On Learning Research: A Conversation with Lauren Resnick

You are co-director of a major center for research on cognitive learning. How is research on learning being done these days?

Researchers are beginning to pay more attention to learning as it occurs in real-life settings—settings that include, but are not limited to, schools. There isn't as much study of informal, out-of-school learning as one might wish, but there is some.

Then there's research in the laboratory, which may be just a corner of a classroom where a child comes and works for a time on special problems. But even that kind of research is now likely to be concerned with the learning of complex subject matter. The days of paired associates and nonsense syllables are over.

When I was trained as a teacher, our ed. psych. textbooks listed principles of learning, some of which, I think, were derived from studies with animals.

That's true. There was a long and quite productive period of research in which principles of human learning and the learning of animals were rather closely linked. As long as we were studying forms of learning that were relatively simple, in which ver-balization was not central, in which the kinds of representational forms that, as far as we know, only humans use, were not so important, it was possible to find strong parallels between human and animal learning. Under those conditions it was more convenient to do the studies with animals. They didn't get bored as easily; they didn't have other things to do with their time.

It has become fashionable in some circles to dismiss that kind of research as "rat psychology."

I wouldn't dismiss it. The arithmetic textbooks of 1950 were quite different

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from those of 1900 and much more effective. We have questions now about how much of the math content they were teaching at those earlier times should be at the core of today's mathematics curriculum; but, if you want to teach those computational skills, you can do it well or badly. And we got to know how to do it very well, in large part through the work of psychologists like Edward L. Thorndike, whose work began with cats. These days, of course, we want to do more than teach rote calculation skills. We're reaching for new goals concerned with thinking, reflection, understanding, so those older psychologies cannot answer today's questions.

Does that mean we now have a new kind of research on learning?

Well, it's in progress. We don't have a finished psychology from which to draw clear educational prescriptions. But we have a vibrant research field with definite implications to be explored.

Some inservice trainers claim that we do have a large body of research about how people learn and we simply have to apply it.

If we accept an outdated definition of what it means to know something,

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they are correct. That is, if knowledge consists of small bits of information to be accumulated, then we know how it is learned and therefore how to teach it. In that case the pedagogy has to do with how you organize practice, how you structure and sequence the material, and how you manage motivation.

You're saying that, for example, if that's how you view learning, then it's important to know that spaced practice is more effective than massed practice.

Right, but if you view knowledge as something more than an accumulation of little bits, if you want students to understand and be able to use knowledge reflectively, that's different.

Of course, some things should still be taught through drill and practice.

Absolutely. But for some of the new goals that go under the rubric of thinking, we definitely don't know everything we need to know. In fact, the story's even a little worse than that; my hypothesis is that some of what we "know" about learning conflicts with the goal of teaching thinking. There are ways in which the two are incompatible.

For example?

If you believe that mathematics is a collection of specific pieces of knowledge, it is very reasonable to build tests that sample that knowledge. That's what we have in current achievement tests: collections of items, each of which has a right answer. And those tests encourage

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teaching that emphasizes bits of knowledge because that's how you improve students' scores. With the kind of teaching those tests promote, children come to believe that mathematics is a collection of questions to which one can find the answer within about a minute, or not at all.

Either you know how to do this particular trick or you don't—

And that is contradictory to the goal of having children come to believe that mathematics is an organized system of thought that they are capable of figuring out.

I use mathematics as an example because a lot of current research deals with mathematics learning, but the same story can be told for literally every subject.

It would seem that this new definition of what it means to "know" would make the researcher's job much more complex.

Well, for one thing, researchers can no longer avoid a certain amount of subject-matter specialization. One of the great luxuries of the old-style research on learning was that you could look for principles that had general validity. Now we believe that we must first immerse ourselves in the study of how people learn particular things in particular environments.

How do researchers go about doing this new kind of research?

Every possible methodology, experimental and observational, has its place. In fact, we ought not to accept a new finding until the phenomenon has been studied by several people using several different methodologies. Our knowledge of learning is a cumulative matter, not a matter of revealed truth coming from any one investigator or any single study.

Can you give an example?

Well, one way to study learning is by watching a single child try to figure out over an extended period of time how certain mathematical structures work. The experimenter would probably also conduct clinical interviews, probing carefully for hints about the

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child's understanding. Then he or she might try to build a very detailed analysis of that child's changing knowledge, including what circumstances seemed to produce the changes.

It has also proved helpful to build computer models that "learn" more or less the same material and in much the same way that a child does. These models don't tell us that children are computers; that's not the point. They help us devise strongly specified theories of what children might be thinking.

Some researchers continue to conduct formal experiments, don't they?

Yes. In the experimental tradition the investigator gets a good baseline assessment of what children know, then intervenes in some way, and tracks any changes.

To what extent does the current research on learning focus on what are referred to as "strategies"?

There are mental processes that learners can deliberately recruit to help themselves learn or understand something new, and some researchers and teachers are trying to train people in the use of these "strategies." When I assessed the research literature in this area three years ago, I concluded that strategy training by itself does not get us very far. Just as knowledge is not a collection of separate facts, so learning competence is not a collection of separate skills. Learning competence does indeed involve having certain strategies, but more than anything it seems to involve knowing when to use them and—to put it simply—wanting to bother using them.

I think that attention to strategies will not be effective unless there is also attention to self-monitoring and motivation. Competence is much more holistic than we used to think. The thing that seems to be most general is a perception of oneself as capable of organizing one's attentional resources. I'm inclined to believe that that sense of being in control, rather than any particular set of cognitive strategies, is what turns out to be general.

It may be analogous to our efforts to teach spelling. Many years ago analysts developed numerous rules for how to spell English words. Some children are naturally good spellers, but we've sometimes tried conscientiously to teach the others to follow these rules. The problem is that the kids who are the poor spellers are also the ones who have the most difficulty remembering and applying all those rules.

In addition, the poor spellers have the hardest time noticing when they don't know how to spell a word and therefore need a rule. And that may be the single largest difference between good spellers and bad spellers: good spellers have a kind of built-in monitoring function, so they immediately notice misspelled words.

And you're saying that when we try to teach learning strategies, we can run into the same kind of problem?

Let me put it another way. At the moment we know quite a bit about what discriminates able people from not so able ones. For one thing we know they employ these strategies of various kinds. What we don't know is whether you can directly put the strategies into other people.

And yet the whole business may in the long run be very productive.

Well, some researchers are betting on that and are trying various ways of directly teaching these strategies. Others, however—and I'm among the others—are betting that it's just too easy a way to try to solve this very complicated question. We're betting that the solution includes development of self-monitoring ability, that it includes definition of oneself as someone who's able to do these complex things, and that the specific strategies will have to be embedded in content.

I'm still not sure I understand why the emphasis on content.

This is probably the single most important theoretical issue in the field of learning research, and nobody knows the answers. In fact, nobody even knows exactly how to formulate the questions. We're having trouble figuring out what we mean by strategies and whether self-monitoring and motivation are separate from strategies or part of them. But there's another factor: doing this self-monitoring, and knowing when and how to apply strategies, may turn out to be quite subject matter- and situation-specific.

I mentioned earlier the principles of learning in psychology textbooks. What can you say about the products of this new kind of research? Can the findings be summarized as general principles of learning?

Yes, but they don't translate into instructional practice quite as easily as the earlier findings. What people learn is virtually never a direct replica of what they have read or been told or

even of what they have been drilled on. We know that to understand something is to interpret it and, further, that our interpretation is based partly on what we've been told or have read, but also on what we already know and on general reasoning and logical abilities.

Now, that does not mean that all learning must therefore be through discovery; it definitely does *not* say that. What it does say is that it is not enough just to focus on making an excellent presentation, because you cannot assume that your elegant explanation will be heard and understood in its entirety. In fact, you can be almost 99 percent sure that no child in your classroom will get it the way you said it. Most children will get some portion of what you said but not all of it, a few will get it totally garbled, and a few will go beyond what you said.

Leinhardt (1987) did an interesting study of an expert teacher's teaching regrouping in subtraction. The teacher gave a very clear explanation, she used manipulatives, and so on. She did all the things you could hope for. But when the researcher interviewed the individual children to see what they had learned, she found partial knowledge and misunderstandings, along with a few instances in which children constructed genuinely new explanations. We have to figure out how to teach in ways that don't just "impart"

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knowledge, but instead help students to construct their own interpretations.

And that's true even when the students are motivated, are trying to understand.

Yes, they are constructing knowledge, filling in gaps, and interpreting *in order to* understand. This isn't something that happens only in school. The same thing goes on in conversations: speakers do not say everything that might need to be said, and listeners do not just take in the words of the speaker. No message is 100 percent complete; there are always gaps. Comprehension takes place when the speaker and the listener construct a common space of representation. But it's almost never 100 percent in common. There is usually some difference between the ideas of two people even when they use the same words.

Now this constructivist principle leads us to a new view of errors in learning. When we find an error, we need to see whether there's an underlying idea behind it. Very often there is.

An error is also learning, then, in a way?

Yes. We used to think of errors as just mistakes, something to be gotten rid of, but now we see that errors are frequently the result of a person's trying hard to make sense of something. It follows that teachers may not always want to teach the rules and "tricks of the trade" that get rid of errors, because they might be getting rid of the clues they need in order to follow their students' thinking.

I'm wondering about how what you've said applies to practitioners. As you know, the research on teaching conducted in the '70s and early '80s produced numerous generalizations about the kind of classroom teaching that produces higher test scores. It was relatively easy to summarize and convey to teachers because it was at the level of observable behavior. It described what these teachers did in generic terms: they made their objectives clear, had smooth transitions, gave guided practice, and so on. But the kind

of learning research you are talking about will be less appealing to generalists because it will not be easily generalizable. How does one derive statements applicable to other teachers from descriptions of how excellent teachers teach particular topics in the humanities, for example?

It's very hard. You can produce descriptive statements, but you soon discover that they are not adequate as prescriptions. For example, you might observe that good teachers ask questions that lead students to see analogies. Well, that's fine at the descriptive level; but it isn't much help to the person who says, "Okay, I'll try to do that," because asking such a question in a physics lesson is quite different from asking it in a history lesson. In each case it depends on the teacher's having some idea about what constitutes a good analogy, which in turn means he or she must know the subject matter well. The clear implication is that teachers may be guided by principles of learning, but they will have to rely on their own subject matter knowledge and communication skills in specific cases.

What you have said would seem to have implications for teacher in-service and supervision.

Right. As you know, I believe we must make thinking the main agenda of our schools (Resnick 1987), and that won't happen unless teachers are expected to think. It certainly won't happen if supervisors try to tell them exactly what to do, even if the directives are supposedly derived from research. Research must play a different role; we have to build a new model.

What's the alternative?

Researchers will need to provide a body of research-based theory that will have to be thoroughly understood in the context of the particular subject matter being taught. We will have to get better at communicating what we do know—we don't know enough yet—but practitioners cannot expect from us, if they ever did, simplified prescriptions for what to do next.□

References

Leinhardt, G. (1987). "Development of an Expert Explanation: An Analysis of a Sequence of Subtraction Lessons." *Cognition and Instruction* 4: 225-282.

Resnick, L. B. *Education and Learning to Think.* Washington, D.C.: Academy Press, 1987

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