

CHAPTER 26

Marie M. Clay's Theoretical Perspective: A Literacy Processing Theory

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Marie M. Clay was a clinical child psychologist who chose to study young learners during their initial, formative years of literacy acquisition. Applying the perspectives and practices of developmental psychology (Clay, 2001), she sought to document behavioral changes in children's literacy development by capturing performance in reading and writing tasks collected over time. She therefore designed studies to gather empirical evidence collected in controlled conditions, and she grounded her tentative theories in the resulting data (Clay, 1998).

Clay's initial work was motivated by questions resulting from the correlations found between learners' literacy performance in the first year of school and their rankings among peers in subsequent years. Specifically, she found that those with very limited progress in reading and writing at the end of their first year of instruction remained among the lowest performing students year after year. To address this challenge and create instructional opportunities to change predictions of failure, Clay chose to initiate her work by pursuing clarification of optimal literacy development among young learners, that is, securing descriptions of the literacy progress of successful children.

Applying the perspectives and practices of developmental psychology (Clay, 1991a), she documented changes in children's literacy development by capturing behavioral performance in reading and writing tasks collected longitudinally. There were no existing accounts of learners engaged in their earliest school-based encounters with literacy; therefore, she set out to document what occurs, which she referred to as a legitimate first step (Clay, 2001). Although delineation of behaviors changing over time was her first objective, related goals, aligned with her developmental orientation, were explanations of observed changes and consideration of how to modify learning conditions to optimize development for all individuals (Clay, 2004). For struggling learners, she described this as "leading children back...to a more secure developmental track, that is, to the *recovery of a more normal trajectory*" (Clay, 1998, pp. 288–289), which brought her to the study of intervention.

Resulting from her earliest investigations of literacy, Clay (2001) embraced a complex theory of literacy and defined reading as

a message-getting, problem-solving activity, which increases in power and flexibility the more it is practised. It is complex because within the directional constraints of written language, verbal and perceptual behaviours are purposefully directed in some integrated way to the problem of extracting sequences of information from texts to yield meaningful and specific communications. (p. 1)

Her quest for theoretical explanations focused on building understandings of both the specific perceptual and cognitive behaviors involved in reading and writing and explanations of the integration of complex in-the-head processes. Thus, explanations of progress involved descriptions of working systems, that is, the perceptual and cognitive working systems directed to complete reading and writing tasks.

The acquisition of literacy processing “begins when a child is expected to compose and write a simple message or read a simple continuous text” (Clay, 2001, p. 97), for it is in processing complete messages that the working systems for literacy are engaged and developed. She therefore focused on learners reading continuous texts and composing and writing personal messages.

Initially, Clay focused on discovering the emerging and changing literacy behaviors of children who were found to be proficient readers and writers for their age cohort. She sought to base her inferences on patterns of development in the behaviors of those children exhibiting expected changes in reading and writing over their first year of school. An additional benefit of detailed accounts of optimal development was understandings of “when and how to begin teaching, of the changes that may be expected over time, of the track that most children take, of the variability to be expected, and of different developmental paths” (Clay, 1998, p. 255).

Clay considered the pre-school, developmental histories of children to be unique, individual, and replete with complex learning tasks. Children construct their own understandings as a result of opportunities to learn, they do not shy away from complexity, and they bring their unique stores of knowledge with them to school. At 5 years of age, each school entrant has extensive knowledge of oral language even though their oral language acquisition is incomplete. Their oral language proficiency, their vocabulary knowledge, their knowledge of their worlds, and their pre-school experiences with literacy are available when formal literacy instruction begins and they initiate construction of complex processing systems.

The following discussion reviews Clay’s discoveries resulting from her meticulous efforts to describe changes observed in children’s literacy processing during early acquisition, the theoretical perspective resulting from her quest to explain observed changes, and actions relative to promoting optimal development for young learners in need of a more secure developmental track.

Research Efforts: Documenting Changes Observed in Literacy Processing

Clay began her quest to document change in observable literacy behaviors with an atheoretical, no-hypothesis stance to data collection (Clay, 1982). Unsatisfied

with existing explanations of reading acquisition, she sought new understandings through scientific methodology involving both qualitative and quantitative procedures. Her initial goal was to record children's behaviors sequentially "using reliable, systematic sampling and observation techniques" (Jones & Smith-Burke, 1999, p. 262).

Clay's methodology deviated from prevalent approaches that tended to quantify the effects of instruction by examining learners' pre- and postinstructional performance. In opposition to quantifying the effects of instruction (or teaching), Clay's interest was the delineation of qualitative changes in children's learning. She focused on the study of observable behaviors in how children work in reading and writing continuous texts (i.e., literacy processing) and interpreted changes as signals of change in psychological processes, such as perceiving, linking, and decision making. She referred to her perspective as a literacy processing view of progress in literacy acquisition and determined that the resulting descriptions of change offered an alternative view of progress—alternative to the more common use of pre- and posttests and statistical computations to set expectations (of both curricular goals and student achievement) and to evaluate results (Clay, 2001). Her focus included examining what young readers do as they encounter and problem solve increasingly difficult tasks. Therefore, by studying learners over time through the documentation of observed behaviors, she sought to clarify the sequence of changes in ways children process information and the emergence of competencies for effective reading and writing.

To conduct her research, she developed and applied an unusual lens, defined by her as any observational tool or research methodology that gathers "detailed data on changes in literacy processing over short intervals of time from subjects engaged in reading or writing continuous texts" (Clay, 2001, p. 16). Clay's running record of reading provides an example of an observational tool for collecting sequential, detailed accounts of what occurs as a child reads continuous text.

Clay's (1982) seminal research of 100 New Zealand children entering school at the age of 5.0 was a longitudinal study involving both weekly, systematic observations of individuals' writing and reading behaviors collected within natural settings and a test battery administered at three points over each child's first year of school. Clay conducted her study in classrooms where children were engaged in writing personal messages and reading storybooks daily within weeks of entering school. Although the participants were from different classrooms and schools, Clay determined that the common curriculum guidelines created instructional consistency across settings. Teachers did not delay opportunities for authentic literacy tasks, nor did they follow a prescriptive curriculum requiring proficiency with prerequisite skills prior to engaging children in reading and writing stories. Teachers expected children to work as independently as possible, and their expectations matched children's competencies. Thus, initial writing samples were often drawings with labeling provided by an adult. Although none of her participants could read at entry to school, all were introduced to short story books written in a familiar language within their first seven weeks of school.

When children reached the end of their first year of instruction and were tested with standardized instruments, Clay used the results to create four groups of varying levels of proficiency: high, high average, low average, and low. Comparing the performance within and between groups, Clay (1966) discovered that children were significantly different in their literacy learning. The results revealed multifaceted ways in which children “constructed complex literacy processing systems for both reading and writing” (Clay, 2001, p. 288). Her documented map of literacy behaviors allowed her to describe literacy learning in the process of change, which gave Clay the genesis of her literacy processing theory.

This study prompted ongoing research conducted by Clay and her colleagues to pursue and confirm understandings and to test alternative hypotheses. The foci of her extensive body of research include the reading behaviors of children in their third year of instruction, syntactic analyses of reading errors, self-correction behavior, writing development, oral language performance, language proficiency of bilingual children, analysis of linguistic variables in oral reading (juncture, pitch, stress), concepts about print, visual perception, prevention, and early intervention (see Clay, 1982, 2001).

Research Findings: Documented Changes in Literacy Behaviors Over Time

Clay observed that the young learners she followed often read their first books using low-level strategies, or primitive working systems, acquired from experiences with talking, writing, and listening to stories prior to entering school. For example, some appeared to rely on their auditory memory of predictable sentences or stories. Many were aware of concepts of books, including awareness of the connections between pictures and text and anticipating and using a repeated sentence pattern. Their prereading behaviors indicated that they were attending to many aspects of literacy as

- they responded to print with a series of utterances
- they checked with pictures for agreement
- they matched pointing and word utterance on 50 percent of the text
- they increased attention to words using the spaces between words to guide them
- they located one or more words on request (Clay, 2001, p. 59)

Although such early processing behaviors (low-level strategies for reading) are not effective, they were found by Clay to be an adequate, initial starting place as they evolved into behaviors revealing more complex working systems and accurate and efficient responses as a result of instruction. Clay (1982) confirmed that the development and learning that led to more appropriate literacy processing behaviors resulted from ongoing exposure to stories (i.e., continuous texts). There was no advantage to delaying text reading and personal writing opportunities for 5-year-old children. In contrast, experience in continuous texts revealed important advantages.

Clay (1966, 1982) reported observing changes in a range of behaviors in each of four areas as learners exhibited more proficient reading behaviors. These four areas are (1) the directional constraints on movement (i.e., consistent left to right movement across words and lines of text), (2) visual perception of print (i.e., awareness of letter and word forms), (3) constructing appropriate types of speech responses (i.e., appropriate speech or syntax), and (4) the matching of spoken word units to written word units (i.e., synchronized one-to-one matching; Clay, 1982).

Clay determined that the earliest, teacher-scaffolded reading and writing activities supported essential learning neglected by most literacy theories. This includes the appropriate directional schema for attending to print and the movement patterns for processing text. “Directional behaviors manage the order in which readers and writers attend to anything in print. Gaining control of them is a foundational step in literacy as oral language is matched to written language” (Clay, 2001, p. 118). Establishing consistency in directing visual attention to print so lines of text, words, letters, and clusters of letters within words are scanned left to right in sequence is challenging and requires time. Evidence resulting from a study of quadruplets revealed both a time span of six months and clear, individual differences among children in the time needed to secure appropriate directional scanning of text (Clay, 1974, 2001).

Where to look, what to look for, and how to fixate and move the eyes across print are among the first things learned by novice readers. For the beginning reader/writer, this learning involves coordinating the body, hand, and eye movements needed for literacy processing, and thus, motor behaviors create an early working system for processing text. Gradually, directional order and one-to-one matching of speech with print become established routines requiring no conscious attention. This learning is one of the advantages of immersing beginning readers in the reading and writing of continuous texts.

In regard to visual perception of print, Clay found the richest depictions of the learner’s awareness of letter and word forms in the writing products of her proficient learners. The following is a brief depiction of this learning of the features of print and the relationship between letters and words. Children gradually shifted from creating messages by drawing and writing to recording written messages without drawings; they exhibited awareness that writing consists of letters, a string of letters comprise a word, a word is a specific sequence of letters, and the sequence of letters relates to the spoken form of the word (Clay, 1998). The child’s knowledge of letters and sound–symbol relationships is neither extensive nor complete at this point, and gaining control of this information is a major task. However, awareness and initial understandings create supportive visual knowledge for early reading that will continue to expand as a result of ongoing reading and writing experiences.

With only a few known items of visual knowledge (several letters and words), the proficient readers appeared to expand their literacy processing by increased applications of their newly acquired information. Analyses of their oral reading errors revealed searching and monitoring behaviors on the basis of visual

information, often only an initial letter. The important processing advance was the child's increased receptiveness to visual information and ability to pull a new kind of information in print knowledge together with other knowledge sources (i.e., syntactic information) to read a message (Clay, 2001, p. 64).

Clay determined that early writing experiences served as a significant source of new learning that contributed to the child's construction of more effective working systems for processing literacy. Children in her studies were learning to read and write concurrently, which created benefits supporting the acquisition of foundational knowledge and the inner control of literacy processing. By writing a single sentence, the learner coordinates a range of behaviors: movement patterns required for dealing with print, ordering written language in appropriate sequences, visual scanning of letters and words, and the analysis of sounds in words. The learner attends to features of letters, learns new letters and some words, and begins to link sounds with letters. Writing experiences help build the working systems needed to search for information in print, strategies used to combine and check information, an awareness of how to construct a message, and awareness of the sources of knowledge available in written language (Clay, 2001, p. 17). These represent key, foundational aspects shared by writing and reading.

Based on her study of writing development over time, Clay (1975) observed that in the writing context, young writers

do not learn about language on any one level of organization before they manipulate units at higher levels. When they know a few letters they can produce several words, and with several words they can make a variety of sentences. (p. 19)

Their attention to letters, sounds, and words serves their efforts to record personal messages, and they manage the complexity of the full range of information sources to complete their intentions. Clay (1982) noted that although their initial understandings are perhaps intuitive, her observations and evidence suggest that children learn on all levels of the language hierarchy at once, and it is the "rich intermingling of language learning across levels which probably accounts in some way for the fast progress which the best children can make" (Clay, 1975, p. 19). This represents the reciprocity between writing and reading that is so beneficial to the learner's construction of early literacy systems and acquisition of language knowledge that extends processing in both reading and writing.

Interestingly, Clay (1982) found no developmental sequence apparent in her records of proficient readers' emerging and changing behaviors in reading and writing. Individual children exhibited unique developmental histories, including "by-passing many of the steps which another child may follow" (Clay, 1982, p. 14). This discovery confirmed that individual learners take different paths to proficient reading and writing development (Clay, 1998, 2001). However, records also revealed that some children had difficulties with various aspects of the four early areas of development, and others persisted with inappropriate responses to reading and writing, such as a consistent right to left approach to print or inventing stories when asked to read (Clay, 1982).

In regard to changes documented in the readers' awareness of foundational literacy behaviors, records of reading behaviors revealed increasing awareness of the following:

- where to attend
- where to search
- what information to use
- what to relate information to
- how to monitor its acceptability
- what to do in the face of a dissonant result (Clay, 2001, p. 104)

As children gained awareness and their behaviors suggested more proficient working systems, they began to integrate information from two or more sources (e.g., from visual and syntactic information sources) more consistently to match what they said to the print. These behaviors were early forms of efficient reading behaviors that “became purposefully directed in some primitively integrated way to the problem of extracting a sequence of cues from text” (Clay, 2001, p. 60). These behaviors were interpreted by the teachers in Clay's study as indicative of the learners' preparedness for their first formal instructional texts.

One pattern of behavior appearing in Clay's original data was the unprompted, spontaneous self-correction of reading errors by young learners. Self-corrections were observed in the earliest readings of stories and first appeared when the child noted that his or her speech (oral reading of words) did not correspond to (match) the locating movements for the printed words on the page (often involving finger pointing). Based on monitoring appropriate movement patterns for reading, the reader revised, or corrected, his reading. This early behavior indicates a learner's willingness to choose between alternatives in order to read a precise message and maintain a fit between the language and visual information, two sources of information for text reading (Clay, 1991b, 2001).

As her proficient readers advanced in text reading levels, Clay (1991b, 2001) found that self-correction behaviors revealed that readers could search and check more and more detail in print to both correct and confirm their reading, which involved the range of information sources: visual information, including letter forms and letter-sound relationships; syntax; and semantic information. Clay (1982, 1991b, 2001) proposed that self-correction and the problem solving it entails is tutorial for the reader who is reinforced internally for his or her monitoring, searching, generating, choosing, and evaluating. Thus, Clay (2001) suggested that a learner's “willingness to choose between alternatives leads to a search for more information and this can potentially take processing to new levels of complexity” (p. 120).

There were two additional discoveries regarding self-correction behavior. First, a high level of reading accuracy (90%) is required for proficient self-correction behavior, and there is a clear progression in the amount of rereading completed by readers engaged in self-correcting. Records revealed that rereading is initially done

from the very beginning of a sentence or a line of text and progresses to the rereading of a phrase, then rereading of a word, then an initial letter. Clay (2001) reported that this sequence, a pattern found to be identical in the records of high and low progress readers, provides a way to judge progress and observe change in the reader's literacy processing over time.

At the point when proficient learners transitioned into formal instruction, Clay's (2001) records of behaviors revealed the following:

- They could not read, but they identified the words in the text with 80% accuracy.
- They selected words one after the other to construct viable sentences.
- They could reject a response and try a different one.
- They began to self-correct.
- They knew a few words in reading and/or writing.
- They could bring two kinds of behaviors together (e.g., verbal and pointing behavior).
- They often stressed the separation (juncture) between words.

Gradually, readers demonstrated the ability to construct what a line of text might say, locate the sequence of information to attend to, and detect, or monitor, mismatches between their seeing and saying (Clay, 2001).

As these beginning readers worked with different kinds of information, their processing was labored, observable, and sequential. The transitions and development that Clay observed were replicated by Nalder (as cited in Clay, 2001) and delineated as follows:

- (Readers) begin to try to use the language of the book, to match what they say line by line and (later) word by word with some attention to occasional visual cues in known words. Language composed by the child supports any processing but can override the printed text.
- Another change is detected when the reader uses the language of the book, matched word to word, and definitely attends to some visual information. There is a lot of searching, checking and self-correcting with appropriate appeals for help and some omissions.
- Within about six months, fluent accurate reading is achieved by many with some successful solving, and two or more sources of information are used for one decision.
- After six months at school, proficient readers can be independent when handling the challenges in appropriately selected easy texts, using several sources of information (semantic, syntactic, visual, or sounds in sequence), and knowing how to check one kind of information against another.

Therefore, as a result of instruction in continuous text, “a quite simple set of responses became controlled, accurate and co-ordinated” (Clay, 2001, p. 59). In effect, these behaviors were early forms of efficient reading behaviors that

became purposefully directed in some primitively integrated way to the problem of extracting a sequence of cues from text. Children were attending to letters, and words, and the sounds of letters in reading and writing, and they monitored these activities while enjoying the story they were composing in either reading or writing. (Clay, 2001, p. 60)

Clay had documented the early emergence of foundational processing and ongoing changes in her readers’ literacy processing systems. She found that from the beginning, proficient readers use language and visual and motor information so “what on the surface looks like simple word-by-word reading...involves children in linking many things they know from different sources (visual, auditory/phonological, movement, speaking/articulating, and knowledge of the language)” (Clay, 2001, p. 79) to read a precise message. In effect, the reader making good progress constructs a literacy processing system that involves all language knowledge sources, including story structure, language structure, words and word structure, letters, and the features and sounds of letters.

Over time, the records of oral reading by proficient, beginning readers revealed increasing attention to and success with the visual information in text (e.g., initial letters, letter clusters, word parts, words) while maintaining appropriate syntactic and semantic utterances for the given context. In the beginning reader, each knowledge source is limited, and proficient development results from ongoing instruction in both reading and writing contexts. Much of the new learning entails visual perception and the acquisition of a large set of items (e.g., letters, letter clusters, words) acquired over time. However, in both reading and writing contexts, Clay’s young learners engaged in literacy activities successfully by being allowed to draw on their existing language knowledge while being introduced to new learning. Clay (1982) found this to be true of a diverse set of learners, even bilingual children whose command of the English language of instruction was limited.

Proficient readers used their knowledge of oral language from the beginning. Their oral language provided a reliable source of information for predicting messages and for detecting reading errors. Gradually, the readers’ awareness of semantic and syntactic information in text was enhanced by visual perceptual learning, including the learning of letters, letter–sound associations, words, and the use of word parts and syllables. Over time, semantic and syntactic information sources continued to expand, and important learning also proceeded “in the direction of more and more receptiveness to visual perception cues which must eventually dominate the process” (Clay, 1982, p. 28). Reading is a visual task, and the learner’s increased, detailed control of visual information is an essential part of early reading acquisition (Clay, 2001).

In addition to the observed changes over time in a proficient reader's awareness of and increasing knowledge of the range of sources of language information in text, Clay's (2001) evidence also revealed how the early, primitive literacy processing expanded into more efficient decision-making. She discovered that proficient readers were constructing a network of strategic behaviors, action systems, or cell assemblies for processing text—cognitive terms useful in describing “what readers do as they work sequentially on the information sources in print to get the author's message” (Clay, 2001, p. 198). The readers had learned how to search and check information, how to go back to search again, and how to monitor their reading and confirm their decision making. The types of strategic behaviors they applied include the following:

- controlling serial order according to the directional rules for the script being read, across lines and within words
- using what you know about in reading to help writing and vice versa
- problem-solving with more than one kind of information
- actively searching for various types of information in print
- using visual information
- using language information
- drawing on stored information
- using phonological information
- working on categories, rules or probabilities about features in print
- using strategies which maintain fluency
- using strategies which problem-solve new features of printed words and meanings
- using strategies which detect and correct error (Clay, 2001, p. 199)

To explore the reading of proficient readers after three years of instruction, children's oral reading behaviors were gathered in a number of studies conducted by Clay and colleagues (see Clay, 1982). Clay's summary of this observational data revealed successful readers working sequentially across text, giving detailed attention to the range of information sources. They read accurately at a good pace, solved new or difficult words independently, and detected and self-corrected many of their errors.

Analyses of oral reading errors showed that on many occasions, the word read, although wrong, was typically influenced by syntax, meaning, letter knowledge, and letter–sound relationships. When an error occurred and was uncorrected, the substituted word corresponded to the text word on all four types of information, suggesting that good readers could be using subword, word, syntactic, and semantic information jointly when approaching unfamiliar words to read with accuracy. Self-corrections implied a mismatch between the information used in the substitution and other information sources available to and monitored by the reader. In addition to noting that these readers attended to multiple sources of language information, Clay (2001) also discovered that when the proficient

readers in this age group engaged in analyzing text, they initiated their problem solving from any one of the information sources. In summarizing her observations, Clay (1982) suggested that the processing behaviors of these readers approximated the behaviors of a mature reader.

Summary of the Research

This overview of the documented findings of studies conducted by Clay with follow-up investigations by her colleagues confirms that literacy processing behaviors of young learners engaged in reading and writing continuous text change over time. Beginning, novice readers/writers apply low-level strategies in their earliest attempts to read and write as they approach literacy tasks with vague, rudimentary understandings. They gain proficiency as a result of opportunities to engage in reading and writing continuous texts with supportive instruction. They acquire more knowledge to support their processing, and over time their behaviors indicate acquisition of a more efficient and effective inner processing system, a complex network of working systems for processing text.

The patterns of behaviors observed in the records of children over multiple early studies, and ultimately over years of research with thousands of learners in her early intervention, led Clay to two theoretical considerations. She had discovered a transformative model of literacy acquisition, explaining changes in processing systems from primitive to more expert over the first year of school, and she had evidence on which to base a literacy processing theory.

Theoretical Perspective: Literacy Processing Theory

Resulting from her earliest investigations, Clay embraced a complex theory of literacy and defined reading, as we saw in the first section of this chapter. Her quest for theoretical explanations focused on building understandings of both the specific perceptual and cognitive behaviors involved in reading and writing and explanations of the integration of complex in-the-head processes. Thus, explanations of progress involved descriptions of the emergence of a network of complex neural processing systems, that is, the perceptual and cognitive working systems directed to complete reading and writing tasks.

Literacy processing is a reader's decision making about what a text says. It involves

many working systems in the brain which search for and pick up verbal and perceptual information governed by directional rules; other systems which work on that information and make decisions; other systems which monitor and verify those decisions; and systems which produce responses. (Clay, 2001, p. 1)

These working systems are neural networks, perceptual and cognitive systems, which are constructed by the learner as a result of engagement in reading continuous texts to discern meaningful messages. For the proficient reader after one year of instruction, these working systems have the capacity to function as

self-extending systems, allowing the learner to expand his or her competencies in acts of processing texts of increasing demands.

Readers operate on multiple sources of information to read for meaning, and Clay found this processing reflective of Rumelhart's (1994; see Chapter 29 this volume) interactive theory of reading. Rumelhart's theory posits that all knowledge sources are decision-making sources, and the reader's perceptions during reading are the product of interactions among all levels of the language hierarchy. For Rumelhart, this involves hypothesis generating and evaluating during the act of reading as tentative decisions about the message are made and then confirmed or revised on the basis of perceiving more and more information. For example, decisions regarding perceptions of letter features, letter sounds, letter clusters, and words are evaluated and confirmed or revised in conjunction with decisions regarding syntactic information, at either a phrase or clause level, and decisions on the basis of semantic information, which is more general knowledge of the topic or genre. Thus, the reader attends to all available sources of information in text (visual, syntactic, semantic), and "the reading process is the product of the simultaneous joint application of all the knowledge sources" (Chapter 29 this volume, p. 732).

The reader's knowledge of the language information sources in text support his or her complex processing systems, that is, the decision making that serves reading for meaning. The reader's working systems consider, scan, and integrate information from all levels of the language hierarchy when processing text, and therefore, giving more value to any level of the linguist's hierarchy of language information is unproductive and may be misleading. It is agreement across information sources that confirms a good decision and incongruity that signals the need for more searching, confirming, and perhaps correcting. To add understanding of the perceptual and cognitive working systems, Clay (2001) referenced Singer's concept of assembling the working systems for a specific task, a theory that allows "more scope for knowledge sources and neurological networks to be used flexibly and effectively by readers" (p. 101).

According to Singer (1994), readers who have acquired the necessary working systems are able to mobilize rapidly and flexibly a hierarchical organization of subsystems in which a minimum of mental energy and attention are devoted to input systems (perceptual systems involved in the perception of stimuli, including visual information) and a maximum is expended on mediation and output systems (cognitive systems involved in interpreting, inferring, integrating, and responding). Thus, when reading is proceeding in a fluent, proficient manner, the perceptual working systems operate without conscious attention, allowing the reader to focus attention on thinking about and responding to meaning, which engages the cognitive systems.

This processing suggests that the reader is employing working systems to search and monitor information sources supportive of his construction of meaning with ease. In terms of visual information specifically, this means that the information is located and scanned proficiently and recognized instantly. However, when a reader detects any disruption of meaning, the reader will shift attention

to problem solve the dissonance by attending more closely to information sources supportive in refining his or her decision making. In beginning readers, this often involves analyzing visual information to identify words by focusing on the features and sounds of letters, or clusters of letters. As the young reader acquires more knowledge of each information source in text and “comes to know how and when each kind of information can help with decisions” (Clay, 2001, p. 111), the reader becomes more efficient in shifting to problem solving and resolving any issue quickly without loss of meaning.

Cognition and perception (and the related working systems) function on a problem-solving continuum (Bruner, 1957, 1974; Clay, 1991b, 2001), and shifts of conscious attention and problem-solving behaviors occur in ever-changing sequences. In effect, the reader adapts a range of complex processes flexibly “to the demands of a specific literacy task by assembling a temporary system from among those available to deal with the literacy task at hand” (Clay, 2001, p. 101).

Singer (1994) described readers mobilizing “cell assemblies in the brain and organizing them into different working systems according to moment-to-moment changes in the tasks or purposes of the reader” (Clay, 2001, p. 112). This suggests the individualized nature of both the emerging literacy processing systems of young readers and the ongoing, ever-changing assemblies of working systems supporting proficient reading. Clay (1998, 2001) and Singer both concluded that there could be more than one route to successful reading: “Individuals may attain the same level of achievement but by means of different compilations of working systems” (Clay, 2001, p. 113). Reading and learning to read vary in many ways across individuals.

The neural networks for literacy do not exist before the child engages in reading and writing continuous texts. Yet, as teachers provide children opportunities to write and to read a gradient of texts with increments of increasing challenges, learners have new opportunities to work at higher levels of complexity. This creates the problem-solving experiences that extend the efficiency of the neural processing systems.

Clay’s literacy processing theory, a theory of assembling a complex network of perceptual and cognitive working systems for reading or writing continuous texts, is based on her observational research. Her meticulous documentation and study of patterns of behaviors collected over time revealed key discoveries. These include the “critical factor of individual differences” (Clay, 2001, p. 137) substantiating different paths to proficient literacy acquisition among young learners; the reciprocity of reading and writing; the transformational nature of literacy acquisition, that is, change over time in processing behaviors as learners acquire more knowledge and initial primitive strategies become more like that of a mature reader; and the initial evidence of a learner’s self-extending system, “the strategic power to use what is known in the service of problem-solving the unknown” (Clay, 2001, p. 129). In effect, learners acquire a neural network of complex working systems that learns to extend itself.

While aspects of both Singer and Rumelhart's models of reading resonated with Clay's observations, she found that because neither theorist had addressed the early formative period of literacy acquisition, their explanations were incomplete. Clay's (2001) theory offers literacy awareness and orientation to print as essential aspects of early literacy learning:

Children have to adapt their preschool working systems to make them work on the written code, learn some new skills, lay down the foundational knowledge sources and learn how knowledge from very different sources can be found, assembled, and integrated. (Clay, 2001, p. 137)

The key concepts include knowing the following:

- how to assemble stories
- that print can be written
- that attention must follow the rules of direction
- that symbols have only one orientation
- how to switch attention out to the page and back into the head
- how to work with complex information and come to decisions (Clay, 2001, p. 137)

In summary, Clay's meticulous documentation of observed literacy behaviors collected over time revealed changes in children's literacy processing during early acquisition and led her to a complex literacy processing theory, which she described as follows:

In a complex model of interacting competencies in reading and writing the reader can potentially draw from all his or her current understanding, and all his or her language competencies, and visual information, and phonological information and knowledge of printing conventions, in ways which *extend both the searching and linking processes as well as the item knowledge repertoires*. Learners pull together necessary information from print in simple ways at first..., but as opportunities to read and write accumulate over time the learner becomes able to quickly and momentarily construct a somewhat complex operating system which might solve the problem. (Clay, 2001, p. 224)

It was her perspective that this complex processing theory was critically important in creating powerful learning opportunities for any child struggling with early literacy.

Instructional Implications of a Complex Literacy Theory

As Clay's research focus evolved to investigating instructional assistance for young readers/writers struggling with literacy acquisition, she approached challenging issues with a developmental perspective and her emerging, theoretical explanations of change over time in literacy processing behaviors. Her goal was an intervention designed to allow optimal literacy development that would result

in proficient performance in reading and writing and prevent subsequent failures. On the basis of her theoretical perspective, it is apparent that such complex learning results from “a curriculum of psychological processes (perceptual and cognitive) necessary for working with written language” (Clay, 2005a, p. 18). Specific goals are to accelerate the pace of learning, lift each child’s level of achievement, and build a secure foundation for subsequent literacy learning (Clay, 2001).

Intervening early in the child’s educational experience was paramount to Clay, as she had determined that the developing competencies of low-progress children differed from those of proficient learners from the initial, earliest opportunities to read and write (Clay, 1966, 1982). Low-progress students were observed to initiate literacy learning with ineffective behaviors, and their processing did not improve during their first year of instruction. Consequently, Clay (1987) realized that the gap existing between proficient and low-progress children in the first year of school widened over time. For these children, classroom programs did not meet their individual needs, and the most deleterious outcome of such instruction, inadequate for any of a wide range of reasons, is a child who has learned to be leaning disabled (Clay, 1987; Vellutino, 2010). For both Clay and Vellutino, this means that children may appear learning disabled as a result of instructional and experiential deficits, not as a result of cognitive deficits. Early intervention is key to averting ongoing difficulties and confusion and to bringing children quickly to levels of proficiency that allow them to profit from classroom literacy programs.

An important aspect of designing instruction to meet individual needs was Clay’s rejection of any single cause of literacy difficulties. Multiple causes, idiosyncratic to individual learners, require individual programs of instruction delivered in one-on-one settings. This allows the greatest scope for adjusting instruction to “find ways around a child’s limitations in some functions, and which could break a cycle of interacting deficits, whatever those limitations might be” (Clay, 2001, p. 220). One-on-one instructional settings allow the teacher to focus intently on the learner’s response repertoire, respond immediately with the most appropriate, contingent support, and adjust instruction as needed. This is the important experience needed by the child who is having severe difficulty in acquiring literacy.

Clay based the goals of her early, individually delivered intervention on her study of proficient readers and focused on how to help struggling learners acquire complex neural networks for processing text. Active learners construct theories of reading and writing that emerge from primitive beginnings and transform as a result of instruction and experience into more mature behaviors. Instruction must support the child’s construction of working systems that use all sources of language knowledge to read and write texts and become able to expand and improve as a result of ongoing challenge in texts of increasing complexity. Self-improvement results from the independent learning created by effective linking, evaluating, and decision making, which constitutes the self-extending system. Such independence in reading and writing is encouraged by teachers who scaffold

the learner (Vygotsky, 1962) and ultimately act as a resource as the child “pursues a large amount of the activity by himself, pushing the boundaries of his own capacities” (Clay, 1991b, p. 255). Because the self-extending system creates a bootstrapping effect (Stanovich, 1986), Clay (2001) likened it to what Stanovich labeled the positive Matthew effect; she attributed this effect to the complexity of interacting neural networks.

Complex learning results from instruction that starts with a child’s strengths and builds on his or her existing, perhaps primitive, processing systems (Clay, 1998, 2005a). Teachers accomplish this by drawing on the child’s competent systems while supporting new tentative responding until new strengths are established (Clay, 2001). As a result, the child experiences success, feels in control of his or her learning, and gains awareness of new features of text and/or new ways of responding (Clay, 1998). Teachers make use of each individual’s existing response repertoire; therefore, each child’s series of lessons is unique, and different paths to efficient processing are expected and supported (Clay, 1998).

Clay (2005a) identified two key hypotheses that informed her intervention plan. The first is that the child’s instruction should be based on the teacher’s continuous, detailed observations of literacy behaviors. Thus, the reflective teacher considers her observations of the child’s problem-solving strategies in writing and in reading daily (using running records). The child’s new discoveries, partially correct responses, and self-correction behaviors inform instructional decisions, which often occurs on a moment-to-moment basis. The second hypothesis is that the reciprocal relationship between reading and writing creates powerful opportunities for the learner’s competencies in one area to support learning in the second.

More specifically, Clay (2001) discerned that the similar aspects shared by reading and writing include the following:

- 1) the stores of knowledge about letters, sounds and words which they can draw upon,
- 2) the ways in which known oral language contributes to print activities,
- 3) some similar processes that learners use to search for the information they need to solve new problems, and
- 4) ways in which they pull together or integrate different types of information common to both activities. (p. 33)

More specific examples of processes common to both reading and writing activities include the following:

- controlling serial order
- problem-solving with more than one kind of information
- drawing on stored information and acting on it
- using visual information
- using phonological information
- using the meaning of what was composed
- using the vocabulary and structure of what was composed

- searching, checking and correcting
- categorizing, using rules, and estimating probabilities of occurrence (Clay, 2001, p. 32)

Clay's (2005b) instructional plan for daily lessons includes reading texts of easy and instructional levels, writing personal stories, and using brief decontextualized activities to support learning items such as letters and words, which are encountered in and linked to reading and writing activities. The texts for reading are not controlled or contrived; they are selected to give the young reader access to all levels of the language hierarchy as working systems for perceiving, integrating, and evaluating information sources—strengthened only as a result of reading continuous, meaningful texts.

In describing the instruction that reflects important theoretical constructs, Clay (2001) emphasized the following:

- The teacher would support the development of literacy processing by astute selection of tasks, judicious sharing of tasks, and by varying the time, difficulty, content, interest and methods of instruction, and type and amount of conversation within the standard lesson activities.
- The teacher would foster and support active constructive problem-solving, self-monitoring, and self correction from the first lesson, helping learners to understand that they must take over the expansion of their own competencies. To do this the teacher would focus on process variables (how to get and use information) rather than on mere correctness and habitual responses, and would temporarily value responses that were partially correct for what ever they contributed toward correctness.
- The teacher would set the level of task difficulty to ensure high rates of correct responding plus appropriate challenge so that the active processing system could learn from its own attempts to go beyond current knowledge. (p. 225)

Clay (2009) approached the challenges in helping low-progress learners recover a more normal trajectory of literacy performance by asking, what is possible? This led to years of exploration and theory refinement, lesson design, and extensive research of instructional approaches, teacher effectiveness, and children's progress. The result of her development and design efforts was an early intervention known internationally as Reading Recovery, an intervention she also referred to as Reading and Writing Recovery (Clay, 2001). Reading Recovery is currently available to children experiencing the most difficulty in reading and writing following one year of schooling in educational systems around the world.

In the early development phase of her intervention,

Clay used a grounded theory approach: She used observations of children and teachers to develop theory, she used theory to guide selection of methods, she applied the methods to practice in a systematic way, and she used detailed observations and records to confirm or revise theory and procedures. (Jones & Smith-Burke, 1999, p. 271)

Clay (2009) conducted studies to explore questions regarding teaching procedures, teacher-training possibilities, implementation issues, decisions about when to end a child's series of lessons, and sustained effects for participants one year as well as three years following the intervention (Jones & Smith-Burke, 1999). In this way, working with teachers and testing the intervention in schools, Clay was able to confirm instructional decisions and discern important training and implementation issues.

Professional development and implementation issues received extensive attention as Clay was asked to scale up Reading Recovery, and she approached all challenges with tentativeness, flexibility, and a problem-solving attitude (Clay, 2001). Always supportive of classroom teachers, she designed a trainer-of-trainer model of professional preparation and found teachers astute learners of her complex literacy theory and instructional procedures. She was masterful in addressing implementation issues, and as educators from other countries and in languages other than English worked with her to adopt and implement Reading Recovery, she was sensitive to cultural and educational differences. "Using a process of accommodation, she found adaptive ways to implement Reading Recovery without lessening the high standards that lead to optimal results for both teachers and children" (Doyle, 2009, pp. 292–293).

The success of these efforts is assessed in evaluation studies replicated by each country with a national implementation, and the resulting data, collected and analyzed for each participating child, are reported annually (see Watson & Askew, 2009, for full descriptions). These reports confirm that Reading Recovery has been successful in accelerating learning and securing a firm literacy foundation for children in diverse settings and in multiple languages, including English, Spanish, and French.

Clay (2001) has attributed the success of Reading Recovery to five key aspects, including the specific guidelines for program delivery, the training that prepares teachers to be astute decision makers, a theory of constructive learning, a complex theory of literacy learning, and lesson components that support perceptual and cognitive processing. These components suggest that she based her early intervention on considerations of behaviors observed in proficient learners over time and instructional modifications needed to optimize literacy development for struggling learners.

Summary

This discussion has presented a review of Marie M. Clay's complex literacy processing theory, her theoretical perspective of literacy learning, and implications of her theory for her design of an intervention for children struggling with early literacy. From these efforts, via a grounded theory process, Clay solidified her literacy processing theory of reading and writing continuous texts, explaining how literacy learning is transformed in a series of changes from simple to more complex processes. Her studies afforded examination of behavioral evidence revealing the nature of the learner's construction of literacy processing abilities

over time. In addition, noting that new entrants bring vastly different personal repertoires of experience and knowledge to school, she documented how unique, or individual, their paths to literacy might be.

Clay's analyses of early literacy behaviors led to what she called a literacy processing theory, a theory of assembling perceptual and cognitive working systems capable of completing increasingly complex tasks (Clay, 2001). She considered Rumelhart's (Chapter 29 this volume) information processing theory helpful for considering the integration of language information sources, and she was informed by the theoretical discussions of Holmes (1953, 1960/1970) and Singer (1994). However, Clay also realized that theorists had not considered the challenges and learning associated with initial literacy acquisition. Her observational research led her to important discoveries, and her resulting theory is a multifaceted theory of beginning reading and writing, accounting for the early, foundational learning necessary for acquiring complex cognitive processing.

When Clay initiated her observational research, her methodology differed from the existing practices to quantify learner performance. Her interest was to delineate qualitative changes in children's learning. She created new assessment tools, considered an unusual lens for documenting behaviors sequentially, and collected data longitudinally. Therefore, her focus and approach parallel the microgenetic analyses of learning, as described by Siegler (2006), currently applied by developmental psychologists, and discussed in relation to Clay's literacy processing perspective by Schwartz and Gallant (2011).

Microgenetic analyses involve the scientific exploration of the genesis, or very beginnings, of learners' strategic behaviors, how children's learning occurs, and how it changes over time. Specifically, the methods of study include observations that span the period of rapidly changing competencies by securing a density of observations—a high amount of observations in relation to the rate of change. The resulting observations of learners engaged in specific tasks are analyzed intensively with the goal of inferring in-the-head processes (see Siegler, 2006). Clay's studies (1966, 1974, 1975, 1982, 2001) of changes over time in the reading and writing behaviors of novice learners not only provide the first, rich model of this scientific approach to the study of early literacy but also reveal the importance and power of alternative approaches to understanding complex literacy learning.

Clay was astute at transitioning her theory to practice, making a remarkable difference for children, teachers, and schools. Again, she applied scientific rigor to test all aspects of her assessment instruments, the instructional practices designed to support the learner's construction of perceptual/cognitive working systems, teachers' professional development, and effective implementations of early intervention in a wide range of differing school systems. The success of her Reading Recovery early intervention, substantiated internationally by ongoing analyses of student data, attests to the robustness of her theoretical perspectives of literacy acquisition, children's learning, professional development, and systemic design.

Additional indicators of effectiveness are found in evaluations conducted by non-Reading Recovery entities. The National Center on Response to Intervention in the United States has endorsed her assessment tool, *An Observation Survey of Early Literacy Achievement* (Clay, 2006), and the What Works Clearinghouse (2008a, 2008b) has substantiated the scientific evidence resulting from multiple researchers' investigations of instructional effects. Reading Recovery is currently recognized as a powerful, scientifically based Response to Intervention, and in fact, Clay's contribution to the movement is considered seminal (Vellutino, 2010). Vellutino has acknowledged that "Marie Clay was actually the first reading researcher to use RTI to identify children who might be afflicted by organically based reading difficulties" (p. 7) as opposed to limitations resulting from experiential or instructional deficits which Reading Recovery instruction addresses.

Clay (2001) has written that she used theory as a tool to explain the changes in literacy behaviors discovered in the reading and writing processes that she documented so astutely. Always tentative, she described herself as living in a "perpetual state of enquiry" (Clay, 2001, p. 3) and sought refinement of her perspectives through her ongoing search for answers to important, new questions. Her quest for explanations and her actions relative to promoting the optimal development of learning potential among young learners are profound contributions to the literacy community and millions of children around the world.

QUESTIONS FOR REFLECTION

1. What implications for instruction arise from Clay's finding that there is no single consistent developmental sequence that exists for all young readers and writers?
2. How can an early-literacy teacher use Clay's findings and theories to structure effective interventions for each child?
3. Why is it important, according to Clay, to integrate reading and writing activities for emergent readers?

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