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Apprenticeship and Exploration: A New Approach to Literacy Instruction

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I can still remember the rich mixture of excitement and terror as I perched on the wobbly seat of my big sister's red and white Schwinn bicycle, pointing down the lawn toward the driveway. My father firmly held me and the bike upright as he began to push gently forward. We were moving, gaining momentum, my legs still limp on the pedals. As he had carefully warned, he ran alongside, gradually letting go of the handlebar, then of the seat itself — and I was solo, a bike rider at last!

Or sort of. Ten yards later, out of momentum and still not pedaling, I fell.

Nonetheless, I was soon a bike rider, and an expert at that. About a year later, at age seven

or eight, I discovered the family record player. I don't remember being particularly interested in any of the music on our records, but I loved playing everything at the wrong speed.

Soon I discovered that I could drag my thumb on the side of the turntable and slow the speed to just about anything I wanted. A short step from that was placing my index finger on the center of the record and spinning faster and faster. None of this did much for music appreciation, but I learned a lot about the properties of speed, sound, rotation, relative pitch, acceleration, constancy, and fragility (of the record player, which finally wore out).

I learned, for example, that

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pitch was related to speed of rotation, that force applied at the center of the record had a much larger acceleration effect than at the edges, that relative pitches were a constant, that you could tell the loud parts of records just by looking at the grooves, and that candle wax spilled on the surface of the record had an effect on sound quality. I learned a lot from playing with the record player.

There are different kinds of knowing.

These memories illustrate two very different

kinds of knowing, articulated twenty years ago by Jerome Bruner (1972). He made the distinction between “knowing how” and “knowing that.” His separation of these two kinds of knowing appealed to many

Effective learning is a combination of student exploration and modeling by the teacher and other mentors.

educators and became widely cited in the literature of psychology and education. Knowing how to ride a bike seems substantively different from knowing that a bike has two wheels. The former is a skill; the latter is a property. But how different actually are these two kinds of knowing?

Very different, according to a growing body of evidence. Recently, Bruner’s distinction has garnered support and attention from an unexpected quarter — the neurosciences. Oddly enough, the critical findings first came from a group of amnesiacs who seemed unable to learn anything (Martinez and Kesner, 1991). It is a story that has relevance for understanding the ways in which children learn.

After some kinds of specific brain damage, patients develop a severe anterograde amnesia. They can normally remember events that occurred prior to their injury (retrograde memory) but seem unable to learn new information. Thus they may re-

member the name of their sixth grade teacher but be unable to remember the name of someone they met yesterday. Such patients not only fail to learn the names of new people whom they have met, they fail even to recognize that they have ever seen them before — even after hundreds of introductions. The difficulty is not limited to names but to almost any new information. They cannot recall the name of a newly elected president, what day it is, or their new home address.

For decades it was commonly accepted that such patients could not learn any new information, that the anterograde amnesia was total. Further study, however, indicated that there were surprising discontinuities. The same patients who could not recognize their doctors from day to day could, in fact, learn how to solve a maze, do a puzzle, and ride a bike. Through practice, their skills improved, showing retention from one day to the next. A startling revelation was that this improvement in skill came without any apparent recognition of the task from day to day. The patients would fail to recognize the maze when it was presented, reacting as if they had never seen it before in spite of improved performance. When asked to recall how they solved the maze, the patients were completely unable to do so. In a fundamental way, they were learning *how* to solve the maze but not learning *that* they knew it.

These cases and other related findings led neuroscientists and cognitive scientists to develop new ideas about what learning and memory really are. From many different kinds of neurological research it has become clear that there is not one neurology of learning or one neurology of memory. Instead, we have a number of ways of knowing, learning, and remembering, and although they often operate in an integrated fashion, they are easily separable.

Neuroscientists have discovered that different parts of our brain, even different chemistries, are critical to each kind of knowing (Martinez and Kesner, 1991).

The research in the neurosciences is dramatic, and it is not the only evidence that there is more than one way of knowing. Researchers from a variety of fields have recently argued that we have been far too narrow in our conception of what knowing is. The work of Howard Gardner in multiple intelligences is an important example in the field of education (1983, 1991).

Just as there are different ways of knowing, there are different methods of teaching — each selected depending on the knowing involved. What does this mean for teaching? For many educators there is a growing realization that we have also been too narrow in our choice of teaching methods. Just as there is not one kind of knowing, there is not one method of teaching. Rather, the optimal conditions for learning — the ideal pedagogy — depend on the kind of knowing involved. This paper looks at two of those methods — apprenticeship and exploration — and their implications for literacy development.

Apprenticeship, with its five basic elements, is a method as old as human culture.

The pedagogy my father used to help me learn to ride my bike — the apprenticeship method — is as old as human culture and as current as modern cognitive science. When teaching their children to ride a bike, most parents naturally adopt this method.

Apprenticeship's basic elements:

- First, there is a mentor who has already mastered the skill and who can provide demonstrations of what successful, expert performance looks like. Actually,

**Scholastic Literacy Place
Philosophical Foundations**

1. *Literacy is developed within the personal, social, and intellectual contexts of the learner.*
2. *A literacy program should provide developmental continuity.*
3. *The successful learner is motivated, strategic, knowledgeable, and interactive.*
4. *Children learn best when they have real purposes and can make connections to real life.*
5. **Effective learning is a combination of student exploration and teacher and mentor modeling.**
6. *Assessment is an ongoing and multidimensional process that is an integral part of instruction.*
7. *Making reading and writing connections across multiple sources and curricula facilitates meaning.*
8. *Literacy for the future means literacy in multiple technologies.*
9. *Education must respond to society's diverse population and must serve all children.*
10. *Interactions among students, teachers, parents, and community form the network that supports learning.*

in the case of bike riding, there are experts everywhere who provide models for emulation and motivation to the young would-be rider — an older sibling, a classmate, or a friend. The mentor's role is often to draw the learner's attention selectively to important facets of the skill that might not be apparent in progress. "Watch how I lean as I turn," "Watch how I use the pedals."

- Second, there is opportunity for guided practice. Learning any skill, whether it is playing the piano, driving a car, doing needlepoint, or playing chess, requires practice — repeated opportunities to increase fluency of performance. No one can learn to ride a bike by reading instructions *about* riding a bike, or even by watching someone else do it. Skills are devel-

oped through active, meaningful practice in the skill itself. Every bike rider in the world practiced a good deal.

- Third, there are often scaffolds to support early performance. In learning to ride a bike, one of two scaffolds is usually used: training wheels or a mentor who is willing to run alongside holding the bike upright. There are countless other scaffolds to support the early rider — the incline in the driveway is often a scaffold for the act of pedaling, for example.
- Fourth, the scaffolds are faded or gradually released, so that performance is more and more independent. In my father's case, he held the bike rigidly upright with both hands for my first run. In time, he let go of one hand, then (and I remember this clearly because I did the same with my daughter) let go of everything but one finger with which he psychologically held me firm against the dangers of the uneven driveway. Last, he ran alongside with no fingers. This gradual release of support had one very important effect — from the beginning I was performing the full act of riding the bike. I was not just pedaling, or just steering, but clearly had the feel of the act of riding, well supported at that.
- Fifth, there are opportunities for demonstration of the newly practiced skill. I couldn't wait for my sister to come home from camp and see me riding all by myself.

Apprenticeship is finding new respect from cognitive scientists.

The apprenticeship model of learning is ubiquitous across cultures. Western schooling, with its de-emphasis on apprenticeship learning, is an exception. In recent years, however, there has been renewed interest in it by many researchers and practitioners in cognitive science and education

(Antonacci, and Colasacco, 1994; Collins, Brown, and Newman, 1989; Gardner, 1991; Lave, 1990; Resnick, 1989; Rogoff, 1990; Vanderbilt, 1990).

One major focus of the apprenticeship research comes from the teaching of thinking skills. Researchers have found that apprenticeship models are ideal for teaching children how to use strategies for thinking critically, for gathering information, for organizing, and for monitoring, and they have spearheaded the recent interest in “cognitive apprenticeships” (Resnick, 1989).

It is not only in developing thinking skills that children need to know how. Much of what children know comes from learning how — learning how to make letters, how to play the piano, how to dance, how to take turns in conversation, how to search for things, how to draw with perspective, how to find the main point. In these things, children need to learn like apprentices — with clear modeling, plenty of practice, gradually released support, and opportunities for demonstration.

When it comes to learning *that* — understanding the properties of our world — another approach is needed.

In Bruner's terms, children need not only to know *how*, they need to know *that*. They need to know that liquids can be poured into different shapes but that the volume will remain constant, that written sentences end with a period, that objects can be grouped and regrouped into classes of objects, that parents cannot handle really loud sounds (unless they make them), that the color of liquids is a poor predictor of their taste or weight, that tone of voice is a key predictor of what a big sister will do next. They need to learn the properties of things, how they work, what the components are, what the relationships between properties are, and so on. How do children best learn these things?

Children are natural scientists. Piaget, Vygotsky, Bruner, and virtually every other developmentalist have noted that children are constantly searching to discover the

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properties of the world in which they live. Other than language, it is the curiosity of children, their unstoppable urge to explore and get into things, that most differentiates them from other species. Frogs and turtles are not curious; they are not scientists in the pond. Evolution has prepared them with perfectly adapted rou-

tines that are just right for the ecology of the pond.

Children do not come into the world so prepared. Much more helpless and dependent than most species, they must learn and construct what is special about their environment, what its properties are. Evolution has prepared them not for a fixed environment like a pond but for many environments, each with different properties. Evolution has prepared them to learn what these properties are. Evolution has prepared them to play.

Children learn some things best through exploration and play.

Jacob Bronowski is one of a great many scientists who have come to recognize that “all science is a form of play” (1973). His wonderful overview of the development of our species makes explicit the formal similarities between what scientists do and what children do. It is scientists’ continued childlike ability to “play” with substance and speed, with the properties of matter and movement, that allows them to dis-

cover the properties of our world.

Other scientists have looked more closely at how children play, investigating its evolutionary value for our species, realizing that there is a connection between the fact that we are at the same time the most playful and the most adaptive of the species. One researcher defines play as “optimal generic learning by experimentation in a relaxed field” (Fagen, 1976). This experimentation in a relaxed field is how we most efficiently learn *that* in Burner’s sense, whether as a scientist or as a child.

School learning is focused on a somewhat different kind of knowing *that*. Much school learning requires acquiring factual knowledge — knowing that Austin is the capital of Texas, that $7 \times 8 = 56$, that water boils at 212°F — followed by assessment to see if the facts have been retained, to see if they are “known.” This kind of knowing is very different from knowing how to ride a bike or knowing that speed and pitch are correlated. For this kind of learning, neither apprenticeship nor play is an optimal instructional approach. But how important is this kind of knowing?

Through the history of our culture, learning facts has been vital. Being an educated person has required the availability of such information in your head. When the goal of education is to ensure that everyone in the culture has a large body of facts in his or her head, the pedagogy and assessment reflect that goal. Educational research has focused on “associative” models of learning — how to organize the presentation of information so that it is remembered, how to provide webs of information rather than isolated bits, and so forth.

The importance of remembering lots of information has lost much of its value in recent years. New technologies, which have already transformed our culture, are gradually transforming the goals of our

schools. Rote memorization of facts is less important than in previous centuries because such information is available everywhere; distributed widely in books or in various devices like handheld calculators, databases, and electronic references.

Virtually all the facts that used to dominate the enterprise of schooling can now be captured on a single CD. Any child can quickly use a disk reader to find out that George III was the king of England at the time of the American Revolution, that the Norman Conquest happened in 1066, the conversion of Celsius to Fahrenheit, and not only the names of the planets, but their weights, circumferences, orbits, and so on. This information has moved from in your head to at your fingertips.

The result of these changes is that education is refocusing on knowing *how* — how to search for information, how to organize, how to categorize, how to think, how to communicate — and knowing *that* — that authors have points of view, that there are many kinds of cultures and many kinds of knowing, that economics is an important determinant of history, that water is heavier than oil.

Ignorance is being defined less in terms of what a child can remember and more in terms of what a child can do. Teachers who still see children — rather than books or computers — as information storage devices are troubled by the changes. If their enterprise is not to teach the names of the planets and the times tables, then what is it? And what will be the pedagogy?

Others are seeing opportunities for pedagogical innovation based on changing educational goals. In the last decade, there has been renewed interest in apprenticeship and in exploration by many educators and cognitive scientists (Antonacci, and Colasacco, 1994; Bruer, 1993; Bruner, Jolly, and Silva, 1990; Collins, Brown,

and Newman, 1989; Daiute, 1989; Edwards and Maloy, 1992; Vukelich, 1993; Wells, 1990).

These methods suggest a new pedagogy for literacy development.

For most educators, literacy is the most important enterprise of schooling. In my view, we will be more successful in teaching literacy when we include in our instructional approaches more of what we know about how we learn to ride bikes and how we learn the properties of the world around us.

These methods, already adopted by many teachers, and the use of newer curricula and technological tools for the classroom enable us to use apprenticeship and exploration, old and proven pedagogies, in literacy development.

Take reading, for example. Like most school subjects, reading is often taught as if knowing facts were at its core. Admittedly, some factual knowledge is important. The names of the letters, the spoken words that match many “sight” words, the mnemonic rules for spelling (especially irregular words), and other rote information are important for children to learn.

This kind of knowing, however, represents a just small part of what learning to read really requires. Reading is an act of increasing skill where practice leads to expertise — knowing *how* to make sense of a

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passage even though it contains an unfamiliar word, for example. Reading also requires understanding the properties of written language — knowing *that* in good writing each paragraph addresses an idea and possibly includes a transition statement leading to the next paragraph's idea.

Apprenticeship is an important pedagogy for literacy development.

The learning *how* of reading has many levels: learning how to decode single words, learning how to construct meaning from extended text, learning how to monitor for comprehension, learning how to derive an author's point of view. Children need to see expert readers as models. (Reading big books and using think-aloud techniques have become very popular for modeling and mentoring.) Every time a reading or writing skill is presented, children should see models of success. It is no coincidence that one of the best predictors of reading and writing success is the amount of "expert" reading children have seen in the home as their parents read to them or as parents write stories as children dictate.

Children also need plenty of opportunity for guided practice with the scaffolds that will allow them to succeed in real acts of making meaning. Dividing practice into isolated and meaningless skills is like teaching children to pedal, then to steer, then to balance on a bike. By scaffolding children, we can help them to make meaning, or ride a bike, right from the beginning. There are many common classroom scaffolds. The teacher, working one-on-one, can provide support for difficult words, as can peers in a cooperative-learning group. Electronic books, such as *WiggleWorks: The Scholastic Beginning Literacy System*, provide scaffolds at a child's request. While reading for meaning, children can ask the computer to read a word or sentence aloud, just as a teacher might scaffold them. When beginning to write, children

can place story-critical words into their compositions to make written meaning, even before they can spell these words.

Exploration is equally important for learning to read and write.

The knowing *that* of reading and writing is knowing the properties of written language, knowing that letters represent sounds, that the letter *a* represents a specific sound in one context and a different sound in other contexts (*fat* versus *fate*), that changing the context in which a vowel resides change its sound, or that the word *rock* has different meanings in different contexts, that *sign* and *insignificant* have a common root.

Knowing the properties of language is more like understanding how the record player works than like knowing the capital of Texas. Teaching these properties as facts has always resulted in learning that is inert and rarely applied by children. But how can learning to read and write be more like science?

Consider how children learn spoken language: They play with the sounds of the language, experimenting with the properties of speech and sound; they move from babbling to experimentation with words. As babies babble and begin to explore the connections between sounds and meanings, they get responses, including imitation and correction, from their parents. The learning of language is a great example of exploration — optimum experimentation in a relaxed field — and children are nearly universally successful in learning language.

Teachers have used various kinds of literacy groups to encourage a more interactive and playful atmosphere for reading and writing. However, short of a one-to-one situation, it is difficult to support children's experiments with written language because there is no response capacity in the medium of print. New electronic

media, with the capacity to read aloud whatever text children type, provide an ideal environment for exploring the properties of written language and its relationship to spoken language. By using the computer to speak aloud each letter and word he or she writes (something that paper and pencil cannot do), a child can experiment directly and playfully with the properties of sound/symbol correspondence and ask the computer for an immediate response. They can try a letter sequence and hear how it sounds when read by the computer. Such activity provides opportunities to play and experiment with the building blocks of literacy.

Finally, children need the opportunity to demonstrate their growing literacy skills in meaningful contexts. Reading aloud in small groups or writing papers for the teacher are not enough. Projects — like creating a play and producing it, or generating a plan for a business — are best when involving children in real communication, in the fruits of literacy.

Children have many ways of knowing. Knowing *how* and knowing *that* are only two — but they are two important ones. When we want children to acquire a broad range of literacies, our methods must be at least as robust and supportive as the methods my dad used to teach me to ride a bike and at least as rich as those provided by my old record player. 🌅

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