Goodman & Burke, 1969; Pumfrey & Fletcher, 1989; Williams & Clay, 1982).

Often students' responses fit well in the story, but additional searching and checking led to revision and self-correction. Readers seemed to look for converging evidence from multiple knowledge sources (Rumelhart, 1994) that, if not achieved, sparked an additional search. In the following example, a substitution that fit the semantic, syntactic, and visual/phonemic constraints of the story quite well was fixed on the spot. It is not possible to know precisely

what triggered the correction, but the child may have checked the end of the word, recognized the inflectional ending *–ed*, and noticed the disparity. In the example, Carla's second attempt, *begged*, resolved the problem and fit semantically and syntactically.

Text: …with little food and water, the sailors begged to turn back…

Carla: …with little food and water, the sailors *began—begged* to turn back…

Self-correction has been reported as a sign of progress in children's first year of reading instruction (Biemiller, 1970; Clay, 1966) that continues across the next two years (Goodman & Burke, 1969; Williams & Clay, 1982) or more. Although beginning readers often repeat entire sentences to self-correct (Clay, 1966), proficient second graders in this study made self-corrections close to the point of error. This difference points to another sign of progress; readers are becoming more efficient, and the process of detecting and correcting errors serves to strengthen the system.

Extending the system

The notions of economical processing (Gibson & Levin, 1975) and bootstrapping (Stanovich, 1986) are useful ways to think about second graders' growing expertise. As children get more efficient at problem solving, they make more successful decisions with ease. By carrying out complex acts of processing, children extend the range of their strategies and the size of their response repertoires. Clay (1991, 2001) refers to this concept as a *self-extending system* of literacy expertise. Large amounts of successful solving enable the reader to apply strategies to increasingly difficult texts such that children extend their own competencies.

In this study, second graders consistently read large stretches of relatively error-free text and engaged in the rapid searching, checking, and self-correcting acts that strengthen the processing systems. Across the year they read increasingly difficult texts, many at the junior high level, a strong indication that they had extended the capacity of their processing systems. These children were successfully applying their repertoire of strategies to difficult text containing unusual vocabulary and unfamiliar subject matter. They had developed sophisticated response repertoires well suited to the literacy challenges they faced.

Proficient Readers Have a Large Repertoire of Ways to Problem Solve Words

As proficient readers process text, they smoothly integrate visible sources of information in print (letters, clusters, and words) with invisible information

(phonological, syntactic, and semantic knowledge), employing a range of searching and checking actions (Clay, 2001). Most of their attempts fit the text along several dimensions. The following examples illustrate this multi-dimensional "fit":

Text: The young *tsar* Peter the Great…

Lenny: The young *star* Peter the Great…

Aaron: The young *teaser* Peter the Great…

Sometimes a solution is more elusive, and students take a different approach:

Zach: The young *T-S-A-R* Peter the Great…

Audrey: The young *t-sar* Peter the Great…

Looking only at letters and words ignores much of what readers do in the solving process. The present discussion, however, focuses on just one portion of the complex network of decision-making: using the visible information in print. Many reports hypothesize about the internal processes readers use at different phases of word-reading expertise (Ehri, 1994, 1995; Henderson, 1982), but descriptions of how children overtly take apart words during text reading are scarce. The present study describes the variety of ways children solve words, their expertise at using phonological and orthographic knowledge, and the word parts predominantly used.

Variety of ways to solve

Second graders initiated one-step and multi-step overt solving behaviors to take apart words as they read. Students employed an amazing variety of overt solving behaviors, including more than 50 different multi-step solving behaviors. The following behaviors represent a sample of overt word-level solving behaviors:

1. The child said the first part of the word, then started over and said the whole word. (*int, interesting* for *interesting*)
2. The child said the first consonant cluster or sound of the word, and then said the whole word. (/w/*, washer* for *washer*)
3. The child made four or more attempts using a variety of word parts and/or whole words. (*con, con, cunny, cunny, continuted* for *continued*)
4. The child made consecutive substitutions. (*hid, heard, head* for *head*)
5. The child separated or elongated the first sound or cluster then said the remainder of the word. (*dr–ied* for *dried*)

6. The child said first part of a word 2 different ways, started over, and said the whole word. (*dis, diseye, disease* for *disease*)
7. The child divided the word into three or more parts. (*in–hab–i–tents* for *inhabitants*)

Expertise

It is commonly accepted that there is a general progression of development in which readers become more adept at using their increasing orthographic and phonological knowledge (Calhoon & Leslie, 2002; Ehri, 1995; Samuels et al., 1978). They are economical in their ability to quickly access large units, and they can make fine discriminations if needed (Clay, 1991; Gibson & Levin, 1986). Indeed, second graders in the present investigation were expert at accessing helpful units.

When overtly solving at the subword level, whether in one-step or multi-step solving, second graders consistently did three things:

1. attempted the words
2. worked left to right across words (e.g., *in–hab–i–tents* for *inhabitants*)
3. used a rich variety of word parts, including (a) multi-syllable units (e.g., *parlin, pairlinen, pairliment* for *parliament*), (b) syllables (e.g., *pre–met–eev* for *primitive*), (c) parts of compound words (e.g., *ship–yard* for *shipyard*), (d) morpheme stems with inflectional or derivational endings (e.g., *long, longer* for *longer*), (e) onset-rime (e.g., /f/*–eat* for *feat*), (f) letter clusters (e.g., *pr, proved* for *proved*), and (g) individual letters combined with other word parts (e.g., *star, t-sar* for *tsar*)

Readers worked proficiently and persistently, exhibiting a fascinating range of actions. However, the actions that they did *not* demonstrate were equally impressive. Across hundreds of solving behaviors, there were four actions that readers never took:

1. They never attempted letter-by-letter or phoneme-by-phoneme solving.
2. They never skipped the difficult word and read to the end of the sentence.
3. They never appealed for help before trying the word.
4. They never stopped and failed to respond.

Although teachers often encourage students to use the first two techniques when they run into difficulty, these do not appear to be useful strategies; good readers do not problem solve in these ways. Proficient readers usually use larger, more helpful parts of words to extend their own capacities for problem solving.

They independently initiate solving attempts and work at the problem until they reach a correct response or decide that they have done everything they can do. Admittedly, it is not possible to determine whether readers know if their final responses are correct, but they consistently initiate attempts without asking for help.

Units of solving

With the current focus on phonemic awareness and systematic phonics instruction, it is interesting to see which word parts proficient readers use when they come to new or unknown words. Second graders have an unquestionable preference for using the larger, more efficient units of visual information in their solving. In this study they articulated whole words in 92% of their solving attempts, either as consecutive substitutions or in combination with other word parts. They used word parts in 68% of their solving attempts, and they isolated individual sounds or consonant clusters in 27% of overt solving attempts. Among hundreds of solving attempts in this study, not a single proficient reader tried to work out a word by sounding phoneme by phoneme across the word.

As part of the larger study, not reported here, the children were also asked to read words in isolation. Responses revealed the same overt solving behaviors that were found when reading continuous text (Kaye, 2002). Again, children consistently attempted words, worked left to right across words, and used a rich variety of word parts. They never attempted a phoneme-by-phoneme solving.

SUMMARY AND IMPLICATIONS

This investigation provides a baseline for understanding the literacy processing of proficient second-grade readers. When students are efficiently processing text, they flexibly draw from a vast response repertoire. They use their expertise in language and their knowledge of print, stories, and the world to problem solve as they read. Supported by mostly correct responding, readers are able to momentarily direct their attention to the detail of letters and sounds as needed. When they need to problem solve words in greater detail, second graders can draw upon their orthographic and phonological knowledge with incredible flexibility and efficiency, usually using the larger subword units. Then they are free to get back to the message of the text.

The proficient second graders in this study demonstrated impressive processing behaviors as shown by the compelling list below:

- always taking the initiative to solve problems rather than appealing for help
- using a vast repertoire of actions to problem solve
- assembling working systems for problem solving on the run

- focusing on larger units rather than sounding phoneme by phoneme
- using multiple sources of information and taking correcting actions to eliminate dissonance
- reading a large amount of text correctly, with only momentary pauses for problem solving words

These behaviors give insight into the meaning of *on grade level* as related to the observable reading behaviors of children engaged with text. This investigation, which underscores the complex nature of reading, has implications for teachers' expectations of readers as well as their teaching decisions. The evidence challenges us, as educators, to search for ways to foster these behaviors in all readers.

Sensitive, systematic observation by classroom teachers is important for supporting student's reading progress. Analyzing records of students' reading on continuous text is recommended to help teachers get insight into the processes children use as they read (Johnston, 1997; Leu, 1982; Wixson, 1979), looking for signs of strength and difficulty. They might reflect upon the following questions to guide their analyses. Are there large stretches of accurate reading? At difficulty, does the student stop and appeal for help or take initiative to work at the problem? Is problem solving rapid? Does the student make short, helpful repetitions to confirm and self-correct? Are the substitutions a "good fit" with the text, reflecting use of multiple sources of information? Does the student search for alternatives and work at difficulties?

It is equally important that teachers consider the challenges offered by particular texts so they can ensure that students have opportunities to extend the capacity of their processing systems. It is recommended that teachers give students opportunities to read large amounts of continuous text at an appropriate level of difficulty so that children have opportunities to build efficient working systems and extend their response repertoires. It is only on continuous texts that students can engage in the sequential decision-making processes needed to strengthen their processing (Clay, 2001).

This study also opens several avenues for future research. Additional investigations are needed to build upon this description of literacy processing in proficient second-grade readers. One alternative is to examine children's reading with a more individualized and in-depth perspective, using case studies of different children. Frequent, detailed observations of students reading continuous text would allow the researcher to construct profiles of individuals' learning and capture unique differences. Extending this study across time would reveal how proficient readers continue to address the challenges of increasing text difficulty in later grades.

This investigation also has implications for research in the area of reading difficulty. An understanding of proficient readers' paths of progress can help

educators who work with children experiencing difficulty. Replication of the present study with low-progress readers could provide important insights into the nature of their struggles. Given the individual nature of learning, the complexity of the reading process, and the challenges associated with aggregated data, descriptions of the *varied* ways children get off-track in their learning would be critical. This research is a starting point for individuals responsible for designing and refining intervention programs beyond first grade. It represents a description of reading behaviors of proficient readers, but much work needs to be done to determine how to best teach struggling readers in second grade and beyond.

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