"e-Nough!"

"e-Learning" is a misnomer – it's mostly just "e-Teaching."
For *any* teaching to reliably and consistently produce the results we want, we still have a lot to learn about learning.

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"I'm always ready to learn, although I do not always like being taught."
– Winston Churchill

What is learning? Are there different kinds? How many? Can we accurately measure them? Can we produce them reliably? How long do they last?

These perennially important learning questions are newly relevant in the context of "electronic teaching." *The trouble is, we have no good answers to any of them*. But we do know one thing – teaching ("e" or otherwise) does not guarantee learning.

What *is* Learning, anyway?

Although the two are often conflated, teaching and learning are very different – teaching is done *to* people, in open view; learning is done *by* people and happens in the privacy and solipsistic isolation of each student's mind.

It is fashionable in some circles today to say "everybody learns differently." And in one sense this is completely true – we all come to what ever it is to be learned with different experiences, all of which affect our learning. ("Prior knowledge," and "g" – the general intelligence factor [1] – are the two most important factors influencing learning.) Yet we are also all humans, with the same biology. And learning is a biological, process. So how do we reconcile these two things when we design our "e-Teaching?"

"Learning theory" has moved historically from learning as something unknowable (philosophy), to learning as something knowable only indirectly through behavior (psychology), to learning as something that will someday be as well-understood as the process of digestion (neuroscience). "Everything the brain produces, from the most

private thoughts to the most public acts, should be understood as a biological process," writes Nobel-Prize-in-Medicine-winning scientist Eric. R. Kandel in the chapter "Cellular Mechanisms of Meaning and the Biological Basis of Individuality" in the standard textbook "Principles of Neural Science" (4th ed 2000). Many today think about an over-arching multi-discipline of "Cognitive Science."

So we might wonder "What have all these scientists discovered that can help us build better learning programs?" So far, not as much as we would like, it turns out. For they have still not produced definitive consensus on what learning is, how many kinds there are, how we produce and measure them, and how long the effects last.

Why We Know So Little

I'm going to suggest at least three reasons for this. First, we don't always ask (or answer) the right questions about learning, or make the right distinctions. Second, our efforts to quickly direct research toward improving classroom teaching often lead us astray. And third, there are some old concepts and language that are just very difficult for us to throw away, along with some old common-sense truths that are very hard for many to accept.

Despite researchers' supposed "open minds" it is surprising how often key questions – especially ones that are tough to answer – are excluded from being asked. Stephen Wolfram cites mathematics as a discipline which routinely defines those questions it can't answer as being "outside the field." "What is learning?" ranks high among these rarely-asked – and certainly unsatisfactorily answered – questions.

Since one job of the teaching profession is to assess learning, one might assume that anyone in the teaching profession could easily define precisely what learning is, and that all their answers would be essentially the same. But I doubt it. (Go to the web right now and email me your own answer to "What is learning?" – without looking anything up – at marc@games2train.com . We'll see just how much consensus there actually is).

I suspect that one of the basic reasons we have made such little progress in assessing students' learning is that we lack a good understanding of what learning really is. We often don't even define it. The recently published book "How People Learn," for example, (National Academy Press, 2000), a report of the Committee on Developments in the Science of Learning of the Commission on Behavior and Social Science of the National Research Council, with additional material from the Committee on Learning Research and Educational Practice (!), never defines the "what" for which they claim to have "explained" the "how."

Can *anyone* define learning?

"Although learning can be understood as a change in an organism's capacities or behavior brought about by experience," writes Daniel Riesberg in the entry "Learning" in the MIT cognitive sciences online database (http://cognet.mit.edu/MITECS/Entry/reisberg.html), "this rough definition encompasses

many cases usually not considered examples of learning (e.g. an increase in muscular strength brought about by exercise). More important," he goes on, "it fails to reflect the many forms of learning which may be distinguished, for example, according to what is learned, may be governed by different principles, and may involve different processes."

Note Riesberg's heavy use of the conditional: *May* be distinguished, *may* be governed, *may* involve. We really don't know.

How can this be? How can it be that the very core mechanism of what we are trying to do remains an indefinable mystery? If we can't say what it is we're trying to produce, how can we judge if we are producing it, and doing it right, or in the best way? In fact how can we judge if we are doing it at all?

If you think these questions are frivolous, think again. For we are, I maintain, with respect to learning, pretty much where medicine was in the 18th century. They knew and could recognize the result they wanted to produce: a healthy body. We are trying to produce an educated, trained or "learned" person. Like those early doctors, we have a few means that have worked reliably in some situations over millennia.

But just try to get consensus on exactly what works when and with whom. In most of our learning situations, we are at sea. As we will see in a minute, there is absolutely no agreement on the "right" way to produce learning, with any group, in any situation, at any level. We move from fad to fad. If something works in one place, educators tend to just apply it all over, just like those 18th century doctors who "bled" their patients for any ailment. I imagine someone once or twice must have seen a healing result that correlated with a bleeding. But an awful lot of people were bled to death – George Washington among them! Although our primitive knowledge of learning may not have actually killed anybody (has it?), many of us have suffered harm at the hands of people trying to make learning happen, and many of us in turn continue to turn around and inflict the same harm on our students.

So let's consider the question "What is Learning?" Is it one thing? Is it several things? If the latter, why do we use the same word?

The people from educational research, educational methods, pedagogy, instructional design, learning science, cognition and instruction, cognitive psychology, behavioral psychology, educational psychology, human factors, training, child development, linguistics, neuro-linguistics, biology, computer science, neuroscience, and cognitive neurology, don't have a clear answer. In fact, the National Academy of Science has established a committee on "New Development in the Science of Learning," whose goal is to "synthesize new findings from research to create a user-friendly theory of human learning."

Unfortunately, they haven't yet produced one, at least not for public consumption. But the sooner they get there the better. What we now have are *lots* of theories - hundreds, in fact. If you care to, you can read about many of them in the "Handbook of Contemporary

Learning Theories" (Mowrer & Klein, eds. Lawrence Erlbaum Assoc., 2000) and at the TIP database, where 52 of them are listed in alphabetical order, from "ACT*" through "Triarchic" (http://tip.psychology.org/theories.html). And you'll have to go yet elsewhere for neurological-based theories.

Why is there so little attempt to do what physics does, for example – unite all these partial theories ("theorettes"?) into a larger coherent theory and not be satisfied until we do? After all, the brain functions the same way (although perhaps not equally effectively) in all of us, despite our individual differences in prior knowledge, "g" and other things. Whatever the processes that constitute learning, they have to be the same at their core for everyone. What are they? How many different key pieces are there? How do they fit together?

Defining Learning

The dictionary defines learning as "Gaining knowledge or skill" [Concise Oxford Dictionary, 1999]

Psychologists define learning as: "A relatively permanent change in behavior that is attributable to practice and experience, inferred from improvement in performance" [http://www.wpunj.edu/cos/ex-movsci/mllearn/sld001.htm]

Neuroscientists teach that "Learning is the process by which we acquire knowledge about the world, while memory is the process by which that knowledge is encoded, stored, and later retrieved." [Principles of Neural Science, Kandel, Schwartz, Jessell, 4th ed. 2000]

Let me propose a definition of my own:

"Human Learning is the set of processes people employ, both consciously and unconsciously, to effect changes to their knowledge, capacities and/or beliefs.

Whatever its failings, this definition helps us remember that: (1) Learning is not one process, but several – sometimes separate, often interrelated. These processes can be enumerated, and associated with material to be learned. (2) Learning most be done by the learner – whether consciously or unconsciously – it can't be done by a teacher or anyone else (3) learning involves not only "knowledge" (facts, groups of facts, relationships between facts), and "doing" (capacities tasks, skills and behaviors) but also "beliefs" (theories, understanding of how and why things work or happen), which are much less often talked about in this context. What this definition *leaves out* is also important: "acquisition" "experience" "permanence" "improvement" "performance," and especially "being taught" are not intrinsic to learning, although they are related.

The Great "How Do People Learn" Debate

Of course having a definition is hardly enough – we need to know *how* people learn. Today asking that question is a lot like asking "What is the true religion?" Every

religious person is convinced his or her religion is the true one, and yet there are, according to one organization that tracks them, over 4,000 different religions in the world. [2] We may not have thousands of learning theories, but we do have hundreds. Instead of a coherent understanding, what we have at the turn of the second millennium – after dealing with learning for literally thousands of years – is just a large variety of points of view on how learning happens, each with its own self-proclaimed experts, each with a particular "theorette" of learning to champion. Let's look at some examples:

Learning comes from doing.
Learning is imitation, which is unique to man and a few animals.
You can't learn unless you fail.
Learning happens when one is engaged in hard and challenging activities.
Learning comes from observing people we respect.
Learning is a developmental process.
Learning is primarily a social activity.
Learning needs multiple senses involved.
Learning happens best without thinking.
Learning happens better by thinking about it.
Learning takes practice, says one. No says another, that's "drill and kill."
People learn in context. People learn when elements are *abstracted* from context.
We learn by principles, says one. By procedures, says the other.
They can't *think*, says the one. They can't *add*, says the other.
Everyone has a different "learning style."
We learn X percent of what we hear, Y percent of what we see, Z percent of what we do.
Situated Learning, says one. Case-based reasoning, says another. Goal-based learning says a third. All of the above, says a fourth.
Learning should be fun, peeps the girl in the corner. Learning is hard work, answers another.
We learn automatically, from the company we keep, says yet another.
People learn in "chunks."
People learn just in time, only when they need to.
People learn aurally, visually and kinesthetically.
People learn through feedback.
People learn through reflection.
People learn through a loop of doing and reflecting.
People learn through coaching.
People learn from constructing things.
People learn from models.
People learn from mistakes.
People learn from stories and parables.
People learn by constructing their own knowledge.
People learn when they're working.
People learn by playing.
People learn through games.
People learn when they're having fun.
People learn in context.

People learn when things are relevant.
And on, and on, and on.

How can we have such disparity? Is learning really that complicated? I strongly suspect it's not (I'll go into this next time). In my opinion researchers have complicated matters related to learning *so far* beyond where they need to be in order for us to understand and use them, that it has rendered the entire body of learning research practically useless. No wonder the NAS wants create "a 'user-friendly' theory of human learning."

Do we need *more* research? In their book *The Monster Under the Bed*, Stan Davis and Jim Bodkin point out that nationally, "less than 0.1 percent [yes, that's one tenth of one percent] of our school budgets is destined for educational research—the lowest figure for research spent on any major budgeted activity. Compared with health, defense, space, energy or new products, new knowledge on the learning process is definitely a poor relation.…The federal government spends three times more for agricultural research, twenty-one times more for space research, and 30 times more for research on health." "We know more about how to improve the use of diapers," they say, "than of brains." [3]

But the real issue may not be quantity so much as quality. "The history of educational research is not necessarily encouraging to those who foresee a golden age of scientific clarity," writes James Traub in the *New York Times*. [4] There *is* a lot of stuff out there branded as "learning research." But as anyone who has ever looked at the it knows, most of it is not just user-unfriendly – it's also full of opinion, conjecture and wishful thinking that is partly or totally incorrect. "People outside of the educational establishment are often shocked to learn how little in instructional practice has been evaluated using the standard paraphernalia of social science–control groups, random assignment, data collection, statistics," writes MIT Psychology Professor Steven Pinker. [5] And much of the best research, done inside the armed forces for training purposes, rarely if ever gets looked at outside the military.

Further, although much of the research conflates learning with education and pedagogy, it still has little connection to classroom practice, which, says Pinker, "is set by fads, romantic theories, slick packages and political crusades."

How can this happen?

A great part of the reason is that there is so little theoretical consensus – scientific or otherwise – about what learning is and how to make it happen. And one key reason for this is that there is so little differentiation in the term "learning."

Learning Differentiation

One possible explanation for so many competing theories of how people learn is that "learning" is an extremely broad term, covering a lot of ground. Riesberg (above) tells us there are "many forms of learning which may be distinguished, for example, according to what is learned, may be governed by different principles, and may involve different processes." The standard neuroscience textbook says that "From a cognitive point of

view, any complex human activity almost always involves an intricate interplay among different kinds of knowledge, perceptual discriminations, motor and cognitive skills, strategies and performance demands or contexts. Correspondingly, many kinds of learning are involved, and they are not all achieved in the same way." Christine Massey of the Institute for Cognitive Research at the University of Pennsylvania, says there is a need for "more differentiated views of learning."

The key issue here is differentiating between the various "types" of learning. We are deeply in need of more and better distinctions between such things as:

- The learning that goes on constantly, 24/7 – mostly, but not entirely, at a non-conscious level – just because we are human and take things in. (Take a university course on the first day. Before I hear a word the teacher says, I have learned much from and about her, including approximate age, sex, posture, attitude, punctuality, and possibly the part of the world her ancestors came from. As she talks I am learning about her speech, clarity of thought, many more attitudes (nice, mean, etc.), style (formal or informal). I'm learning about my classmates from the way they react to him and to each other. I'm learning about the ventilation in the room, and possibly, from the smells around me, what some people had (or are having) for lunch.)

- The learning of "information," such as when I learn the name of my teacher, the names of my classmates, and what texts we will be using. I learn what the teacher says, at least in the sense that I have heard it (consciously or not), and possibly written it down. Professors in medicine and the sciences know that this kind of learning (or rather the fact it exists in your mind) may sometimes get recalled unexpectedly in times of need, as in "I seem to remember one of my teachers talking about that once when I was half asleep…"

- The learning when we give something our full consciousness and attention. This consists of both taking in information and making various connections in our head with other information.

- The learning where we transfer things from short to long term memory, as, for example when we learn new vocabulary.

- The learning where we discover principles that we can articulate and then apply in other situations.

- The conscious, step-by-step learning of skills or procedures.

- The learning that transfers skills consciously learned into non-conscious behaviors through repeated practice (such as in surgery).

- The learning of skills that are hard or impossible to put into words, such as riding a bicycle or juggling.

- The combination of conscious and non-conscious learning of new abilities, such as writing, or interpersonal skills.

- The learning from playing with systems, simulations and other participatory experiences.

- The learning in debriefings and after action reviews. Etc.

And this is by no means the definitive or exhaustive list.

For something so central to what we do, our learning vocabulary is extremely impoverished. The few distinctions and names we have are inconsistent. Some distinguish between "knowledge, skills, and abilities," others between "hard" skills and "soft" skills. Knowledge is classified by some as Explicit versus Implicit, by others as Declarative versus Non-declarative, by still others as Tacit, Conditionalized or Inert. Neuroscientists speak of declarative memory and non-declarative memory, the latter including priming, procedural, associative and non-associative. Some refer to learning as reflexive or reflective, others to "artisan" and "virtuoso" learners. All this is not terribly helpful, because there is such different usage and so much crossover. Are we talking about the same things? Do we have the "cuts" right? Why can't we all just come to consensus?

At this point I'm not yet proposing a new vocabulary list. But I am suggesting we would all benefit from thinking more about this question.

One key differentiator mentioned above but often ignored is *what* is being learned – not particular subject matter content, but the *type* of material (facts, judgment, theory, etc). It is useful because it leads us directly to different types of learning. For example, a budding doctor in medical school needs to learn the English and Latin names of all the parts of the body (facts), the ways the body systems behave (theory, observation, dynamics), how to perform procedures (physical skills), how to diagnose (process, judgment, reason), how to talk with patients and manage time (behavior, skill), how to present cases to other doctors (language), and how to do research (organization, discovery), among many other things. Each of these requires a different type of learning.

But we rarely, if ever, hear "these are ways that people learn *facts*. And these are ways that people learn *skills*. And these are ways that people learn *theory*. And these are the ways people learn *judgment*. And these are ways that people learn to *reason*. When we do this, many of our problems in creating learning – with or without technology – begin to sort themselves out, because we know, from long experience, how most of these types of learning happen:

We learn *facts* through questions, memorization, association, and drill.
We learn *skills (physical or mental)* through imitation, feedback, continuous practice and increasing challenge

We learn *judgment* through hearing stories, asking questions and making choices & getting feedback and coaching
We learn *behaviors* through imitation, feedback and practice.
We learn *processes* through explanation and practice.
We learn *about existing theories* through logical explanation and questioning.
We learn to *create and test theories* through experimentation and questioning.
We learn *reasoning* through puzzles and examples.
We lean *procedures* through imitation and practice.
We learn *creativity* through playing.
We learn *language* through imitation, practice and immersion.
We learn *programming and other systems* through principles and graduated tasks.
We learn *observation* through examples, doing, and feedback
We learn *speeches or performance roles* by memorization, practice and coaching.
We learn *the behavior of dynamic systems* by observation and experimentation.

This list is by no means complete or exhaustive, but is meant to show only that the same learning methods are not used for every type of thing we learn. In every discipline or domain there is a wide variety of material or content to be learned by students, all of which *are* learned differently.

So the best first cut on understanding learning, it seems to me, is not by type of learner, or subject matter, *but by type of material to be learned.* The second cuts are more individualistic – what does this person already know, and how "smart" is he or she?

Without these differentiations in learning we cannot truly understand what is going on in the learning process or how to make it happen. Too often our so-called "learning experts" fail to take these types of distinctions into account, and speak of learning as if it were a single, monolithic process. "People learn by X," they say, or "People don't learn by Y." But not a single one of these blanket statements is true. We don't learn *everything* by "doing" or "failure" or reflection" or anything else. It's a mix we have to sort out. And by *not* sorting, the so-called "experts" lead us astray.

"Herding"

How else do the so-called "learning experts" lead us astray? The insistence of many on a limited number of "learning styles" based on such things as a "written, oral or kinesthetic," predilection, or "multiple intelligences," or Meyers-Briggs classifications, etc. (often based on little or no evidence) is leading us seriously down false paths, especially in creating e-Teaching.

But even more destructive, in my view, is that in a rush to "apply" the results of learning research to education and teaching, researchers often wind up making it harder for us to understand what is happening with individual learners. Designers of electronic teaching who do not have backgrounds in "education," "instructional design," "pedagogy" or "cognitive psychology" (but come at the issue of creating learning as a pragmatic problem in need of solution) often find the so-called "learning experts'" work almost

totally useless. I have often wondered why this is so, and I finally think I have figured it out. While some researchers *do* study learning to find out how it works, the groups mentioned above study learning principally to "improve education." ("Applied" research.) And since most of our education happens in groups (i.e. classes), what they are really trying to figure out is "how learning happens in groups." Unfortunately, learning doesn't happen in groups at all – learning happens in minds. And minds are helped best to learn in a one-on one situation.

It has been absolutely clearly and firmly established (to a large extent, but not exclusively, by research funded by the US military) that students learn best through a one-on-one relationship with an instructor (i.e. "tutoring"). All people. All things. And the difference between one-on-one and classroom is not trivial – it is two standard deviations. [6] "The average tutored student's achievement is better than 98 percent of classroom students," writes Michael Parmentier, former head of Readiness and Training Policy Programs at the Office of the Secretary of Defense. [7]

Why? Here the answer is less clear. As we have seen, we know relatively little for sure about the details of how people learn. But practically speaking, we do have some thousands of years of experience that show us that some things clearly help. A high frequency of interaction. Having your mistakes corrected instantly. Asking frequent questions and getting immediate answers. Making decisions and seeing their consequences. Doing, in situations that require it. Being forced to reflect on what you are doing, reading or thinking through probing questions. Marshalling your thoughts in formal form. Practice and repetition. Motivation. Although we can't yet articulate all the mechanisms through which they work, we do know these things help people to learn.

But as soon as we move from one-on-one instruction to classrooms, everything we instinctively know about what makes for good learning goes out the window. The frequency of interaction drops to near zero, as does question asking – the average time between questions for individuals in classrooms has been measured at 10 hours. [8] Immediacy of feedback is practically nonexistent. Decision making becomes intermittent. Reflection? – you're on your own. Motivation? Only if you're extraordinarily lucky.

So when we uncover the "real" learning question of most of our educational and learning research, we find it is not really "How do People Learn?" but "How Do We Get People To Learn in Classes? (or other groups)."

I actually think it might be more accurate (although certainly less elegant) to refer to these classes or groups of students, as "herds," and to today's teaching as "herding." Humans have always found it more cost-effective to deal with herds rather than individuals. According to a recent history of food, much early hunting was really herding – driving the whole pack of buffalo over the cliff to get your meat, rather than using a spear. [9] Everyone knows herding animals (or people) who don't want to be herded isn't always easy – you can see the well-known commercial about herding cats at www.eds.com/advertising/advertising_tv_catherding.shtml – but it's often more "efficient" than one-on-one. We do it in our schools for many reasons. Yet most of us

recognize that, despite the fashionable but mostly meaningless noise we hear about "learning communities" and the fact that interaction with others is sometimes useful for learning, students don't learn as much in herds as they would had they been taught exclusively one-on-one.

Herding introduces all sorts of new variables into the mix that are not there with one-on-one, the most obvious being heterogeneity. All teachers know the rule of thumb that you're always going too slowly for one-third of a class and too quickly for another third. (Though a more accurate version might use ½). With one-on-one, though, a learner's particular mix of prior knowledge and abilities, especially "g," are much less of a factor – the good tutor automatically adapts to the level and questions of the learner and provides challenges that are appropriate. The herded, student, of course, must adapt to the teacher.

In fact, our instinctive understanding of the importance for learning of homogeneity on the "g" level is why we have a college admission process which – for all its emphasis on certain kinds of diversity – tries hard to sort learners into relatively well-stratified, if not completely accurate, levels of "g." We don't hear about this much from the schools, except through the code word "exclusive," but any kid will tell you whether he (or she) is or isn't "smart enough to get into Harvard." Some even argue that this sorting process alone, and the stamp it gives, is enough, and nothing further has to be learned (this is the Japanese university system.)

But whether the herds are homogeneous or not, the research shows – and, more importantly, everybody knows from experience – that people learn far less when they are herded. Much, if not most of the actual learning takes place not in the lecture hall, but when the students are on their own, studying by themselves. And since they typically are given little guidance on how to learn, they must try to puzzle it out for themselves – underlining? cramming? asking your friends? You decide. Unfortunately tutoring – the one proven learning helper that works better than all the others – is left as the method of "last resort" reserved only for when you're not getting it (read "dumb.") Plus, to get this most effective form of instruction, you might have to spend more money on top of the sky-high tuition you are already shelling out!

Assuming, Denying, and Getting Past the Obvious

This is the *real* opportunity of electronic teaching – bringing the benefits of one-on-one instruction to everyone. But achieving this is very different than just putting stuff out there and saying "go at your own pace." The military has been thinking about this for years and has attempted to develop "intelligent tutors." The approach is the right one.

But what have we "educators" done as we've tried to create our (badly-named) "e-Learning"? For the most part we have *not* thought carefully about what learning is – different processes, learner controlled, conscious and unconscious, and involving knowledge, tasks and beliefs. We have *not* differentiated between they types of learning involved and the best strategies for each, but rather just grabbed any old single "theorette" as a "theoretical" basis for our work. (One group has belatedly inserted a

"pedagogy" button on each screen, citing someone's favorite "theorette" to justify their work.)

What we *have* done, unfortunately, is taken all the techniques that we have developed and fine-tuned for herding, such as lectures, demonstrations and tests, put them onto the computer, and assumed they would work. And perhaps worst of all, we have adopted the most meaningless metric of all – screen time available to be viewed – as the basis for buying and selling "learning."

So I say "e-Nough!" To consistently produce true learning, which is what our "e-Learning" needs to accomplish, we will need to do much more. In addition to providing much more motivation through gameplay (see OTH Volume 10 Number 1), we will have to take the tutor, not the teacher, as our instructional paradigm, and incorporate all those things that have been obvious to any good tutor for thousands of years: Start where the learner is, provide motivation, keep the tasks challenging but not out of reach, encourage questions, allow for lots of practice. And, to make it reliable, we will need build on a better, more highly differentiated understanding of learning, which is still to come.

It will also do us no good to deny the facts, even if we don't particularly like them. For example, experience shows that "drill and practice" works better for some people and things than other methods theoretically designed to provide "understanding." (e.g. "Direct Instruction" versus "Open Schools")[10] Let's accept this, even though we might wish it were otherwise, and provide fun, motivating ways to make it happen.

Nor will it help us to spend a lot of time, money and effort researching the obvious. For example, here are the three "key findings" in the previously-mentioned "How People Learn:"

1. Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp new concepts and information that are taught, or they may learn them for purposes of a test but revert to their preconceptions outside a classroom.

Breathes there an educator to whom this is news? If there does, and she is not a sweet, 80-yerar-old kindergarten teacher, what is he or she doing teaching in the 21st century? This is a good example of our research being oriented toward herding, rather than learning, because in classrooms this is hard to do whereas in one-on-one it is a given. A less obvious, but more interesting finding (mentioned only in passing in the book) is that the same is probably true, perhaps even more, for teachers. "In education, a priori beliefs about the way children ought to learn or about the relative value of different kinds of knowledge seem to have tremendous force in shaping judgments about effectiveness," writes Traub. [11]

2. To develop competence in an area of inquiry, students must (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in a ways that facilitate retrieval and application.

Again, does anyone find this a revelation, justifying years of research? This is nothing more than the authors' beliefs about what constitutes "competence." And once more, what they are ultimately concerned with is "How do we develop this when herding?"

3. A "metacognative" approach to instruction can help students to take control of their own learning by defining learning goals and monitoring their progress in achieving them.

Here, finally, is something worth thinking about. What this says, in plain English, is that just *thinking* about learning can help. Anyone who later in life is able to teach him or herself something new has clearly learned this, but many of our students never do. As mentioned before, our students get little formal guidance in this area, and often flounder. It would appear that this type of reflection and understanding is something that can and should be codified and taught, quite possibly separate from any subject matter (some call it "learning to learn.") I'm certain we can build much of this into our e-Teaching. But we won't be able to do this totally effectively until we understand more about the process of learning – especially the things that produce the different kinds of learning reliably – rather than just duplicating the teaching environments where learning sometimes occurs.

How can we increase our understanding what learning is and how to make it happen? Many are looking to neuroscience, with its growing understanding of the brain and how it works, as a potential source of understanding and way out of our dilemma. Does modern neuroscience provide us with the missing answers to our puzzle? As with everything else associated with learning, there are varying opinions. In my next column I will examine the current learning-oriented findings of neuroscientists to see how much guidance – and consistency – we are getting from them that can aid us in our quest to reliably, effectively and efficiently produce learning in our students.

Next Issue: *Neuroscience and Learning - What Is It Telling Us?*

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Notes

[1] For a clear up-to-date explanation of "g", see Linda S. Gottfredson, "The General Intelligence Factor," *Scientific American*, November 1998.

[2] www.adherents.com/

[3] Stan Davis and Jim Botkin, *The Monster Under the Bed*, Simon & Schuster, 1994, p.151.

[4] James Traub "Does It Work?" *The New York Times* (Education Life) November 10, 2002

[5] www.edge.org/q2003/q03_pinker.html

[6] Bloom, B.S. The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring. *Educational Researcher*, 13, 4-16, 1984

[7] Michael Parmentier, Advanced Distributed Learning briefing, Spring 2000.

[8] Graesser, A.C., & Person, N.K. (1994) "Question asking during tutoring,". *American Educational Research Journa*l, 31, 104-107.

[9] Felipe Hernandez-Armesto, *Near a Thousand Tables: A History of Food*, Free Press, 2002, p. 63

[10] James Traub , *op. cit.*

[11] *Ibid.*