

**Dr. G. Reid Lyon** is the former Chief of the Child Development and Behavior Branch within the [National Institute of Child Health and Human Development](#) (NICHD) at the [National Institute of Health](#) (NIH). In this position he was responsible for the direction, development, and management of research programs in reading development, cognitive neuroscience, developmental psychology, behavioral pediatrics, language and attention disorders, and human learning and learning disorders. Dr. Lyon is currently a senior vice president for research and evaluation with Best Associates. [Additional bio info](#)

Dr. Lyon has taught children with learning disabilities, served as a third grade classroom teacher, and as a school psychologist for twelve years in the public schools. He has authored, co-authored and edited over 100 journal articles, books, and book chapters addressing learning differences and disabilities in children. At the NICHD he was responsible for translating NIH scientific discoveries relevant to the health and education of children to the White House, the United States Congress, and other governmental agencies. He has served as an advisor to President George W. Bush on issues related to child development and education research and policies. On July 1, 2005 Dr. Lyon resigned from his position at NICHD and accepted a position with Best Associates as a senior vice president for research and evaluation.

We found Dr. Lyon to be a rigorous researcher and scientist who is also an emotionally passionate champion of the well being of children.



The following transcript has not been edited for journal or magazine publication ([see 'Interview Notes' for more details](#)). Bold is used to emphasize our [Children of the Code] sense of the importance of what is being said and does not necessarily reflect gestures or tones of emphasis that occurred during the interview.

David Boulton: Dr. Lyon, it's a real pleasure and honor to meet with you.

Dr. Reid Lyon: Likewise, delighted.

David Boulton: Can you give us a quick sketch of how it is you've come to be here and what drives and impassions you?

### **Personal Background:**

Dr. Reid Lyon: I've been at the National Institute of Health since 1991. Prior to that I was a Professor of Neurology at the University of Vermont, and prior to that a Professor at Northwestern University and the University of Alabama. I started out as a physiological psychologist, and I studied brain development in Makak monkeys. My task was to try to figure out which systems in the brain had something to do with the vocalizations of monkeys. But, what I wanted to do was research that was more applied, and I really wanted to study kids -- I had my own little one coming up then. I switched from animal models to kid models because I also thought that kids wouldn't bite like Macque monkeys, but I was wrong about that.

I got some very good advice as I started that career change: If I'm going to study children, I need to actually go where they work and live; I need to walk along side the kids in their job. Their job is school. That meant I had to learn how to be a teacher, so I went back and took education courses and became certified as an elementary school teacher and as a special education teacher. Now, I say I took courses, but that is not to say that I learned anything. As a matter of fact, I had no idea what I was doing when I got into my third grade classroom other than calling the roll and recess.

What struck me when I got in my third grade classroom was about thirty percent of these nine year olds couldn't read well at all, some not at all. I couldn't understand that because reading to me was not laborious and I took it for granted. I think by the end of the year the thirty percent that I didn't help had actually extended to about forty percent because I screwed another ten percent up. I just didn't have any idea what I was doing.

No one had ever talked to me about how reading develops and what you do when kids come to it differently. I had been taught in these education courses that reading was a natural process and that what you needed to do was provide kids with rich, interesting literature and motivate them, and that they, in fact, would then inculcate the principles and move right along. I was taught not to deal with specific skills because that, in fact, would be de-motivating. I tried that and I didn't help anybody.

I figured that my problem might be student-teacher ratio. I had about twenty-eight kids. So, the next year I went and taught kids with severe reading difficulties in a special education classroom – the same kids all day. And I didn't help them either. Not only did I see that, I noticed a couple of things: How reading or the lack of reading development hurt them. I could see even with the nine year olds that when they were unable to read it seemed to me that, even if I had a magic bullet, they didn't even want to try it. **They had already started to avoid print and a lot of these kids would become active and look, in a sense, attentionally different and possibly would have been diagnosed as ADD. But their attentional difficulties were just simple avoidance. They would become distractable and fidgety when they had to read. Why? They wanted to get out of it. So, that affected me, both in my head and in my heart, to watch these tender kids who have to perform in the most visible academic thing called reading and not be able to do it.**

What I've learned, after studying kids and asking kids how they feel about reading, is that **kids look at reading, as a proxy for intelligence. So, when they see kids who are not able to read, they judge those kids as not as bright as they are or something like that.** When kids don't learn to read, obviously it internalizes. And that really blew me away. Actually, at this point a bunch of things were blowing me away: 1) I didn't know what I was doing; 2) I needed to know what I was doing because **my job was much more than learning how to read, it was the development of social and emotional competencies and all kind of things like that;** 3) I also saw **this tremendous impact on the kid's self-awareness, self-concept and so forth.**

#### **Four Questions:**

Dr. Reid Lyon: I began to think about what I needed to do to figure this out. Four questions came to my mind over a period of time. **The first question was how do kids learn how to read? What are the skills, the abilities that go into it? What are the environments that are most influential in helping develop those skills and abilities? What are the genetic factors that push the neurobiology that allow the skills and abilities to develop within the context of the environment? What kind of instructional interactions bolster that process or in fact limit the process or impede it? That's the first thing that I needed to learn.**

The second thing I needed to learn was **how in the world are some kids learning to read and others aren't?** That is, which of these skills and abilities and environments and instructional interactions and genetics and neurobiology is getting in the way? Which factors make it difficult for which kids?

**All of these kids that I had tried to teach and who didn't do well had by nine years of age already begun to avoid the reading process because they couldn't do it.** So, my third question was, **how can we prevent it? How can we prevent reading failure from ever raising its ugly and deleterious face with these kids?** How can we identify kids at risk before they ever get to school, figure out what to do and bring them right up to snuff as they come into first grade?

I knew we weren't going to be able to do that for all kids, and the fourth question was **how do we help kids at older ages with all the baggage they're carrying begin to get over the hump? How do we begin to get over the motivational humps and the reading humps and the fact that as they get older they're expected to read to learn, but they can't even read?** The learning content is coming in through print, but they don't have print. **How can that be negotiated? How can we adjudicate those complexities?**

My own research program began back in the mid-70's with the first two questions: 1) What does it take to learn to read? 2) What goes wrong when you don't? Some of that work was informative, much of it was not. But I began to work with other groups of scientists who were studying these same questions, and along the way as my career moved forward, I was probably one of the few people in the country who had a specialization in neurobiology and developmental neuroscience and in education, if I can call the latter a specialization.

### **NICHD – NIH:**

Dr. Reid Lyon: My boss here at [NICHD](#), at the [NIH](#), [Dr. Duane Alexander](#), is a pediatrician who is committed and passionate about children's learning. He knows about children's health, but he also knows about their cognitive, social, emotional and academic development, and he found that we had huge gaps in our knowledge base. So, he asked me in the mid-80's to begin to work with his staff to construct initiatives to close the gaps between what we know about those four questions: **1) What does it take to learn to read? 2) What goes wrong when you don't? 3) How do you prevent it? 4) How do you remediate it?** And what we don't know. How do we fill in the informational lacuna such that we can actually move science to human beings, science to policy, science to practice? In 1991 he recruited me here to [NICHD](#) to formulate and direct a program that would do that with significant intensity.

What we have built is a research network composed of forty-four sites in North America, Europe and Asia. All of the sites go after these four questions because we need to replicate. Science, as you know, builds, and when you're doing science in very complex situations, social and behavioral science versus petri dishes, no one study will ever illuminate fully what we're trying to understand. So, you have to have multiple converging studies with converging evidence bearing on these questions so that we can trust the outcomes. It's a long process. It takes tremendous amounts of money; it takes tremendous amounts of talent and so on.

We have at each of these sites multi-disciplinary teams. **What I mean by that is there's no way to answer those four questions unless you have neurologists on board, pediatricians on board, neuroscientists on board, educators on board, cognitive neuroscientists on board and so forth and so on.** All of the teams at the sites are going after these four questions. They're replicating each other, but then they also extend at their own sites their own particular looks at specific problems they're interested in.

What that has allowed us to do over the years is develop a body of information that does in fact address those four questions sufficiently enough that we can now inform practice and policy. ([Click here to read more about NICHD Research](#)). We could never have done that before.

### **The Challenge:**

Dr. Reid Lyon: My toughest challenge is not so much the science anymore. **The toughest challenge we have is in moving the science to the development of teachers and their preparation, such that what they learn is actually objective and is based upon converging evidence rather than philosophies, belief systems, or appeals to authority.** We need to get the information to teachers who have been, in a sense, propagandized into these very broad and general and non-evidentiary kinds of approaches that they use in teaching reading -- absolute failures in terms of our scientific tests vis a vi their effectiveness.

When I was a teacher I wanted to get up every morning and make a difference in kids' lives, and when I saw I wasn't making a difference in kids' lives that hurt the kids. **But it also made me feel dumb, foolish, embarrassed. Our teachers sometimes feel the same way, but they can only teach what they've been taught, typically.**

Teachers come to these very complex interactions, to teach reading for example, with a very limited set of knowledge modules, if you will, a very limited set of concepts in terms of how kids learn to read. Why is Sam having such difficulties? What do I see in pre-school, in kindergarten that might give me a red flag so that Sam is not hindered by all of the flops and problems that occur down stream from reading failure?

That's a very difficult thing to do. The resistance in the educational community, particularly at the higher education level where teachers are trained, is enormous, almost unbelievable. **When you show people objective information, non-philosophically driven research that for these kids, these interactions work very productively such that where a youngster was at the tenth percentile in reading before, and is now at the sixtieth percentile in reading, and you can show that time after time, but you still see substantial resistance from the educational community, it begins to tell us that many of these issues are way beyond the kid issues, these are adult issues.** They are fascinating adult issues where human beings are latching on to their beliefs, their assumptions, their egos and their careers rather than looking very clearly at what works, what doesn't, making sure people know what works, measuring it and getting the kids up to snuff.

### **The Purpose of the Series:**

David Boulton: [Exactly where we meet.](#) That's the very purpose of this series. That, without a social reframing of just how important this is and a new understanding, a new interior framework that breaks out of the oversimplified polarities of thought that have historically represented this whole space, we're going to keep this going on.

In a conversation with [James Wendorf](#), he recounted that he was asked by somebody in an interview to summarize the past ten years of brain research and then after he did he was asked what the challenge was for the next ten years. He said, 'Well, it's exactly what you're trying to do: **we need to somehow take what we've learned, what we can see in our experiments and our research and get that across in a way that actually shifts the way we think about this as a nation, as a country, as a people.'**

Dr. Reid Lyon: **Absolutely.** And you know it's tougher than we ever thought, than I ever thought. We're, in fact, trying to study the factors that maintain these kinds of dichotomous thinking, where people polarize phonics/whole language, qualitative versus quantitative research. Where people with little kids will grasp onto social-emotional development versus cognitive development, which is a fascinating dichotomy for this reason. When I talk to the president about reading he is fascinated himself about why is it that we have a great deal of information that isn't traveling, particularly when human life is at stake. He views education as not just education, but as public health. And it indeed is.

David Boulton: [And national security.](#)

### **Dichotomies and Polarities:**

Dr. Reid Lyon: **Absolutely. Some questions are, why do people dichotomize phonics and whole language? Why do they look at qualitative versus quantitative methodologies? Why do they look at cognitive versus social and emotional development? The common theme is a lack of knowledge. What pervades those dichotomies is a lack of understanding that goes directly to how we prepare educators in education. There is no reason why that kind of concrete thinking should exist, but it does.**

And it does so in very surprising ways. Let me give you an example. We are working very hard with little ones from age birth to five now to try to understand what they can learn: what their brains can deal with; whether or not they like to interact with letters and numbers and all kinds of cognitive things. Does that hurt them? Is that developmentally inappropriate? No. So, we're doing a good deal of study.

**On the neuroscience side we know that little one's brains are moving much more robustly than we ever thought. As you know, at six months of age every kid who's coming along okay in every culture, using every language, can receive and produce every consonant and vowel of every language, even if the language they will ultimately use doesn't contain those consonants and vowels. That's a hefty brain. We know that kids by eighteen months of age will start to learn nine new words a day, at least every day. Amazing. It's an amazing proliferation of not only neuronal capacity, but also of the behavioral stuff that the neurons push.**

### **Head Start:**

Dr. Reid Lyon: In the early childhood community, what the argument has been for many, many years, particularly in **Head Start, is that what we need to do is focus on our little ones to ensure that they are socially competent... that they know how to get along with kids, that they can attend and so on and so forth. Well, of course you do, you've got to do that. You want the kids to feel socially competent. There's also an emphasis on emotional health. You want to make sure that kids are attaching well to adults, kids are getting along with other kids, they feel good about themselves; the nurturing environment is built to do that, of course.**

**But the weird thing has been to not, while you're doing that, provide any kind of interaction that might look at letters or letter sounds or numbers or words and reading and so forth and so on because that's deemed developmentally inappropriate and it has been assumed that in fact will push them too quickly, push the nervous system too quickly and so on. That is absolutely not true for a number of reasons. If it is true or if people see kids being harmed by interactions to develop numbers, letters, sounds and all of the things we know that go into later reading, it's because it is being taught incorrectly. It's being presented to the kids in a way that may be developmentally**

inappropriate. You don't work with three year olds and four year olds the way you work with a first or second grader. I think people have that in their minds.

### **The Disconnect:**

Dr. Reid Lyon: But here's the disconnect, and this is ironic: we obviously work with a lot of colleges and universities and we're on campuses doing a lot of studies. **One of the things some of our studies do is look at the interactions that occur between moms and dads and kids. When you look at professors working with their kids from birth onward, they're reading to those kids from day one, typically. They are not only reading, but as they read even at six months of age they're pointing out the letters and the sounds. They're getting the kids to see the relationships between letters and sounds and vocabulary and concepts; they're extending language. They do it on the lap; they do it at bed time; they do it at the dinner table. They have magnetic letters on the refrigerator. What they're doing is building not only a knowledge of language and print and how all of that goes together, but they're building brain. We can see kids who don't have these interactions and they show us brain development substantially different from kids who do have these interactions.**

Now what is surprising is that a lot of these folks who interact with their kids in a very good nurturing environment and who do a lot of good systematic teaching from birth to five will then go into their undergraduate and graduate courses and teach their students never to do that. They teach their students never to do it because it's not developmentally appropriate. That's the disconnect.

The fact of the matter is, when we do our studies and we identify kids at risk for reading failure, we know that the majority of those kids who are at risk and who will hit the wall as they learn to read are kids from poverty. They are kids from disadvantaged families whose parents are working too hard to interact in the ways I just described, who may themselves not read, where there may not be books in the home; these parents may not even know they're supposed to interact with their kids that way.

We have early childhood programs where the kids go and develop good social competencies and emotional health, but the programs are bereft of any kinds of systematic interactions to do what middle and upper-middle class parents do all of the time, **and the social and the emotional positives that come out of that nurturing environment go straight downhill once those kids get in school and do not learn to read.**

### **Unconscionable:**

Dr. Reid Lyon: So, there is a fascinating set of disconnects that you see among an ostensibly learned and knowledgeable prophesiat. It's one of the most silliest things and saddest things I have ever seen. **The bottom line is for a country like America to be leaving behind about thirty-eight to forty percent of its youngsters in terms of not learning to read is unconscionable.**

What makes it equally or doubly unconscionable is if you disaggregate those data, seventy percent approximately of young African Americans kids can't read. Seventy percent! If you look at Hispanic kids, the figure is sixty-five to seventy percent. That means we are producing failure where it doesn't have to be. We know what we can do to help those youngsters; we know how to get to them early; we know how to identify these kids at risk, at four or five years of age; we know how to bring to bear good evidence-based programs that if applied and implemented will move

**those kids all the way from the tenth percentile right up to the average range, to be concrete. We can reduce illiteracy in many of our research sites - in real classrooms in real schools with real kids at risk where ninety-eight percent are free and reduced lunch, and eighty percent are a minority. That is seventy percent of kids leaving the first grade as failing readers reducing to two to six percent when we do it right.** When I'm saying we do it right that means we bring to bear what we know from those four questions.

### **Shame Avoidance:**

David Boulton: A couple of points. You covered such a wide ground and there's a variety of places we could go. You said 'avoid print.'

One of the most powerful concepts in the [emerging emotional science of 'affects'](#), is called the Compass of Shame." Or, what we've called in this series relative to reading, the [Downward Spiral of Shame](#). Basically what it points to is that children, like all of us, tend to [move away from what brings about shame](#). **Moving away from print is almost second order to moving away from feeling shame....**

Dr. Reid Lyon: Right.

David Boulton: **Which is associated with trying to process this code.**

Dr. Reid Lyon: **Absolutely.** The most visible thing our kids do throughout their early years is read. Reading is the most frequent and visible behavior visible to peers as kids enter school.

David Boulton: **Visible because there's a structure to it where we can see them struggling.**

Dr. Reid Lyon: Yes, absolutely. Typically, from first through third grades there is a lot of oral reading, and there are interactions where the kids are expected to read out loud, orally or in round robin. **When kids are hesitant, disfluent, inaccurate, slow and labored in reading, that is very visible to their peers and remember the peers, the other kids, again look at reading as a proxy for intelligence.** It doesn't matter if this kid is already a genius and can do algebra in the second grade, reading produces particular perceptions. **Better said, lousy reading produces a perception of stupidity and dumbness to peers and clearly to the youngster who is struggling. That is the shame.** There are very visible differences between kids who are doing well with print and youngsters who are struggling with print. **They feel like they're failures; they tell us that.** ([More "shame stories"](#))

One of the things that is both great but also sad, is that we have had the opportunity in my job working with all of our scientists at all of our sites to follow kids from before they enter school until, in many cases, they're now twenty-three. What is wonderful about that is we can walk through life with folks who are going to become very good readers. Sadly, we also walk through life with kids, adolescents and then adults who never learn how to read. And sadly, when we talk with these kids, adolescents and adults who've had a tough time with the shame of not learning to read, we find it is further exacerbated by the fact that they can't compete occupationally and vocationally; they don't do well in school, **clearly the adolescents show us a level of pain that this society doesn't even see.** Most of society takes this for granted, **but all of this begins to build up together and keep kids further behind.**

### **Impoverished Vocabulary:**

Dr. Reid Lyon: You know, if we just go back to the little kids we start with...now we're starting at birth, as I mentioned, and **by three years of age kids from poverty, disadvantaged, whatever their race or ethnicity, are already thirty to forty percent behind in vocabulary development.** Whereas your kids and my kids are going to learn about nine new words a day from eighteen months of age onward, kids from disadvantaged are going to learn about three. Now what happens is, they're not learning or picking up the vocabulary, but they're also not getting those interactions that stimulate brain, that help kids understand that our language is composed of smaller units, and we can talk about how that is so important for reading development.

**So, you've got kids coming into pre-school, kindergarten and first grade who are already behind the curve in vocabulary. Even if we could teach them to read print, what are they going to relate it to?** The fact is, we also have these same kids having a difficult time understanding the code because they have not understood what the building blocks are. And again, we can visit that. Here they come, we can get them up to snuff with good instruction in terms of bringing print off the page, but if we don't also bolster vocabulary, comprehension, which is why we teach kids to read, their learning continues to lag.

### **Vocabulary Enters Through Print:**

Dr. Reid Lyon: Consider the kids who we don't get to who still are having print problems that are labored, hesitant, and inaccurate as they come up through second grade, third grade, and fifth grade. Well after fourth grade, or during fourth grade and beyond, [vocabulary now enters through print](#). It doesn't enter through hanging out with your friends on the corner. So, now we start to get further behind in vocabulary, such that even when the kids are accommodated for, that is books are read to them through some platform or modality and they have some type of accommodations, they still do not have the background knowledge that should have been fostered by reading from day one and **we have this constant trajectory of failure with the gap widening and widening.**

### **Research Protocols:**

Dr. Reid Lyon: When we ask that first question, what does it take to read, it's neat to describe how we've done the studies. There's no way you can make sense out of kids and their development unless you hang out with them and walk with them. You can't study kids on anything at one point in time and really learn anything because you don't know what happened before and you don't know what happened after. So, when I was brought to [NIH](#) and we developed the research protocols, what we wanted to make sure of were the following kinds of things: 1) What does it take to learn to read? 2) What goes wrong when you don't? 3) How can we prevent it? 4) How do you remediate it when you can't prevent it? **What's the best way to understand and capture the knowledge to allow us to do it?**

What we had to do was start before the kids got to school. We started at five at that time, back in 1983. The reason we started at five rather than at three or one was because we didn't have good enough measures to go lower than. We do now in many ways. We also knew we had to look at all kids, not just these kids or these kids, but populations of kids of every race, every ethnicity, of every background because those four questions apply to the whole civilization. So, we would sample large groups of kids at five years of ages that represent epidemiologically what you see out there in the population and we would measure all of these kids on those things that people thought were critical for reading. There were a lot of goofy ideas and there still are about reading and how it develops, but scientifically you can't argue with the concept that you have to measure it, compete the hypothesis and test it.

For example, a five year old in our study would be measured on every part of language, phonology, semantics, syntax, pragmatics. We'd look at attention and all phases of attention, all types of memory. We'd go in the home and look at how many books are in the home, how much the parents read to the kids, how well the parents read. We'd look at genetic factors and family factors, we'd look at neuro-biological factors. The kids are pretty well assessed in fun ways, and they like it. You know, a 'me next' kind of thing. We'd do that three times a year for many of these measures and we'd do it for at least five years. So, the minimum amount of time a kid is going to walk with us is five years, the average is nine years, and as we talked about a little bit earlier, we've got a lot of adults with us now. What's amazing is how many of these folks stay with us. You know there's only been a six percent attrition rate in these samples. Where we start, for example, in Connecticut in 1983 with Sally and Ben Shaywitz's study....all of those kids came from the state of Connecticut. They now live in forty-four different states and six foreign countries and we still follow them every year.

Now when you do that and you measure kids across all of these things that people think are critical for reading development, you get to see which ones are right and which ones are wrong. A lot of folks thought that reading came naturally. A lot of folks thought that reading was related to semi-circular canal vestibular system things. Some people felt that reading was really dependent upon visual perception. Some people think that's it's timing and sensory processing. Some people think it's language and phonology. Well, the only way to get to that is to test all of that objectively, compete it and see which ones fall out in the mix as either good, medium or poor predictors of things.

So, what you've got is all these kids coming along with us in the first ten years where we're not doing any interventions; we're following them three times a year and we assess which kids at the end of first, second, third, tenth grade, whatever it may be, read well, which ones read medium and which ones really hit the wall because reading is continuous. Then you can back up at the end of the first grade, at the end of fourth grade, at the end of tenth grade, all the way back to kindergarten and see what you measured that best predicts outcomes at each of these levels. Question number three, you can't prevent if you can't identify early. Question number two, what goes wrong when children don't learn to read? Well, we're measuring on a continuous basis so we can see those measurements of those properties or variables or factors that are most influential in learning how to read or get in the way and prevent learning how to read.

### **What We Know:**

Dr. Reid Lyon: So, what do we know? **Number one, we know that reading is complex and most people give it short shrift as I did when I was a third grade teacher. I just took it for granted. It's one of the most complex, unnatural cognitive interactions that brain and environment have to coalesce together to produce. It's amazing when you look at it. We've got an alphabet that has twenty-six letters. We've got those twenty-six letters corresponding to about forty to forty-four sounds.** Now in an alphabetic language like English or German or Serbo-Croatian or whatever it may be, **the job of the beginning reader is to lay sound on top of these print characters because it's literally impossible to memorize all this stuff.**

So, you've got to ask, what does the kid have to have? Well, when we say question number one, what does it take to be able to learn to read, we know that it initially takes a clear understanding that the language we hear is composed of smaller sounds. These are called phonemes, the smallest units of sound. And people say sure, you know, cat has three sounds /c/ /a/ /t/. And I can ask people all the time how many sounds they hear in big or cat and they say three. But they don't. You don't hear three sounds in cat, I don't hear three sounds in cat, and our kids never get any practice with the sounds in cat because **nature has given us an oral language that allows us to communicate rapidly so that when I say cat I don't say /c/ /a/ /t/. What the hell is a /c/ /a/ /t/? What I say is cat and the minute I start to say cat that /a/ and the /t/ sound co-articulate or bundle together and come by the ear as one pulse of**

sound. Phoneme awareness is much more difficult because you don't hear the sounds. The brain has to pull from that one burble or acoustic bundle the three sounds because the ear won't. The ear never hears the individual sounds unless we spell them out.

### Phonemic Awareness is Artificial:

David Boulton: So, in that sense, **the whole phonemic awareness piece of this is an artifact of learning to read, not something we would naturally have to develop to process the distinctions in oral language.**

Dr. Reid Lyon: **You do not need phonemic awareness to listen and speak** and hang out and talk. Why? Because I'm not spelling the words out to you, I don't say /c/ /a/ /t/.

David Boulton: Yet much of our research seems to suggest that the lack of this is some deficit in children.

Dr. Reid Lyon: **Well, it's not a deficit in children. It's only a deficit if they don't get it to learn how to read. A deficit is only a deficit if it impacts negatively on something critical that has to be developed.**

David Boulton: It's a deficit with respect to the conditioning necessary to take in this artificial process.

Dr. Reid Lyon: **Yeah, it is an artificial process, and it's a random process.** Why do some languages have more or less sounds than we do? Why do some languages have more or less or different characters than we do?

### Language Studies:

David Boulton: Back to your research studies from a few moments ago, **is part of your research intention to actually look at the difference in how many hours of instruction, of what kind and quality, is necessary to get children through the different kinds of orthographies out there relative to their different ambiguities?**

Dr. Reid Lyon: **Yeah, sure. We've studied several kinds of languages.** We study Chinese, logographic languages, and we study Japanese - a couple of forms of Japanese. We study different alphabetic languages, some very transparent, or what we call shallow. We study **Spanish and so forth where the relationship between the sound and the letter is very straight forward, versus English where it gets a bit more complex.** So yes, we do that, but you know, all of this fits together in that phonemic awareness is absolutely critical, non-negotiable to understanding how to read, to knowing how to bring sound to print because we have an alphabetic language, but it is in no way sufficient.

David Boulton: It's necessary, but insufficient, a kind of a 'placeholder' or 'formatting' that's necessary for...

Dr. Reid Lyon: Yes, it's a building block.

David Boulton: Later processing.

### It Takes Phonics:

Dr. Reid Lyon: We have a lot of kids in our studies who can do good phonemic awareness tasks, like rhyming or saying big without the /b/ sound and stuff like that, but they still don't comprehend. So, it is necessary, but not sufficient. We can't find good readers who don't have it, but if you just teach phonemic awareness like educators sometimes do, they'll latch onto it like a magic bullet, and we're not going to get anywhere.

So, what else does it take to learn to read? Well, it does take phonics. I'm sorry, but it takes phonics, which is the F-word in today's society, at least in the education community. But phonics is nothing more than a relationship between sound structure and a print structure. Phonics.

David Boulton: [Phonics developed 400 years ago as an attempt to compensate for the underlying mess in this code.](#)

### Necessary but Insufficient Building Blocks of Reading:

Dr. Reid Lyon: **That's correct. Yes. Oh yeah.** Phonics is absolutely essential, non-negotiable. You can't read English without it. But it's not sufficient. But surprisingly, a lot of people say, 'Well, I never learned phonics, I learned by this or this or this, nobody ever taught me phonics and I read okay.' We'll bring them into our laboratories and we'll have them read a sentence and put a word in there that they have never seen before and guess what they use? Phonics. They use it because a lot of our kids who can learn to read under any instructional method, no matter how cockamamie, are able to do that because they have already been taught these foundational building blocks.

Let's go back to age birth to five. When I was bringing my kids up, I read to them all the time. I read to them systematically, I pointed out letters, I pointed out sounds, I played Twinkle, Twinkle Little Star, Eeny Meeny Miny Mo, I read Dr. Seuss. They were inundated with all of this information that tears language apart. So their brains are now deploying neurons to tear things apart.

David Boulton: [To differentiate.](#)

Dr. Reid Lyon: **Of course, yes, to differentiate.** And once they get into kindergarten and first grade, a lot of our kids have these building blocks already. **We've got a lot of five year olds who know all the letters of the alphabet, who know quite a few of the sounds, if not all of the sounds, and they're ready to go. They have the building blocks.** And because they have them and they move on under any cockamamie approach, a lot of people think it's the cockamamie approach that's teaching them to read. That's how a lot of this philosophy and belief gets situated.

The fact of the matter is most of our kids at risk are kids who did not have these interactions that built the fundamental, foundational linguistic building blocks. They come into kindergarten, first grade, and if they then get instructional approaches that don't take advantage of what we know about the code, if they get instructional approaches that are philosophically based, holistic and so forth, they'll never get it. Because they're coming for clarity, and if they're expected to discover these kinds of things without all of those previous building blocks how are they going to do it? **It's like me being sat in front of a piano listening to Mozart without any musical background and then being expected to induce these things, expected to pick it up naturally. It just doesn't happen.** So, you've got all these kinds of cultural, instructional language things moving at one time, which all can be helped and adjudicated by just knowledge.

### **Teachers Must Ask Themselves Questions:**

**Dr. Reid Lyon: If I had my druthers, instructional methods wouldn't be the big deal out there. What would be the big deal is if teachers could ask themselves what does it take to learn to read?** It takes phonemic awareness, it takes phonics, it takes the rapid application of those print level skills to text - fluency, it's called. Even when they do all of those kinds of things, phonemic awareness and phonics and fluency, if kids don't have vocabulary they won't understand what the heck they're reading. So, they've got to have vocabulary. We've got kids with good phonemic awareness, good phonics, good fluency, good vocabulary – and they still don't comprehend well. And the reason is they're not active, they don't structure their interaction with the print, they don't summarize, they don't predict and so on.

### **The Processing Drain of Inefficient Reflexes:**

David Boulton: Can we say at this point that the processing efficiency

- that's happening faster than thought,
- that's underneath thought,
- that's taking in the eyes' scan of the letters,
- that's converting these letters into sounds,
- that's generating this virtually heard or actually spoken stream of thought that gets popped out like an assembly, a construction,

(is related to) the formation of the reflexes that are underneath volitional awareness - that are generating all of this - if they form inefficiently they consume too much brain bandwidth and drag down comprehension?

Dr. Reid Lyon: There's **no doubt about it. Let me just kind of rephrase what you so elegantly said into just concrete terms. The longer it takes you to read something, the more memory and more attention it's going to require. We've got kids who, on the struggling side, hesitate, mispronounce - it takes them so long to read a passage they can't even remember what the heck they read after a sentence, much less the passage. Yes, the capacity that goes into this print level work is far too great to give room for comprehension for relating new to known, there's no doubt about it. The majority of our kids who have a tough time – they are slow, they are labored in their reading, they are hitting the wall on a lot of these print skills.**

David Boulton: Would you say that there's a correspondence between this poor instructional environment, poor educational environment - because it's not inherently, for the most part, a biological deficit...**it's a 'context of development' deficiency...**

Dr. Reid Lyon: **Yes.**

David Boulton: **That's causing non-functional to inefficient internal reflexes to form that, even for some who can 'break it', they're processing too slow because of the way these things formed...**

Dr. Reid Lyon: **Yes.**

David Boulton: **And perhaps mixed in with shame and other conscripts between the affect and cognitive system, the whole thing is just not efficient enough to fly.**

### Instructional Casualties:

Dr. Reid Lyon: **Absolutely. Absolutely.** The fact is that, oh how do I want to say this? I'll just be blunt. **When we look at the kids who are having a tough time learning to read and we went through the statistics, thirty-eight percent nationally, disaggregate that, seventy percent of kids from poverty and so forth hit the wall. Ninety-five percent of those kids are instructional casualties. About five to six percent of those kids have what we call dyslexia or learning disabilities in reading. Ninety-five percent of the kids hitting the wall in learning to read are what we call NBT: Never Been Taught.** They've probably been with teachers where the heart was in the right place, they've been with teachers who wanted the best for the kids, but they have been with teachers who cannot answer the questions: 1) What goes into reading, what does it take? 2) Why do some kids have difficulty? 3) How can we identify kids early and prevent it? 4) How can we remediate it?

**Again, if we could prepare our teachers to know the depth of knowledge to answer those four questions, our data show that those are the teachers who are extremely successful with the most at risk kids.** In all of our clinical trials we have never found one instructional approach that's equally efficacious and beneficial for all kids with difficulties. So, what that means is that the teacher has to say okay, which programs have shown to be effective. [Russ Whitehurst's](#) shop is working hard on the [What Works Clearinghouse](#), looking at those programs that have been evaluated by good clinical trials and randomized designs - we have to have that. Indeed, some instructional programs are much better for some kids than others, no doubt about it. But even the best will leave some behind.

So, the teacher has to say, okay, here's the program that I see has the most *umph* behind it scientifically, I apply that to my kids, I still have three who aren't responding to this good program, so I have to know what it takes to learn how to read: phonemic awareness, phonics, fluency, vocabulary, comprehension. Where is my program not meeting the kid's needs in these areas? **So, the teacher has to know how to assess that range of foundational building blocks: phonemic awareness, phonics, fluency, vocabulary, comprehension, and has to assess the program intensity and clarity in terms of teaching those for those kids and then modify, adjust...**

David Boulton: [Make it personally relevant.](#)

Dr. Reid Lyon: **Yes, absolutely. It could be actually the shame issue hitting up against motivation making the kid avoid, even with the best program, the teachers have to know all of that.**

### Shame Consumes Bandwidth:

David Boulton: [And at the higher level, once shame kicks in it's a bandwidth consumer.](#)

Dr. Reid Lyon: **It is. It is.**

David Boulton: [So, the moment they move into shame there's a reduction of the processing bandwidth available to process the code.](#)

Dr. Reid Lyon: **Absolutely.** Yeah. But your point about...this is what makes this so sad.

### **The Soft Bigotry of Low Expectations:**

Dr. Reid Lyon: I work for a president now, never thought I would be in a position to do that or have the honor to be able to serve a president. He knows all of this information. I don't mean to make this political. I mean this is an individual who is married to a former teacher where there is a common passion is children's development and learning. His passion, very specifically is reading. It was when he was governor, that's how he brought the [NIH](#) into Texas and so forth, and it clearly is now. **His statement that 'If we do not do well it demonstrates the soft bigotry of low expectations' comes out of the fact that he sees all of the data showing all of those kids at massive risk from disadvantaged homes when taught well doing as well as everybody else. If you can do it there, why aren't we doing it here? If we're not doing it here it's because we have given in to the soft bigotry of low expectations which has, in fact ,concretized itself in developing professional knowledge in teachers that is limited and not evidence based, and not implementing what we know and not providing the robust leadership in schools to make sure teachers have the information and that it's implemented well.**

What I'm saying is that time after time our president, much of our leadership downtown, the secretary of education, the secretary of health and human services, they all know these data. **They all have taken very close looks at the fact that we have a national shame in terms of teaching our kids to read. They all know it doesn't have to be that way. They all know that when we do things right, based upon evidence, not philosophy, not belief, not untested assumptions, but on what continues to grind out of the scientific mill, we reduce that shame, that seventy percent of many kids who cannot learn to read to about two to six percent.**

### **Processing Efficiency and Proficiency:**

David Boulton: **So far our conversation has been about this thirty-eight percent or so who are below basic. But ultimately, if we take this position about the processing inefficiency that's developing the scripts, it runs through the basic and all the way up to this sixty-eight percent or so in fourth grade who are below proficient.**

Dr. Reid Lyon: Right.

### **Most of Our Children All but Fated:**

David Boulton: **So, though we can say that this is a social screen that's got this very hard gate at the lower level, it's also affecting, psychologically, academically and in all these other ways, our population to the extent that we could say: most of our children, to some degree, are having their lives all but fated by how well they learn to read.**

Dr. Reid Lyon: **Absolutely. And if you look at that figure, that only a small percent of our kids are proficient in what it takes to read, understand and generalize content information, that figure is clearly related to instruction. It's clearly related to a very parochial and again, primarily philosophical view of what goes into reading - and using reading to learn, not only learning to read, but reading to learn.** It goes back to what we were saying; teachers at every level, even if they're content teachers: social studies, science or math, must have a much deeper understanding of what it takes to pull print off a page, relate it to what they know, what the kids know and be able to apply, generalize, summarize, predict and so forth.

**All but Fated by How Well They Learn an Archaic Technology:**

David Boulton: Right. One of the things that gets me though, is that what we're saying in effect is that **the majority of our children, to some degree, are having their lives all but fated by how well they learn to interface with an archaic technology.**

Dr. Reid Lyon: **Well, by archaic technology, if you mean lousy teaching...**

David Boulton: **No, I mean by the code itself.**

Dr. Reid Lyon: **Well, I see what you mean. We're not going to change the code, I'm sure.**

David Boulton: **Whoa, whoa, whoa...**

Dr. Reid Lyon: Yeah.

David Boulton: **I agree that we're not going to change the code.** I've been a student of the hundreds of years of many attempts to change it.

Dr. Reid Lyon: Right.

David Boulton: **But though we haven't been able to change it, I think that there's something to be gained by trying to understand it.**

Dr. Reid Lyon: **Absolutely.**

David Boulton: **How much of this problem is connected to the ambiguity that's pent up in this code and where it came from.**

Dr. Reid Lyon: There are scholars as you know who study this up the wazoo and know how the Latin and Greek influences and other influences effected ...

David Boulton: **The collision between two different language systems...**

Dr. Reid Lyon: Right.

David Boulton: **That resulted in this great ambiguity.**

Dr. Reid Lyon: **Right. But we can look at very transparent languages like Spanish and you'll probably still see a very limited number of proficient kids, all things being equally matched on background and environment and all of that. In other words, you do see similar difficulties even in transparent languages. And it is referring...**

David Boulton: Do you have studies on that you can send me?

Dr. Reid Lyon: Sure.

David Boulton: Okay.

Dr. Reid Lyon: In other words...

David Boulton: **And indexed against how much time and instruction has gone in?**

| Dr. Reid Lyon: **Well, I don't know if we've done it that well.**

| (Note: See [Foundation literacy acquisition in European orthographies](#) )

### **Code Inefficiency:**

David Boulton: **I want to say how much does it cost us to get around the inefficiency in this code?**

Dr. Reid Lyon: Well, alright. **Let's take a look at the inefficiency. It is there.** In other words, why do I have one tooth and several teeth and why do I go into a restaurant and sit in one booth and there aren't several beeth? You know those are the kinds of things we're talking about. **But the inconsistency is a little bit exaggerated in the sense that even within these weird words**, demon words, you know o-u-g-h, **there are clusters of small letter patterns that flow all the time.**

David Boulton: **There's no question that at a certain level of mastery in adult oversight looking down upon it...**

Dr. Reid Lyon: Yeah.

David Boulton: **You might say, 'Oh, it makes sense. It's not that ambiguous.'**

Dr. Reid Lyon: Right.

David Boulton: **But from a child's point of view, and we're talking about how they see the letters and they're trying to create the sounds from them.**

Dr. Reid Lyon: Right.

### **Articulation Stutters and Code Ambiguity:**

David Boulton: **The hesitation, the slow processing that we were talking about before...**

Dr. Reid Lyon: **Yeah, yeah.**

David Boulton: **Seems to correspond to the ambiguity. In other words, if you track a child's articulation...**

Dr. Reid Lyon: **Yeah.**

David Boulton: **As they're flowing through the reading stream you can see the bog happen in direct correspondence to the code's knots.**

Dr. Reid Lyon: **You can, you can. Absolutely.** This underscores the need for teachers to know where the ambiguities are...

David Boulton: Right.

Dr. Reid Lyon: To know the sequences that are most efficient to move kids to mastery. **If you look at the instructional programs that are most beneficial for kids at risk**, that really do get swallowed up by this ambiguity, **those instructional programs carry a sequence of presentation designed to move kids systematically...**

### **Probabilistic Instruction or Meeting the Child:**

David Boulton: **But it's statistical, probabilistic cannon fire, rather than trying to get into sync with the child and bring them right to the edge of the ambiguity so that they are actually stuttering, stumbling right there and then helping them learn through it.**

Dr. Reid Lyon: **Well, I would say that that's something we can look at. You know, that's all I can say.**

David Boulton: Alright. I'm not trying to advocate something in particular, but I am trying to say, most of the parents and teachers that I talk to are blown away that what **we're basically saying is that they're children's lives are being fated by a technological accident of history.**

Dr. Reid Lyon: Yeah, yeah. But I...

David Boulton: **This is not a natural thing!**

Dr. Reid Lyon: **No, of course not.** But no reading is natural; even in transparent languages it has to be taught. **It has to be that there is a direct relationship, or an inverse relationship between the amount of intensity, the amount of systematization and the amount of explicitness that goes into instruction...more of that when you have a youngster who has limited to bereft foundational building blocks.**

David Boulton: **But ultimately, the effectiveness of that is as connected to how well we're actually meeting the child in the edge of their ambiguity overwhelm, at the edge of ambiguity overwhelm and helping them right there learn how to resolve that ambiguity.**

Dr. Reid Lyon: **I hear you.** Have you been able to talk with [Louisa Moats](#)?

David Boulton: She's on our list.

Dr. Reid Lyon: Yes. [Louisa](#) will take you through how instruction negotiates that kind of situation. In other words, when we're doing studies and we study program A versus program B, we're not studying A versus B. That's called horse race research. What we're interested in is figuring out what it is within A and B, what the interactions are that meet up with the kids' individual characteristics. Some programs present information to kids in a way where the sounds and the letters are individually given and then blended. Okay, that's called a unit of analysis. Other programs give kids bigger chunks of written language, called on-set-rhymes, rather than /c/ /a/ /t/.

David Boulton: Right. Which creates a differentiation-juxtaposition.

Dr. Reid Lyon: Well, again just trying to figure out how different loads, different linguistic and perceptual loads interact with the kid's characteristics. Some programs move from one step systematically to another; they're pre-scripted. Some programs are responsive, that is if the teacher is good enough they don't have to move from here to here to here, they can see exactly what the...

David Boulton: [So, they're over-generalizing the blast and they're trying to get more granularity in their interactions.](#)

Dr. Reid Lyon: Yeah, well the more granular are the more pre-scripted types of things, responsive moves trying to keep everything in context but being very explicit. Being very systematic takes an enormously talented teacher to do that who knows the answers to those four questions. That's when they become responsive. But all I'm saying is that what we will do is vary all of these teeny components, we'll study units of analysis, we'll study the load – the cognitive linguistic load, we'll study the type of feedback the teacher gives, we'll study the examples from different programs. That is how we can get to the case: number one, no one program is going to be equally effective and why is a program not effective for certain kids? Then we can get the answers in these more granular kinds of unpackings, if you will. [Louisa Moats](#) studies; she's so anal about studying the most amazing teeny, teeny pieces of this that bear on a lot of the ambiguous issues you're talking about.

David Boulton: [Good, I need to talk with her.](#)

Dr. Reid Lyon: Yes.

David Boulton: [You're familiar with some of the attempts to fix the orthography...](#)

Dr. Reid Lyon: Yeah.

David Boulton: [From Benjamin Franklin to the blunder of Theodore Roosevelt.](#)

Dr. Reid Lyon: Well, [Dick Venezky, you talked to Dick; he knows all this stuff.](#)

### **Perspectives on the Code:**

David Boulton: Right. **Well, he and I agree that ultimately the ambiguity in all this, although he wouldn't use that word, he says variability – [because from his perspective it's not ambiguous.](#)**

Dr. Reid Lyon: **Yeah.**

David Boulton: **But none the less, the variability creates this [opportunity for a kind of creative freedom and more extension in differentiating...](#)**

Dr. Reid Lyon: **It does. Well, it does.**

David Boulton: **[In differentiating and extending our cognitive abilities.](#)**

Dr. Reid Lyon: **It does and it may give us even more opportunity with our language than other languages.**

David Boulton: **Exactly.** That's the point of the [Alphabet Effect](#) or that whole [Logan/McCluhan](#) line as well.

Dr. Reid Lyon: **Yeah. Right, but the fact is our somewhat variable orthography, it is inconsistent, some people would say. I think it's more regular than people think I would agree with...**

David Boulton: [But the question isn't what you and I think. It's what is it that's happening to kids as they're learning to process it.](#)

Dr. Reid Lyon: Well, in terms of learning the processes, what we know given the nature of our orthography, is that phonology is critical. In Spanish, it is not so critical because it's much more transparent. So, **we can see the relationship between the building blocks that one needs in English to be able to negotiate our language and the relative emphasis on phonology rather than morphology.**

David Boulton: [But reading has to draw on it in a way rather than project it.](#)

Dr. Reid Lyon: **Well, certainly. But in order to negotiate this code the kid has to have an exquisite understanding of sound boundaries and how to map that on top of either single letter variables or constituents, multiple constituents.**

David Boulton: [One of the things that we've done is try to map out the ambiguity. A letter doesn't have a definitive sound value as you know, it is almost like a wave or a particle...](#)

Dr. Reid Lyon: **It is. Yeah.**

David Boulton: [It could be a definitive thing; it collapses like a wave...](#)

Dr. Reid Lyon: **Well, it co-articulates, yes.**

David Boulton: [It co-implicates.](#)

Dr. Reid Lyon: **Yeah.**

David Boulton: [It co-implicates in the contextual field in that sometimes there are many words down the road that determine what the sound of a letter is. That's how far ahead and how much time buffering we've got to be doing in order to make this thing work.](#)

### **Whole Language:**

Dr. Reid Lyon: **Well, look at the way the system operates when we read. I don't know if you have talked with people about this, but in some ways it goes back to how we've created the shame. I don't know why education and in particular reading, within the field of education, has been so wimpy with respect to building on evidence rather than on heart. Of course you have to have both, but.... The way we went down the road to whole language is really a story of stupidity. Back in the 1960's....**

David Boulton: [Kindergarten and Horace Mann, don't we have to go back to the 1870's?](#)

Dr. Reid Lyon: **Well, yes. Yeah. But I'm talking about in its present form...**

David Boulton: [Its latest incarnation of the battle oscillation.](#)

Dr. Reid Lyon: Well, what I think is different about the last thirty years is we have developed a capability to study this stuff much greater than when Horace Mann or John Dewey was around. So, you know what happened in the sixties and seventies were great intellectual leaps in terms of oral language, that **indeed oral language is natural. Listening and speaking is species universal.** That's why kids in Tokyo and in Toledo know the same sounds initially.

David Boulton: Somewhere between a million and a hundred thousand years depending on which geneticist or anthropologist and how they cross talk.

Dr. Reid Lyon: Right. But what's amazing is kids all over the world can handle the same consonants and vowels. If we go to Tokyo and study kids or we go to Toledo to study kids, those kids will coo for us, they'll babble, they'll use single word holophrastic speech, they'll use pivot open grammar, they do that in every culture. So, **it's species universal, it is proto-plasmically driven. Alright, reading isn't. Reading, as we've discussed, is unnatural, arbitrary....**

David Boulton: **Only a few percent of the population has only been doing it for a few hundred years.**

### **Reading is Unnatural:**

Dr. Reid Lyon: Well, yeah. You know, **why didn't somebody ask if reading was natural; why do we have so many cultures with oral language that still don't have a written language?**

David Boulton: **Even in people that understand this at some intellectual level, there's some kind of gut visceral level, common to the population it seems, that says to itself as it looks at a child, that there's something wrong with them if they can't do it. It must be implicitly held as natural.**

Dr. Reid Lyon: **Well, I hadn't thought about it.**

David Boulton: **Not that it MUST be, but you know what I'm saying.**

Dr. Reid Lyon: **Yeah.**

David Boulton: **That this is the implicate assumption that we're all carrying around; that something is wrong with these kids. It's this atmospheric pressure...**

Dr. Reid Lyon: **Hmm.**

David Boulton: **That's creating this context that's misinforming the teacher and the parent and shaming the child.**

Dr. Reid Lyon: **Okay. Alright. I'll go with that.**

David Boulton: **Okay. I don't mean to put words in your mouth. I'm enjoying our interaction wherever it goes.**

Dr. Reid Lyon: But, figure, look at this: so here we had [Chomsky](#) and David McNeal and all the good folks at MIT and Harvard figuring out that indeed oral language is natural; it is species universal. **The educational folks came along and said well, since reading is based on oral language, which it is to**

**a lot of degree, it also is natural, therefore since we don't teach our kids directly and systematically...**

David Boulton: **Code induced simulation of it, though.**

Dr. Reid Lyon: **Yeah, but...well, yeah.** But their point was that when kids come on the planet and we interact with them, we don't teach them "Sally, today we're going to do verbs, prepositions" – you don't fragment, if you will, the content. You interact with the kids, they say things, you expand it – it occurs in a naturally, nurturing kind of thing. **So, the leap was well, reading is language, therefore reading is natural, and therefore you do not teach the specific skills or the features, that is...**

And the power died in the office and the interview ended....