

# Chapter 1

## Introduction

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### INTRODUCTION

The goal of the book is to provide readers with the expertise to teach all students to be fluent and engaged readers, which includes helping them gain a love for reading. This chapter provides an overview of the book's purpose and describes each chapter. It also describes the strategic science of teaching and its application to reading instruction. Finally, it synthesizes findings in reading research from educational psychology and the science of behavior.

### KEY TERMS

Bidirectional naming	Reinforcement value
Class of responding	Stimulus
Conditioned seeing	Stimulus control
Cusp	Strategic science of teaching
Function	Textual responding
Learn units	Transparent and nontransparent words
Ontogeny	Verbal behavior
Operant	Verbal development cusps
Phylogeny	

## When Text Speaks: Learning to Read and Reading to Learn

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“I teach, but the students don’t learn.” This statement, made by an experienced teacher, reflects both the student and teacher’s experiences. Not only are her students not learning, but this teacher also misses the joy of seeing her students gain from her instruction. She is not alone in her experiences. Recent data from the U.S. Department of Education indicates that fewer than 40 percent of fourth-graders read proficiently.<sup>4</sup> Without effective instruction, students who do not read proficiently will not experience the short and long-term benefits of reading. Thus, there is a need for an approach to education that integrates teaching and learning and helps teachers improve reading outcomes for children in classrooms across the country.

The purpose of this book is to describe the **strategic science of teaching (SST)** and its application to reading instruction. All children with the relevant developmental foundations can be taught to read, but their individual differences require different scientifically based instructional tactics. SST, a comprehensive science of teaching that integrates teaching and learning, maintains that the teaching process is not complete until a student has learned. In this approach to learning, development, and behavior analysis, teaching occurs when the student has mastered an instructional skill or objective, not simply when a lesson has been presented.

In this book, we set forth a strategic approach to teaching reading, considering a synthesis of findings in reading research and the science of behavior across several decades.<sup>2,3</sup> Our focus is on applying the strategic science of teaching to the teaching of reading, and our goal is to offer educators the expertise to teach all students to be fluent and ardent readers, including a passion for reading-to-learn. We think, as one of the prominent psychologists of the twentieth century argued, that while it might be important to teach great books, it is vastly more important to teach a love of reading.<sup>1</sup>

To date, existing knowledge about the science of reading, while extensive, has not improved reading outcomes for all children. This is not a very good recommendation for the utility of the evidence base. How can this book improve this dilemma, especially when we acknowledge that our research has not focused on the science of reading to the degree that many others have? What we present in this book is:

1. a reliable way to implement the consensus findings of prior research regarding the science of reading,
2. seven decades of research findings in the science of behavior ([www.associationforbehavioranalysisInternational](http://www.associationforbehavioranalysisInternational)),

3. four decades of research to develop a strategic science of teaching ([www.cabasschools.org](http://www.cabasschools.org); <https://www.scienceofteaching.org/fasst-board>),
4. a research program focused on how children's language communication develops;<sup>5</sup> and how this results in knowing how to determine what the problem is when individual children are not learning to read, or reading to learn, and how to fix it.<sup>6</sup>

Part of what we must do is explain some special terms associated with our science. In many cases, the terms may seem to be just substitute jargon for the terms teachers have used for decades. However, if that were the case, we could simply use the existing terms. But, if the terms function to allow a different perspective, and that different perspective results in teaching children to read fluently when they would not have done otherwise, then the terms are necessary and earn their keep.

### How Reading Begins

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**THE BEGINNING WORDS.** *When should a child begin to learn to read?* This has been debated for at least a century. Our answer is based on research and successfully teaching young children to read and love to read. It is not children's chronological ages that determine the critical time when they are taught to read; rather, it is the presence of certain developmental milestones identified in research in the science of communicative or verbal behavior. The term **verbal behavior**, as we use it in related behavioral sciences, encompasses all the ways in which we communicate, including, but not limited to, language in all of its forms. In the science of verbal behavior, key milestones are described as **verbal developmental cusps**. Cusps are classes of responses that, when first acquired, open an entirely new area of learning for a child - what we call a **class of responding**. Reading, writing, speaking, and their relevant sub-domains, are all examples of verbal developmental cusps.

One of the things that is learned is called an **operant**. Once the first operant is learned for a particular class of responding, other operants can be learned that belong in that class. That is, until the first or foundational operant is learned, the range of operants belonging to the class cannot be learned or is very difficult to learn. However, learning the foundational operants in a response class makes it possible to learn the range of operants belonging to the entire class.

For example, once a child has learned to say the transparent phoneme sounds for letters and can blend those into words, subsequent reading curricula presume that a range of untaught words can be read (i.e., the child

can see and say untaught words that they have never before encountered). However, the science of behavior tells us that we can expect this to happen *only if* a child has the necessary learning history that allows the formation of this class of responses. Therefore, even if a teacher implements what the research consensus indicates as a best practice, a child missing the necessary learning history may not benefit from even the best teaching practices and curricula. If a particular child does not learn to blend phonemes, and the teacher and the other children progress to the next steps, the child's difficulties in reading continue to multiply. In this case, when we understand the particular **stimulus control** and specific **cusp** that is missing, we can then draw research-based teaching operations or tactics that, when used, result in the child's mastery of blending transparent phonemes. **Stimulus control** refers to the relation between an antecedent or consequent stimulus and a response. When an individual reliably responds to the correct antecedent stimulus, the behavior is said to be under stimulus control. Thus, learning a specific class of responses or operants is made possible when the particular cusp for doing so has been established.

Many classes of responding are not verbal development cusps. However, there is a group of response classes that constitutes verbal developmental cusps. These cusps often determine what children can be taught or learn incidentally from observation or exposure without being taught, and how the teacher should present instruction. Some of these cusps must be present for children to become fluent and ardent readers. Fortunately, there are procedures to assess the presence or absence of cusps, and in many cases, there are tested procedures to establish missing cusps. Once the cusps are present, one or more obstacles to learning to read can be eliminated. The presence or absence of some cusps may also be the source of types of reading "disorders" that, from the science of behavior perspective, are not disorders but problems with stimulus control. That is, some students having difficulty learning to read may have learned the wrong stimulus control. The reading problems may have to do with learning to read or learning from reading as traditionally viewed.

**THINGS WE SEE, HEAR, AND SAY AS LEARNED STIMULUS CONTROL.** The perspective of our science results in a different way of describing what we and our students see, hear, smell, feel, and think. Our **phylogeny** (our genetic material) and ontogeny (our own history of experiences) result in each of us contacting the world a bit differently. When we learn something, such as a new word, we are often surprised when the word seems to appear everywhere. The word was probably always there, but it had not become part of our environment. Thus, one's environment consists of "things" that we contact because we have learned them. "Things" that we

have not learned are not part of our environment; these are “things” we cannot contact. The expression “It’s Greek to me” makes this point. When children cannot read a letter, word, or sentence, these stimuli do not attract their attention. They are not part of their environment or world. **Stimuli** refer to things in the world, and **stimulus control** refers to the things in the environment that we contact, including learned stimulus control. Thus, when a child learns to say phoneme sounds (i.e., a letter sound) for a particular grapheme (i.e., a printed letter), this textual stimulus results in the child saying the letter sound. When they cannot say the sound, the stimulus control is lacking. Seeing and saying a letter sound is an example of a learned operant. Other learned operants include blended words, sentences, or prosody (i.e., saying the sentence with expression).

Knowledgeable educators, designers of curriculum, and psychologists state the goals of instruction as behavioral objectives. Hence, when students learn objectives, they can do, respond to, and have interests in aspects of the world that they could not before, and these actions or products of actions that they have now acquired are observable and countable. However, what is learned is not only the topography of the behavior but also the context, particular environment, or stimuli that result in the behavior; that is, they learn the stimulus control for the behavior. For example, the operant **function** of a word depends on what precedes it (the antecedent to the behavior) as well as the consequence or effect of the behavior. When we decode (i.e., see print and say the word) the word “*sharp*,” the meaning/function of the word is based on what comes before and after the word is said. Both the antecedent and the consequence to saying the word are stimuli. Stimuli that precede the behavior of saying the word aloud or to yourself, are discriminative stimuli. In contrast, the consequence of the word is the reinforcing stimulus or functional effect, including *affect* as an effect on a reader (i.e., the reader sees a *sharp* knife as a mental image). In another example of the reinforcer with the same word, *sharp*, if the sentence reads, “He is sharp as a tack,” the reinforcement function might be seeing a mental image of a person who behaves very intelligently.

Teaching reading requires bringing learners into contact with teaching operations that result in students developing stimulus control for all the components of reading. In education, the components of reading are often categorized as the aspects of teaching children to (a) learn to read and (b) read to learn.

**LEARNING TO READ.** Printed text speaks a story or instructions about what, how, why, when, and where to do something. Learning to read refers to learning the fundamentals of seeing the printed text while simultaneously hearing it as speech. That is, learning to read involves acquiring

the same stimulus control with print that we have when someone speaks to us by telling a story or providing instructions, directions, or descriptions. In other words, text must come to be an extension of listening. Moreover, learning to write should involve the same stimulus control for the writer as if the writer were speaking to a listener who is present. Students learning to read must learn the fundamental stimulus control that results in text speaking to them. Students learning to write learn the stimulus control for affecting a reader's behavior as if they were speaking to a reader.

**IDIOSYNCRATIC STIMULUS CONTROL.** When instruction is inadequate or inconsistent with the best practices that work for most students, some students will learn incorrect stimulus control or need interventions that identify how to develop the correct stimulus control. Some of these have been identified in our labs and research and demonstration schools. The instructions in the chapters for teaching reading will (1) describe instructional operations that minimize problematic stimulus control; (2) explain how to identify which stimulus control needs to be fixed; and (3) describe interventions that have a successful track record addressing the missing repertoires. This teaching process involves implementing scientifically based operations that work for most students and special expertise in problem-solving obstacles to learning. This is the expertise that constitutes a strategic science of teaching. The strategic science of teaching requires using scientific tools and analysis in ways that are inextricably embedded in daily teaching practices. Chapter 2, for example, outlines the fundamental teaching operations that must be in place at the onset of and throughout instruction. If most teachers used these procedures, they could implement most of the findings prescribed in the existing evidence base for the scientific basis of reading.

However, the problem that teachers encounter is knowing what to do when students are required to meet specific objectives. The teacher is left with the problem of "*How to do this?*" This is where the strategic science of teaching adds additional classroom-tested tools. The first steps involve explanations for how to individualize instruction such that the organization and practices used in the classroom (a) deal with different rates of learning and (b) how to know when mastery has or has not occurred. A key scientific tool is the measurement of a student's learning as teaching occurs; several chapters explain how to do that as an essential part of the teaching process and not as something separate. Measurement tells you, for instance, when the objective is mastered so that the student can move forward even if other students cannot. Other tools prescribe tactics for how to do this in classrooms with very different students. Measurement also identifies when the student is not mastering the objective, which indicates that the student is not learning from the present instructional tactics and

seeing that a particular instructional tactic is replaced with one that works. Finally, measurement helps us analyze a learning problem to determine (a) why the student is not learning the correct stimulus control; or (b) if the wrong stimulus control is being learned.

**Table 1.1**  
**Components of Teaching Students to Read in Their Simplest Form**

<i>Term</i>	<i>Explanation</i>
<p><b>1. Reading readiness</b> Seeks out and looks at books and seeks out and listen to stories. The child “loves” to look at books and being read to by readers. In a great deal of educational research, the relation between various ways of looking at the motivation to want to read has been found to be highly predictive of children learning to read fluently.</p>	<p>We describe teaching operations that establish the motivation to learn to read and the motivation to read for content. Strategic science of teaching research identifies ways to determine the degree of motivation to learn to read or read to learn. This is an empirical measure of reading readiness. Moreover, there are tested procedures to establish the motivation to read or read to learn. The first step in teaching children to learn to read is a measurably accurate indication of the presence of the motivation to read. The term in the science of behavior is <b>reinforcement value</b>, which means that they look at, choose, and prefer books; and they continue to read for longer and longer periods under certain conditions. Two chapters in the book are devoted to this type of stimulus control. One chapter is devoted to establishing the reinforcement value for learning to read and another chapter to establishing the reinforcement value for reading to learn.</p>
<p><b>2. Decode</b> Textual Responding (see text and say phonemes or words).</p>	<p>When a reader sees print and says a word, in fact nothing is <i>decoded</i>. Just as students learning to read musical notation aren’t said to decode. If the word were a code and referred to some secretly shared meaning or function, then the word code would apply. Instead, in a science of behavior, the terms <i>textual response</i> and <i>textual responding</i> include the antecedent or discriminative stimulus (i.e., the print) and the action or response. The overwhelming evidence prescribes teaching students to respond to phonemes rather than whole words. However, our research also shows that first they need to learn that phonemes are part of words as described in subsequent chapters. A phoneme is a component of the composite word. After the student has learned the component phonemes, they need to learn to blend. The procedures described in the following chapters illustrate best practices for doing this. In addition, we explain how to overcome the blending difficulties by using research-based procedures. The categories of textual responding should</p>

**Table 1.1 (cont.)**  
**Components of Teaching Students to Read in Their Simplest Form**

<i>Term</i>	<i>Explanation</i>
<p>2. The sound or word that a student hears matches a picture, word, or letter. The word horse goes with a picture of a stimulus (i.e., picture of a horse) or a horse. All these responses and stimuli are related across different modes of sensing and responding. One might say they belong to a cross-modal frame.</p>	<p>include <b>transparent</b> phonemic classes of responding and <b>nontransparent</b> phonemic classes. When a language is transparent, the sounds of text are the same for all words. In nontransparent languages the phonemes may change based on different types of letter groupings. English is only partly transparent, hence making it more difficult to learn “see and say” print.</p> <p>Seeing the text and saying the word “horse” results in mentally seeing (i.e., <b>conditioned seeing</b>) the horse or the stimulus control for horse might also include imagery responses such as smell, feel of riding, sounds of horses, and pleasure or fear from hearing the print in reading. Readers who comprehend have one or more of these stimulus controls. There are several simple “match-to-sample” aspects of this phenomenon. If readers see the word, they must match the print to the horse or picture and vice versa; hear the word and then point to the print; see the word and say it, then match the printed word to the picture or the mental image of what the word “stands for.” Of course, this also extends to much more sophisticated relations such as actions, functions, metaphors.</p>
<p><b>3. Read and do</b>  This is a basic and first step function of learning to read.</p>	<p>There are two major functions of reading. Technical reading is reading to engage in fundamental everyday functioning as well as reading in the fields of science, technology, engineering, and math where the reinforcement function allows the reader to learn from and build on the experiences of others. This function is often overlooked or minimally part of the curriculum in the typical approach to teaching reading. We seek to redress this oversight in the current text by teaching both the technical/scientific functional reinforcement value of reading writing. The other major reinforcement function of reading is aesthetic, entertainment, or existential in nature. Both functions need to be taught as the motivation that drives learning the structures of reading and writing. We outline a sequence of stimulus control to be taught, and how to teach the stimulus control for reading algorithms and doing what is written—ranging from learning to find hidden treasures to learning to do algebra solely from printed algorithms.</p>



**Table 1.1 (cont.)**  
**Components of Teaching Students to Read in Their Simplest Form**

<i>Term</i>	<i>Explanation</i>
<p><b>4. Read and draw</b>  Read and Draw demonstrates mental imagery or as we say, “conditioned seeing.” The term conditioned seeing suggests the source for what some call mental imagery. Conditioned seeing suggest that certain stimuli, in this case words, result in sensing the stimuli as if they were present when, in fact, they are not..</p>	<p>Several chapters deal with aspects of conditioned seeing while one of the chapters deals extensively with how to test for conditioned seeing and then establish the stimulus control for it. Evidence of conditioned seeing is observed when learners draw accurate representations after reading.</p>
<p><b>5. Strategic Science of Teaching</b>  All these objectives need to be taught using a strategic science of teaching with correct presentations or learn units, and accurate and doable practical measurement of students’ learning or not learning. In addition, the measurement must drive individualization such that all students master the objectives, albeit at different rates. Finally, the objectives mastered must be aligned with valid educational standards.</p>	<p>The procedures we describe in this book for teachers to use have been used day in and day out in our CABAS® Schools for almost 40 years and have been shown to be measurably effective ways to teach and measure at the same time. For more information, see <a href="http://www.cabasschools.org">www.cabasschools.org</a> and <a href="https://www.scienceofteaching.org/fasst-board">https://www.scienceofteaching.org/fasst-board</a>.</p>
<p><b>6. Verbal Developmental Cusps.</b>  Presence of the verbal developmental cusps that are the foundations for the joining of print with verbal behavior.</p>	<p>Reading is only possible if the necessary verbal developmental cusps are present. In some cases, difficulty with learning to read stems from missing specific or a combination of verbal development cusps. In this book, each of the chapters specifies the cusps that need be present for students to contact certain types of instruction or experiences. and how to establish those if they are missing.</p>

**Table 1.1 (cont.)**  
**Components of Teaching Students to Read in Their Simplest Form**

<i>Term</i>	<i>Explanation</i>
<b>7. Inference and Comprehension</b>	These are referred to as derived relations. In reading these can include the kinds of stimulus control we described above for the word horse. Someone reading about the sound of horses could demonstrate comprehension by matching hoof beats to the word horse even though the text does not mention hoof beats. The source of comprehension lies in the prior history the reader has with stimulus relations and how they came to learn those relations from observation or direct instruction. Understanding this provides us with tools to improve the relevant stimulus control as they relate to interrelated frames.

Chapters in this book explain how to conduct measurement as an integral part of the teaching process and how to use it to identify the potential source of a learning problem. Once the problem is identified, the teacher can intervene with relevant research-based interventions to establish stimulus control as described in the chapters. Much research in reading describes the objectives or the curriculum (i.e., what we should teach or a science of reading). What we add to that is the science of how to reliably teach that curriculum. There are teaching operations that work for most students with common learning histories, but implementing these also requires a set of practices. Using practices from the strategic science of teaching ensures fidelity of implementation. It includes what to do when these procedures do not work for many stimulus control problems. We describe many of these problems and ways to solve them. Of course, like any science, there is a great deal that we don't know, but research will add tools to the science as the tactics and strategies in the science grow. We think there is enough that we have learned thus far to disseminate to teachers with the expectation that using a strategic science of learning and verbal development can significantly advance the educational prognosis for many children.

For example, the blending response requires the joining of the component phonemes of a word so that the child can say the composite word. However, after children master the prerequisites for learning to read their first transparent phonemes, a subset of students will still have difficulty blending phonemes together so they can read a word. For instance, sometimes mastery of saying individual sounds in a word (i.e., s/n/a/k/e) does not result in saying the whole word (e.g., SNAKE). That is, stimulus con-

trol does not shift from the individual sounds to the composite word sound because the child does not hear the whole word or cannot produce the composite sounds. This is called *idiosyncratic stimulus control*. Some difficulties involving idiosyncratic stimulus control when blending words include not hearing the blend, not producing blending, having problems with combining component sounds into a composite word, struggling with learning particular classes of nontransparent textual responding, demonstrating comprehension only when reading aloud, and making simple inferences in comprehension. The chapters in this book describe analytical processes to identify problems, teaching operations to establish reading repertoires, and developmental interventions to fix identified problems based on prior research.

Once students have learned the components of reading, which we describe as **fluent accurate textual responding**, they are prepared to read to learn. However, fluent textual responding is only one component of reading, and simple comprehension does not necessarily lead to what is needed to learn from reading. Much of the current educational research in reading points to the real problems that students encounter as they move from the grade levels where they learn fundamental stimulus control for early reading to the stimulus control needed to learn from reading. How to fix this is the subject of Part Two of this book.

## READING TO LEARN: WHAT IT IS AND HOW TO DO IT

Once children learn to accurately **textually respond** to novel words (e.g., a minimum of 90 words per minute), or even more when they are fluent (e.g., 150 to 250 words per minute silently), they should acquire functions for using new words from reading a text. Research over the last decade suggests that learning new words from reading is tied to a verbal developmental cusp that is likely an extension of how one learns language functions as a listener; that is, from exposure to others who are using the words in ways that they are typically used. This particular cusp is **incidental bidirectional naming**. A program of research shows that children who demonstrate *incidental bidirectional naming* can learn the names of things simply by listening to another say a word in proximity to the children observing other sensory stimuli (i.e., hearing the word while viewing, smelling, touching, hearing another sound, or tasting another stimulus).<sup>7</sup> This cusp gains other stimulus control as learners have additional experiences with numerous attributes of a stimulus, including its function and its relations to other stimuli. Neurotypical children who are in rich language environments demonstrate this as early as three years old, although it can be established by intervention as early as two years of age. Unfortu-

nately, some children - such as children with disabilities like autism - may acquire this stimulus control later, acquire it only as a listener, or may not ever successfully acquire this stimulus control without intervention.<sup>7</sup> This may mean that they are missing the stimulus control for learning language incidentally. This may also mean that even if they learn to fluently textually respond, they may not learn new word functions from reading because reading comprehension involves the process of hearing another speak (e.g., the writer of a book) and indirectly experiencing what the author writes.

**LEARNING TO LEARN FROM EXPERIENCE ALONE.** Deficits in stimulus control for **Incidental Bi-directional Naming (Inc-BiN)** can interfere with learning new word functions from reading. **Inc-BiN** is a verbal developmental cusp that facilitates incidental language acquisition. One of the reasons that typically-developing children may not learn the stimulus control of BiN from their environment is that they may not have verbal home environments that reflect the written language used in school (i.e., language and non-language communicative interactions). This has at least two unfortunate outcomes: 1) a limited verbal repertoire, and 2) delays in developing the stimulus control for learning words incidentally (Inc-BiN). As previously stated, we use the term **verbal behavior** in place of what others may call *vocabulary*, but we are referring to using words and nonwords in listener and speaker functions. Thus, children in a verbally impoverished environment may enter school with deficits in verbal behavior as both a listener and speaker and lack some or all stimulus control for BiN. Subsequently, when they learn to textually respond and need to learn from text, they do not know what the text means (i.e., the functions of the text) and can't learn new word meanings (i.e., listener and speaker functions). This experiential or instructional history results in an ever-increasing gap between children who have extensive BiN stimulus control and those who do not.

We now have tools to establish stimulus control for Inc-BiN. That is, there are procedures from verbal behavior developmental research that *can lead to children developing stimulus control for Inc-BiN*. Fixing or improving Inc-BiN stimulus control is one of the interventions that can make *reading for learning* possible. Establishing Inc-BiN is one example of addressing problems with stimulus control, which can be the root cause of some reading problems. There are several of these types of stimulus control related to different components of reading. The chapters in this book explain how to determine if the lack of cusps is the source of reading issues and, if so, which intervention or interventions can help children learn faster and more

effectively. In some cases, children may begin to learn in new ways, such as when they develop Inc-BiN stimulus control.

Before identifying the stimulus control for incidental bidirectional naming and how that stimulus control is learned incidentally or with special interventions, some scholars argued that language resulted from a phylogenetically inherent “language acquisition device” and was independent of learning. While this position is rarely held to be the case now, neurological and other physical, anatomical, chemical, and physiological attributes of human evolution contribute to the evolvement of communicative behavior, including language.<sup>8</sup> However, it is the interaction of those attributes with environmental experiences, including the verbal environment, that develops communicative behavior. Nevertheless, as described above, the commonly shared environment of a community is part of an individual’s community only after the individual demonstrates the relevant stimulus control. One of the puzzles in language development has been how children can demonstrate the remarkable attainment of thousands of words without being taught directly (i.e., verbal functions as a listener and speaker in a given language). We now understand that the onset of Inc-BiN is an important part of the puzzle regarding how the environment comes to teach so effectively and that it is a necessary, if not sufficient, explanation for the acquisition of complex language. There are a series of controlling stimuli that, when present, result in the automatic teaching of an ever-expanding verbal stimulus control and an ever-expanding network of relations between words, resulting in complex language and cognition. These findings expand our tools for teaching reading such that students can *learn to learn* from reading when they could not before.

Students learn the usage of new words to the degree that they have acquired levels of stimulus control for Inc-BiN. When they read, the meaning or function of novel words is learned because of the stimulus control made possible by Inc-BiN. They should see what they read as if it were a movie in which they were completely engrossed. Moreover, students who are passionate about reading and love to read use every opportunity to read. The content or story of the description of new and interesting phenomena grabs the reader’s attention. The resulting effect is an ever-expanding stimulus control leading to an expanded environment for the reader, provided the reader has acquired the stimulus control for Inc-BiN. The text speaks and the reader listens. As the reader listens, they learn even more through incidental language acquisition as a function of the Inc-BiN cusp.

However, the achievement of fluent textual responding, and even the achievement of grade-level performance, does not automatically result in an interest in reading (i.e., enhanced **reinforcement value** for reading).

Students can read on grade level and yet lack a passion for reading for (a) information, (b) entertainment, or (c) other aesthetic functions. For students like these, their reinforcement may be receiving good grades, finishing assignments, keeping up with classmates, or other unidentified reinforcers. Research has identified procedures that develop the reinforcement stimulus control for reading fiction; the reinforcement stimulus for reading fiction is embedded in the reading content, and the procedures we describe establish the content as a direct reinforcer for reading. Earlier, we described the importance of establishing reinforcement value for continuously observing, preferring, and choosing books before learning to textually respond as the first and critical step in teaching children to read. The next step is to ensure that the reading content reinforces reading so that students become passionate readers.

One may ask if establishing a high reinforcement value for reading content is necessary for all readers or only for learners with reading challenges. We would argue that it is necessary for all readers. Our work has reliably shown that establishing strong reinforcement value for reading content has increased grade-level comprehension and vocabulary from one to 3.9-grade levels in as little as 312 minutes of intervention.<sup>6</sup> Given that reading-to-learn is an overwhelming obstacle for middle, upper-middle, and high school students, developing procedures to establish reading as a reinforcer that increases reading-to-learn adds a powerful tool for teachers who can reliably implement the procedures.<sup>6</sup> This also suggests that reinforcement for content needs to be a major component of the curriculum.

In addition to reading for content, other stimulus controls may be missing or incorrect. *Corrective Reading*<sup>9</sup> is a curriculum that has an excellent research record and is effective for third through sixth-grade students who are significantly behind grade level. It is very effective when used with procedures from the strategic science of teaching. In fact, any curriculum can effectively be implemented using procedures from the strategic science of teaching (SST). A system-wide application of SST is the Comprehensive Application of Behavior Analysis to Schooling ([www.cabasschools.org](http://www.cabasschools.org)) or CABAS<sup>®</sup>; the model of CABAS<sup>®</sup> designed for general education is the Accelerated Independent Learner model (AIL). The AIL procedures are likely effective when implementing most intact curricula (e.g., *Reading Street*), but they also add functional objectives when curricular objectives are structural, as is often the case. An example is how we have described our objectives using the terms “learning verbal behavior,” not just language, and “learning verbal functions,” not just vocabulary.

**LEARNING THE FUNCTION OF WORDS AS DISTINGUISHED FROM LEARNING VOCABULARY.** Most dictionaries define words by using other words. Dic-

tionaries consist of definitions of words at certain points in the history of a given language community. In the science of verbal behavior, a *word* or group of words has particular functions in a given verbal community, and those functions constitute *meaning*. The meaning cannot be described fully by using other words necessarily. When children learn languages, they really learn verbal functions. Words are used to ask others to do things, to state the word for various stimuli, and to attempt to affect behavior, including thinking and using the words of others. It is beyond the scope of this book to describe the multiple functions of verbal behavior except how the function of language is critical to expert reading and, by extension, expert writing. One dictionary—the *Oxford Dictionary of English*—does provide examples of words in a functional context. In that dictionary, the first and subsequent examples of words are shown as they are used to affect the behavior or emotions of readers. The 30 volumes display usages of words in historical context. They also define words by using other words as other dictionaries do. While dictionaries are indispensable for learning how to use the function of words, they do not necessarily teach the functional usage. Making this distinction is critical when deciding what to teach, how to teach reading comprehension, and how to set the stage for students to read to learn.

When children learn word functions as a listener and a speaker, they learn them under conditions that establish the function of the words in a given context. The context consists of the motivating conditions, such as the need to know to affect the behavior of others or be affected by the behaviors to the mutual benefit of the writer and reader. For example, in the Middle Ages in England, a mother might say to a child, “Fetch the water.” The child under stimulus control of those spoken words will bring water to the mother. However, if another child who demonstrates the stimulus control for Inc-BiN observes this scenario, they will learn to respond as a listener and a speaker as a result of observing another child respond to the words. The degree to which this child picks up functional word usage is related to the degree that Inc-BiN stimulus control exerts on the child. What is important for the objectives of this book is that when we read-to-learn, we learn by observing the speaker and listener functions of print. The degree to which readers benefit from learning word functions from reading builds on their verbal cusps because print is simply an extension of the speaker and listener repertoire. Thus, even if students are fluent textual responders, they may still need interventions to establish stimulus control if they do not demonstrate that they can learn word functions from reading.

Some interventions involve providing intensive instruction for saying the names of things, names of actions, and the functions of words that are

novel for early reading learners—particularly those with disabilities or English Language Learners. There are numerous language interventions for reading in the verbal developmental literature. The focus of chapters in this book is how to identify those students who need particular interventions and how to fix the learning problem. Just as reading is the joining of print to listening, writing is the joining of print to speaking. We regard writing as an extension of reading, and our laboratory and schools have built a program of research that has proven useful. Moreover, just as the functions of reading are scientific/technical and aesthetic, this is also the case with writing. Reading and writing require the structure of grammar and the tools of textually responding. Still, learning function is the most important and often-ignored tool because research in verbal behavior has largely clarified procedures to teach the functions of reading.

### **Writing as an Extension of Reading**

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In the chapter that focuses on writing, our strategy is to teach the function of writing such that the function is the *learned* reinforcement.<sup>10</sup> Just as the function of speaking requires that a learner speaks certain words under the conditions or reinforcement to acquire it, we need to build reinforcing functions into the curricula and corresponding teaching tactics. This does not mean that we ignore structural writing; rather, we describe how to teach writing structure while simultaneously teaching functional objectives. For example, teachers can correct *constructed spelling* in a context in which learning accurate spelling still results in reinforcing effects. This means that the student learns both the correct spelling and the function. The theory that allowing *constructed spelling* will not get in the way of what is mistakenly called *creative usage* is scientifically flawed. Creative usage involves using the correct spelling while learning to “affect a reader” over multiple experiences, which leads to creative or novel effects. In this book, we describe a curriculum and strategic operations to teach the function and reinforcement value for writing.

### **Teaching Reading to Upper Elementary and Adolescent Students**

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Students who advance through elementary school without fluent textual responding repertoires represent a substantial sector of the student population. How can we ameliorate the reading repertoires of the more than 60 percent of upper elementary, middle, and high school students who are not proficient readers? One answer is to use the procedures we describe for beginning and intermediate readers. However, implementing those procedures requires identifying tactics that work for more mature students who have likely received years of ineffective instruction. Repeated reading



difficulties have likely made reading, print, and associated stimuli aversive for older students. Any stimuli associated with reading may evoke a range of responses from older students, including embarrassment, escape, avoidance, truancy, and other non-constructive behaviors that result in teacher disapproval and peer attention. Students learn a set of alternative stimulus controls that may have short-term detrimental effects in the classroom learning environment and long-term detrimental effects for the student. In Chapters 7 and 11, we present some possible solutions for improving the reading outcomes of older aspiring readers.

Research on reading interventions and challenges for adolescents shows at least three important outcomes that inform our reading intervention program for older students. First, research indicates that when older students have reading problems, they may be challenged in at least five areas: (a) reading motivation, (b) decoding multisyllabic words (word study), (c) reading fluency, (d) vocabulary encountered during reading, and (e) reading comprehension<sup>11</sup>. Second, there have been fewer published reading interventions for older students when compared to younger students.<sup>11</sup> Finally, reading interventions can result in sustained positive outcomes for secondary students.<sup>11</sup> We focus our research program on identifying reading interventions for older students based on the science of behavior. The work reported in this book draws from our research and the research of others in the fields of the science of behavior, special and general education, and reading instruction. This book has two chapters dedicated to teaching aspiring readers in the upper elementary, middle, and secondary grades. The interventions described in these chapters have unique features that form an intervention framework, which we describe next.

**CHALLENGES TO READING INSTRUCTION IN UPPER ELEMENTARY, MIDDLE, AND HIGH SCHOOL.** There are several unique challenges that teachers of older students may encounter. One challenge is that middle and high schools are not typically designed to teach early reading skills; neither students' schedules nor teachers' expertise support learning to read at these levels. Thus, the structure of reading instruction in these grades is important. We suggest one of two approaches: 1) whole class reading intervention or 2) reading intervention that targets the specific repertoires of an individual or small group of students. Whole class reading intervention requires that a group of students receives a reading intervention, typically with an existing intervention curriculum such as *Corrective Reading*®. This approach is very effective and works well if a school can dedicate a full period for an entire school year to reading instruction. This approach also works well for upper elementary and middle school students who are behind in reading. However, in high school, there are fewer opportunities

and resources for students to participate in whole-class reading instruction due to curriculum requirements. Further, high school students have some autonomy in their educational experience (e.g., they can typically choose to attend or not attend an intervention classroom). They may also have opinions about the social acceptability of an intervention; opinions also held by middle school students. Finally, students may have developed a set of responses to reading instruction that allows them to avoid reading instruction in school. As a result, we think that using a targeted reading intervention approach for individual or small groups of students is useful for middle and high school students. If possible, reading intervention should be implemented during an after-school or dedicated class period. It also must be carefully developed to ensure that it is reinforcing for students and does not promote escape or avoidance responses. Chapters 7 and 11 provide more detailed descriptions to support reading intervention for upper elementary, middle, and high school students who need reading instruction.

**WE DO NOT GENERALLY VIEW READING COMPREHENSION AS “THINKING.”** Reading comprehension is often considered an advanced reading repertoire that reflects a student’s ability to analyze or infer meaning from a text. In fact, state tests of reading in third grade and higher measure reading comprehension. Test questions usually focus on what a student understands about an author’s purpose, the main idea, and similar concepts intended to measure reading comprehension. Thus, when a student does not score well on the reading portion of a standardized test, educators may frame the issue as a reading comprehension issue because that is what the test was intended to measure. When a reading challenge is identified as a problem with “thinking about reading,” then interventions to address it may try to improve comprehension by using metacognitive strategies intended to help a student reflect on their own thinking.

In this text, however, we take a more parsimonious view of reading comprehension. This view is also foundational to our recommended approach for “reading-to-learn” for older students. First, we view responses to questions such as the author’s purpose and main idea as responses under the stimulus control of specific antecedents. Generally, comprehension questions can be categorized into explicit or implicit questions. Within these categories are specific questions, such as those asking about a story’s main idea, the author’s purpose, and so on. We suggest that correct responses to these questions do not necessarily reflect “thinking” but, instead, reflect

responses under the appropriate stimulus control of a question. For instance, a common reading comprehension question is, “What is the author’s purpose for writing this text?” That question should evoke a particular type of response from a reader, such as “The author is trying to persuade the reader.” Rather than viewing this response as “thinking,” we think the question should have stimulus control over a response that can be established through instruction. That is, we think a student who can answer this comprehension question about an author’s purpose has learned to emit a correct response under a particular type of stimulus control for antecedents and **contextual cues** associated with this type of question. When reading comprehension is operationalized in a way that is observable and measurable, it can be taught directly instead of trying to teach “thinking,” which we cannot observe. Thus, for students who can textually respond but are not demonstrating grade-level reading comprehension, we use relational frames to establish derived relational responding (see Chapter 11). For these students, we also establish the missing **component** repertoires for a specific response and any missing verbal developmental cusps such as **speaker-as-own-listener** behavior. The goal of this approach to reading comprehension is to ensure that students eventually gain the capability of comprehending text without extensive or corrective explicit instruction.

**READING REPERTOIRES FOR OLDER STUDENTS.** As previously described, research indicates that older students have reading difficulties in at least five areas: (a) reading motivation; (b) decoding multi-syllabic words; (c) reading fluency; (d) vocabulary encountered during reading; and (e) reading comprehension.<sup>11</sup> Based on this research, we operationally define these repertoires using research from the science of verbal behavior and then assess them as the major repertoires that adolescent students need to be effective readers. Further, we extend this framework to include two additional repertoires from the science of behavior: (6) learning, defined as repertoires such as Inc-BiN and observational learning that can accelerate the acquisition of complex responses, and (7) academic self-management, defined as behaviors that lead to independence in school settings (e.g., goal setting, self-monitoring, self-reinforcement, self-advocacy). Academic self-management is important because what appears to be a learning challenge may, instead, be attributed to limited self-management. Taken together, these seven repertoires comprise the intervention framework that we use for older students. Table 1.2 illustrates this framework.

**Table 1.2**  
**Framework for Teaching Older Students to Read**

<i>Term</i>	<i>Description</i>	<i>Example</i>
Motivation	Readers choose books as preferred activities or reinforcers. They can engage with text for extended time periods.	A student reads for 10 minutes and chooses books over other academic activities such as coloring.
Word Study	Textually responding to parts of multi-syllabic words instead of individual letters and sounds.	When a student sees the word <i>rented</i> , he breaks the word into two parts (“rent” and “ed”) and then blends them together to read the word.
Fluency	Number of textual stimuli read correctly per minute. This can include letter, word, and passage fluency	A student reads 120 words correctly during a one-minute timing.
Vocabulary	Defining terms based on knowledge of the word and/or from a reading passage	A student reads the word “appealing” in a passage and both defines and uses it.
Comprehension	Speaker-as-own-listener behavior. When reading, a reader can act as a listener for their own self-talk	A student reads a passage aloud and can answer questions about the passage after reading it
Learning	How a student acquires concepts or skills through incidental learning or direct instruction	A student can learn from two demonstration learn units, observing a peer, or through instruction as a listener
Academic Self-Management	Measuring and making changes to one’s own behavior	A student sets their own goals, advocates for their needs with teachers, and follows their self-determined daily schedule

## CONCLUSION

This chapter described a strategic science of teaching and defined important terms and concepts related to early reading and writing instruction. In the subsequent chapters, you will encounter practical applications of behavioral science to reading instruction and intervention for pre-kindergarten through high school learners. Supplemental activities and examples are provided as well. We hope that this book will help more students learn to read successfully.

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