ITForum Paper #12:

A Discussion of Donald A. Norman

and James C. Spohrer's

Learner-Centered Education

Edited by

Gene L. Wilkinson

The ITForum discussion reported here took place between April 1 and April 30, 1996, and is presented virtually verbatim as it occurred. Minor editing was done for stylistic and grammatical consistency and to improve the flow of the discussion. Messages which consist primarily of "cheering" (voting for or against contributors) have been eliminated while those which contribute to the discussion of the issues raised have been kept. In addition, some minor rewording of some posts was done to clarify the intent of messages; but, efforts have been made to preserve the feel of a give-and-take discussion. Any value of this discussion is due to the efforts and insights of the contributors--any failures can be blamed on the editor.

The buttons that appear below will be found at the bottom of each page of the discussion. The first button will take you back to the previous page (in this case, to the beginning of paper #12). The middle button will take you to the ITForum home page. The last button takes you forward into the discussion as it progressed on-line. If you wish to proceed directly to a specific posting, you may consult the index.
1 Apr 96
Jeff Oliver

I was mystified by the paper--at first. The opening line "There is a revolution taking place in education..." is so familiar to anyone who has been in the business a long time. It has been the opening line in sales pitches for authoring systems and in those wishy-washy reports by pundits who have never written any CBT ever since I can remember. As I worked through the paper, it was all in the same vein. A few examples:

[quoting Norman/Spohrer paper] At the heart of the change are new technologies that enable many of the constructive ideas to be carried out.

Technology is certainly a catalyst for change...

Authoring tools, design tools, component software standards, improved distribution... are all critical to widespread viability outside pilot classrooms.
Challenging professions can excite the imaginations of learners.

Meaningless tosh, of course. A summary document referring to other papers that itself contains little of value.

Then I realized--it's 1st April. These guys have just taken an old paper from the late seventies, added a few up-to-date words like "multimedia" and "constructivism," and tied it up with references to some recent work. The sentence "The dimensions of effectiveness and viability were not the focus of these papers" is the piece de resistance. These guys have done research on some areas of their interest without knowing if it's any good. Absolutely classic joke material. Nice try fellas--but I wasn't fooled.

Jeff Oliver

E-mail: 100024.2461@compuserve.com
[quoting Norman/Spohrer paper] In analyzing the papers of this special issue, we find it useful to evaluate them along three dimensions: Engagement, effectiveness, and viability.

I'm not sure I consider these dimensions. Sure, you can have greater or lesser degrees of each, and the more the merrier. But I'm not sure they're at the same level. For instance, isn't engagement a component of effectiveness? I would put effectiveness and viability at a top level. To evaluate viability, you need to figure out what are the working conditions under which these tools can be employed, and under which they cannot. Effectiveness can be evaluated in an artificial setting, and it might be effective in one and not in another.

I'd also quibble on the descriptions: The issue of toy problems scaling is the need for transfer, which Don & Jim have lumped under viability, but I would argue is part of effectiveness. Our measures of effectiveness should capture this. Viability captures something else, about whether the mechanism engineering the transfer can be accomplished on real-world budgets, in hide-bound departments, with real kids.

But these are less interesting issues, really, at least to me. Important, but there's more here than is discussed. Specifically, the dimensions Don & Jim specify aren't the ones that they use to categorize the papers they're discussing! Subsequently they admit that all the papers rate high on engagement and don't even discuss effectiveness and viability. So what are the dimensions that distinguish these efforts? I think there are some interesting dimensions here.

One of the obvious categories is those grouped together as examples of collaborative projects. So one dimension is whether the tool/environment supports or requires collaboration, or is designed for more individual exploration. Increasingly we have the capability to support group work. There are all the standard CSCW issues, in resolution of competing revisions, in formats, in the cognitive research on what representations are useful and how to support them. And, of course, learners may have different cognitive capabilities than adults. However, I think that students can work together even on non-collaborative environments, so it's rather whether the collaboration is synchronous, or asynchronous in time or space.

Another important dimension, and one I'm still coming to grips with, is whether a system is exploratory or constructive. What I'm trying to say here (as both are constructive in one sense) is whether the system has the learner explore an environment and internalize relations, such as in a simulation, or whether the learner is given tools to build a knowledge base or a system, formalizing (and testing) the relations they believe exist. In the exploratory environment you create hypotheses and then act in the world to see if
your predictions hold; there is an external model and the student is building an internal one. In the constructive (and perhaps I should choose a less "loaded" phrase :-) environment, the student has an internal model, and constructs an externalization. Cognitively, I believe I can justify both. The tension is between my interest in building exploratory environments (read: games) and Lloyd's in empowering the learner by supporting their building of games.

A third dimension that I've seen between previous construction kits is whether the construction is of static knowledge or a dynamic system. However, this seems orthogonal to the last two groups of papers, which seem to be both about building dynamic systems (games, microworlds, models of mathematical or scientific phenomena). My take on the distinction between them is the former is about building interactive applications while the second is about building models, but it may be that the latter has model-building tools built into an exploratory environment. I guess I'll have to wait till my copy of this issue of Communications of the ACM arrives (sorry for those of you that aren't in a Computer Science department, maybe you can annoy some colleagues).

So I'll propose different dimensions than Don and Jim raised:

at the top level...

Effectiveness and Viability

At a second level, within effectiveness there's...

Constructive or exploratory

synchronous or asynchronous

Within constructive there's...

static or dynamic (not relevant, necessarily, for the papers listed)

Dr. Clark N. Quinn, Multimedia Manager
Open Net Pty Ltd
210 Clarence Street
Sydney NSW 2000
AUSTRALIA

Phone: +61-2-267-1222 x103
Fax: +61-2-373-2703
E-mail: cquinn@opennet.net.au
1 Apr 96
Don Norman

[quoting Oliver, 1 Apr 96] I was mystified by the paper--at first. The opening line "There is a revolution taking place in education..." is so familiar to anyone who has been in the business a long time.

Ah, I love cynics.

Of course, if you read a bit further along, you will find the line "At the heart is a powerful pedagogy, one that has been developing over the past hundred years."

Which indicates that we fully realized that the ideas were well known.

But the change has not yet happened in American schools (nor anywhere, else, for that matter). So that is why it is still a revolution--a revolution in waiting, if you will.

One reason for the lengthy transition is that the technology has not yet supported the promise. Does the new technology of computer simulation and other tools really support it? Well, to be truthful, not yet. But we are indeed getting closer.

You do have to remember that the paper that I circulated was not an original research paper. It does not pretend to have original ideas. We were asked, Jim Spohrer and I, to write the introduction to the Communications of the ACM's special issue on instructional technology. It was our job to introduce the papers in a positive vein (the introduction is not the place to critique the papers).

When I was asked for a paper relevant to this Forum, I thought that the paper was a good starting point. It was not the end point, nor was it a complete summarization of my personal views.

So, the questions I would ask of you (plural) are these:

What do you think of the initiative toward a learner-centered education, one that involves the students in a constructive activity more than is today traditional in the lecture-centered curriculum. Note that I am not asking whether this is a new idea: the question is whether it is a good idea.

And if it is a good idea, and since the ideas have been around for a long time (perhaps since Socrates, certainly since John Dewey), then how come they haven't yet taken hold?
Am I a fan of computers in the classroom? Nope.

Am I a fan of multimedia? Nope.

I am a fan of deep, constructive thought.

If you want to know more about my personal beliefs, read:

Donald A. Norman (1993). *Things That Make Us Smart*. Addison-wesley. (available in paperback). (Also available in multimedia format on a Voyager CD-ROM (*First person*). But the book is a lot easier to read. The CD-ROM does let you get to know me better as a person.
T. Kent Thomas

[quoting Norman, 1 Apr 96] What do you think of the initiative toward a learner-centered education, one that involves the students in a constructive activity more than is today traditional in the lecture-centered curriculum. Note that I am not asking whether this is a new idea: the question is whether it is a good idea.

In my humble opinion, a total "swing" toward learner-centered education is a big mistake. Granted, the students need more research, analytical, and problem solving skills and, most of all, they need to "learn how to learn"--whatever that overused phrase may mean. But, in my experience and based upon MY personal preferences, I need some clearly defined goals and structure in a learning experience. I think that "learner-centered" or constructivism must be balanced with a more structured approach. All of one approach or another is a mistake.

Exploratory learning methods (if they are as significant a part of your learner-centered premise as they appear to be) generally yield inefficiency (in terms of amount of learning per unit of time spent) and inconsistent results. When this is combined with the learners selecting what they need or want to learn, it can lead to gross inconsistencies and inefficiencies. Meanwhile the U.S. keeps their students in school (i.e., in a "learning environment" for a significantly shorter period than Japan and many (if not most) of our world counterparts. Further, I'm still trying to determine what "I want to be when I grow up" but I'm eternally grateful for an 8th grade English teacher who made me diagram sentences for a full year, as I am now also grateful for my liberal arts B.A., with heavy doses of philosophy, psychology, literature, etc., even though I lamented that it did not teach me "an employable skill" for several years. Bottom line is that I certainly wasn't capable of choosing what I needed to know in the 8th grade, and had I chosen a different undergraduate degree more slanted toward employment, I probably would not be a senior manager in a creative field now. In my humble opinion, adults should be HELD RESPONSIBLE for educating our young, and for any shortfalls that education may have--the children certainly shouldn't! And, we should be diligent and careful to "Teach your children well, their father's health will slowly go by... " (Crosby, Stills, Nash & Young, for those of a later generation)

And if it is a good idea, and since the ideas have been around for a long time (perhaps since Socrates, certainly since John Dewey), then how come they haven't yet taken hold?

I won't try to speak for classroom methods in general, but when exploratory or simulation methods are used in CBT or multimedia, they are VERY time-consuming and expensive to design and develop. Additionally, they are VERY difficult to design well--just as classroom lecture is easier to design and develop than role-plays or more interactive methods. That's why I don't use them more.
As a trainer, I believe in "learner-centered" simulations in CBT/MM absolutely, but I use simpler tutorials (equivalent to demonstrations or lectures) for most of the content. A typical skills training course might include:

50% "linear tutorials" presenting introductions, basic facts, background information, demonstrations, etc.

30% "path simulations" or "prompted simulations" (actually a complex, branched tutorial in most cases) providing guided practice as the learner begins applying the information, and

20% "free-play simulations" to provide the learner independent or unguided practice in applying the information, with a critique of performance at the end.

By the way, the second method costs roughly twice the amount of development time as the first, and the third costs roughly twice the development time as the second.

In my humble opinion, we as practitioners desiring to consider ourselves professionals should not limit ourselves to any one theory, strategy, method, or technique. We should select what we think is most appropriate from as large a "tool kit" as possible. To present one theory/strategy/method/technique as "universally the best, replacing all others," is both illogical (a faulty dilemma) and insupportable, knowing what little we know about how people learn (or what they should learn).

My two cents!

T. Kent Thomas
Director, Creative Services
Clear With Computers (CWC)

E-mail: kentt@prarie.lakes.com
2 Apr 96
Johan Viljoen

I tend to agree with Kent Thomas [1 Apr 96] on a number of issues.

How does one practice what is preached in this regard if you are faced in a lecture hall with classes of up to 200 students who are supposed to learn English (second language) business communication skills? Administrators simply do not understand jargon and vogue words such as "learner-centered," "constructivist," "problem-based," "cooperative learning," etc. To them these are merely educationist clap-trap, therefore no concessions are made regarding time allocation, venues, staff provision, technology, and so forth.

We have just received a directive from Those Up There to increase our "throughput" of students, i.e., our pass rates. All of us know that this is done simply to obtain more state funding for the institution. (That's the diabolical system in South Africa: the higher your student numbers and pass rate, the more state subsidy you get) Administrators/managers are not concerned with quality training--they are concerned only with money. That means maximum savings, minimum budgets. Result: Give those 200 students a generic dose of traditional lecturing based on a cheap textbook, set tests and exams to obtain maximum pass rate, and prove "effectiveness," make the Powers happy, and retain your post.

Unfortunately our programs and our jobs depend exactly upon the matters of effectiveness and viability, BUT as seen from the perspective of those who (grudgingly) have to pay us. Engagement may be crucial to us, to them it is a foreign word.

Regarding assessment, the only clear way of illustrating "success" to such administrators, is by means of figures, i.e., marks and percentage pass rates. We all know that the efficiency of a teacher is measured by the number of straight A's that he/she can produce. Quantity, not quality.

Until we can PROVE to the admin/management types that technology reduces costs of training, they are not going to listen to us. I believe at this stage the odds are against such proof. And that kind of person seems to be terribly short-sighted as well. Long-term benefits do not figure highly in their calculations.

So, those of us idealists who believe that wise application of technology could make a difference to the quality of learning are faced with a formidable task.

Johan Viljoen
Dept. of Language Dynamics
Faculty of Information Sciences
Technikon Pretoria
South Africa

E-mail: jviljoen@TCM.ee.techpta.ac.za
2 Apr 96
Terri Buckner

[quoting Norman, 1 Apr 96] What do you think of the initiative toward a learner-centered education, one that involves the students in a constructive activity more than is today traditional in the lecture-centered curriculum. Note that I am not asking whether this is a new idea: the question is whether it is a good idea.

And if it is a good idea, and since the ideas have been around for a long time (perhaps since Socrates, certainly since John Dewey), then how come they haven't yet taken hold?

This might be a really dumb question, but what exactly is learner-centered education? Is anything that isn't lecture, learner-centered? Is the criteria for being "learner-centered" based on the type of instructional approach employed? Is problem-based learning (PBL) a type of learner-centered education? What if the instructor makes all the decisions about what types of projects, conditions, etc.?

Or, in addition to being a "constructive activity," does it mean that students get to have some control over what activities they do in class or how they are graded? Who decides how much control and over what?

Is it simply a state-of-mind that means I care more about what is good for my students than what is easy for me?

I'm not asking for a users' manual, just some clarification. There are a lot of terms used in educational research that mean kind of the same thing but a little bit different (experiential learning, problem-based learning, constructivism, case based, project based, goal-based scenarios, etc., etc.). My guess is that learner-centered education is being used as an umbrella term. "Learner-centered education" is to "television" as "problem-based learning" is to "Magnavox." Perhaps that analogy is the explanation for why there hasn't been more widespread diffusion. Magnavox is a brand name and there are consumer reports that give consumers information on whether it is reliable, reasonably priced, and how it stands up against other types of television. Educational research isn't that organized. PBL works in some instances, but no one knows how cost-effective it is and since it is defined and implemented differently everywhere it is used we will never get the kind of data that people (like administrators) want to make policy and budgeting decisions. Is this a strength or weakness of educational research? I'm not sure, but it is a frustration.

Terri Buckner

E-mail: tbuckner@garnet.acns.fsu.edu
Tom Reeves

[quoting Norman, 1 Apr 96] What do you think of the initiative toward a learner-centered education, one that involves the students in a constructive activity more than is today traditional in the lecture-centered curriculum. Note that I am not asking whether this is a new idea: the question is whether it is a good idea.

And if it is a good idea, and since the ideas have been around for a long time (perhaps since Socrates, certainly since John Dewey), then how come they haven't yet taken hold?

The very first paper on ITForum was about learners as designers by Dave Jonassen. Now almost two years later, we have Don Norman, wizard of user interface design and guru of mental models research, along with Jim Spohrer, introducing a special issue of the *Communications of the ACM* about learner-centered education. The movement (dare I say "revolution") continues!

With respect to Norman's first question, I think learner-centered education is a great idea, one deserving of far more support, innovation, and research at all levels of education or training. Later this week, I'll be starting the Spring '96 version of my Multimedia Design course, a graduate level course that I intend to be learner-centered. The fifteen students in the class are divided into three five-member teams with each member playing a different role (project manager, designer, evaluator, graphic artist/videographer, and programmer). Each team works for eleven weeks to design a prototype multimedia program for a "client," usually another faculty member in fields such as veterinary medicine, entomology, drama, journalism, or environmental design. Students have assigned readings, e.g., Brenda Laurel's edited volume on the art of human-computer interface design (with contributions from Don Norman among others). They also use an electronic performance support system (EPSS) that my students and I have created called *Multimedia Development Tools*. (A WWW version of these tools is located at http://mime1.marc.gatech.edu/imb/mime/MM_Tools/MMTools.html) We meet as a class once a week for five hours--two hours devoted to presentations and demonstrations and three hours devoted to team meetings and consultations. Most of the important work (and learning) is done outside the context of class meetings. The multimedia prototypes are pressed onto CD-ROMs at the end of the quarter so that each student can add one to his/her portfolio. I can't think of a better way of "teaching" this course. I hope it is learner-centered.

Of course, having only 15 students, most of whom are highly motivated, is a luxury that makes this approach possible. It would be extremely difficult to scale this up to the scores or hundreds of students, many unmotivated or ill-prepared for self-directed learning, faced by Johan Viljoen and most other teachers around the globe. One approach might be to divide large classes up into smaller groups with older, more motivated students, taking on leadership roles in the learner-centered activities. We are trying something like this with large sections of our required undergraduate course in environmental
literacy. Classes of 100 or more students are divided into research groups led by a teaching assistant. On day one of a typical lab, after identifying hypotheses about stream quality or forest growth, students collect "real" data, e.g., water samples or tree measurements, at the nearby state botanical gardens. On day two, they analyze their data using computer-based simulations and analytic tools we have created with funds from the National Science Foundation. Fortunately, the ecology classes we are working with meet for two back-to-back class periods twice a week, or we wouldn't be able to have them collect real data in the field. We have tried to integrate similar approaches into large undergraduate sections that meet five times a week for only fifty-minutes periods without success.

With respect to Norman's second question, I think that the main reason learner-centered education hasn't taken hold is that it appears to threaten the established bureaucracies in education and training. These people aren't about to give up their power and privileges. Let's not forget that democracy is also a great idea, but relatively few of the world's inhabitants enjoy its benefits. Learner-centered education is still a "revolutionary idea," even if it is somewhat of a hyperbole to call what is happening today a "revolution."

It may be a long while before we have the technology to make learner-centered education a reality for the masses of children and adult learners who could benefit from it. For a glimpse of one possible future, I recommend Neal Stephenson's latest sci-fi hit, The Diamond Age, subtitled or A Young Lady's Illustrated Primer. The book's heroine is a young girl who is given a marvelous talking book that "mentors" her throughout her life's experiences. There are only three such primers in existence, but a plot is afoot to clone it for millions of children in the three great clans on the planet (Han, Nippon, and New Atlantis). Stephenson's earlier work, Snow Crash, is also highly recommended for its portrayal of the dark side of the "Infocosm" (what we now call the Internet).

Alas, even with marvelous talking primers, the education bureaucracy may still be able to keep learner-centered education in the realm of science fiction. The struggle continues. Meanwhile, I look forward to reading how others will address Don Norman's two questions.


Thomas C. Reeves, Ph.D.
Department of Instructional Technology
The University of Georgia
607 Aderhold Hall
Athens, GA 30602-7144

Phone: 706/542-3849
2 Apr 96
Bob Cassidy

[quoting Norman, 1 Apr 96] What do you think of the initiative toward a learner-centered education, one that involves the students in a constructive activity more than is today traditional in the lecture-centered curriculum. Note that I am not asking whether this is a new idea: the question is whether it is a good idea.

Can we look at this from a construct other than good or bad? It seems to me that the evolution to learning-centered education follows the move from the Industrial Age to the Information Age. The skills needed in the Industrial Age were "assembly-line" skills. Most workers needed to follow orders and most organizations were top-down in structure. Information Age organizations are web-structured and need individuals who are more creative and self-motivated. There's more leeway in how you do your job and less direction. Is the shift towards learner-centered education just a reaction to the new skills required in today's economy?

Bob Cassidy
Somerton School District
215 N. Carlisle Ave
Somerton, AZ 85350

Phone: 602-627-9388
Fax: 602-627-8217
E-mail: bcassid@somertoneld.k12.az.us
2 Apr 96
Charles Padgett

[quoting Reeves, 2 Apr 96] With respect to Norman's first question, I think learner-centered education is a great idea, one deserving of far more support, innovation, and research at all levels of education or training.

It's a great idea, sure. But, to echo Terri Bruckner's [2 Apr 96] question (and I'm glad I'm not the only one asking!), what is it? What counts?

I ask this from my own experience as a consumer of education. When I first began to take smaller classes, here in the IT program at UGA, I recognized that there was a significant difference. I had a great basis for comparison, since I'd held off on my biology courses until my undergrad senior year (God only knows why) and found it incomprehensible: 300 squalling kids in a big room with one teacher, his words bouncing all around the dimly-lit hall. From that, to having an entire class taught in a computer lab, where we could immediately work with the ideas being presented, was very different.

But again, echoing Terri's question, is a mere lack of lecture enough? Now that I have taken a number of these courses, I've begun to look at the difference less as a paradigm shift, more of a room where it's still sorta hard to learn, if your learning style doesn't elide well with the instruction style. I'm wondering if this will always be a problem with groups. Some of us enjoy hearing the teacher talk, some of us itch to get on with playing with the ideas.

Thus, while I'm sure a class such as Dr. Reeves outlines will be much better than a packed auditorium (heck, I'm sure enough of it that I signed up for the class!), I still worry about the term "learner-centered" as applied to it. For, more often than not, I feel decidedly uncentered, even in small lab-based courses. (Well, Charles, why don't you just go play in the corner for a while, until you decide you can work with others?)

Lest this turn into me whining "What about my needs?", let me push what I'm saying onto a more theoretical slant.

At what point in the continuum of course size, teacher/student ratio, and individual engagement, do we get to call our instruction learner-centered? To extend Don Norman's question a little, where does the implementation of what sounds like a good idea, become good enough? If we're not going to have AI interactive materials ala >Diamond Age anytime soon, at what point in our adding of technologies and rethinking presentation/interface do we start to see a noticeable difference in the quality of a learner's experience?
[quoting Reeves, 2 Apr 96] With respect to Norman's second question, I think that the main reason learner-centered education hasn't taken hold is that it appears to threaten the established bureaucracies in education and training. These people aren't about to give up their power and privileges.

Will they have a choice? "Revolution" may imply some bloody overthrow of power--what if that power is simply displaced? If the trend of technologies is to become more networked and yet adapted to user preference, not to mention cheaper (Apple's Pippin, for example, if they get it through their heads that it could be more than a hyped-up game machine), mightn't it be profitable to entrepreneurs to privatize education, take it out of state hands? I don't know. After reading Johann's [Viljoen, 2 Apr 96] response, and hearing again and again that here at UGA we're trying to have a student body over 35,000 (on a campus that seems barely big enough for 25,000), I can't imagine that smaller, more personal schools wouldn't seem more attractive, both to students and to their future employers.

It may be a long while before we have the technology to make learner-centered education a reality for the masses of children and adult learners who could benefit from it.

I agree with this, at least a little bit, except for one concern. Even in impoverished areas (recognizing that when I say that, I'm thinking of the US version of poverty, which definitely isn't representative of the world-at-large), people have TV's. Kids have their Nintendos, or know someone who does. We know how to market existing technologies for the masses, and we know how to create quality products. So while we're waiting for the revolution that will put all those big bad school administrators against the wall, it seems like a good idea to subvert School by creating affordable, attractive instructional materials. I mean, it can't be that hard, can it? You don't have to have a million-color display and a RISC chip to educate.

Alas, even with marvelous talking primers, the education bureaucracy may still be able to keep learner-centered education in the realm of science fiction. The struggle continues. Meanwhile, I look forward to reading how others will address Don Norman's two questions.

Again, big bucks beat bureaucracy any day of the week. If there is a way to make learner-centered education profitable, and it seems to me there must be, we may find ourselves better able to teach, once the kids get out of class and go home for the day.

Charles Padgett
University of Georgia

E-mail: cpadgett@moe.coe.uga.edu
[quoting Padgett, 2 Apr 96] Thus, while I'm sure a class such as Dr. Reeves outlines will be much better than a packed auditorium (heck, I'm sure enough of it that I signed up for the class!), I still worry about the term "learner-centered" as applied to it.

Or, more to the point, is the "learning" and "retention" any different? It's singularly interesting to me that the generation (mine) who experienced the un-centered baby boom educational cycles, managed SAT and GRE scores higher than today's averages. Later, as an undergrad in the 1960's at UGA, many of my non-major core courses were distributed via campus cable to multiple classrooms as talking heads: the instructional drone of which rivaled the clamor of the cicadas on a hot Athens day. Did I hate that kind of instruction? You bet. The "Romance" stage, as Whitehead termed it, was nowhere to be seen. Did I wade through the monadic instructional design to get the material (precision)? You bet--I needed the credits. Did I later apply (synthesize) some of what I had, at first, merely endured. Surprising to me, yes.

I'm not recommending interminable auditorium lectures. I simply wonder if learner motivation comprises so much of the instructional pie, that re-arranging the remaining crumbs and claiming you've changed the dessert is a little presumptuous.

Rich Reardon

University Media Resources

580 Rarig Center

330 21st Ave South

Minneapolis, MN 55455

Phone: 612-625-3486

Fax: (612-624-6079)

E-mail: reardon@maroon.tc.umn.edu
2 Apr 96
Don Norman

First of all, an announcement: The April issue of the *Communications of the ACM (CACM)* is now out. It includes this (apparently) controversial paper by me and Jim Spohrer, as well as the first set of articles on the topic. The rest of the articles will be published in the May issue of the *CACM*.

Second, it sounds like I may have made a bad choice of paper for this exercise. The paper was meant for a specific context: as an introduction to the papers that had already been selected for publication in a special issue of the *CACM*. We had no part in the section process. Moreover, the introduction was not a place for us to express our complete theory of instruction. Our goal was to provide a framework for understanding the papers. No more, no less.

Finally, let me try to provide a brief review of my views on instruction.

The most important thing is understanding. "Facts" are not the critical part, with mild exceptions. Yes, it is important to have memorized: the order of the letters in the alphabet, the addition tables, the multiplication tables, and a few other things here and there. But on the whole, I don't believe in facts. I believe in understanding. One can always look up facts. (And most facts aren't facts anyway. History, for example, is really a set of points of view, not "facts."). With a good conceptual framework and understanding, usually the stuff that one needs to know is easy to remember.

As I have pointed out in another spot (in my book *Learning and Memory*), when you met someone in the hall who says, "I'll meet you at 5:30 for dinner," you usually do not have to go around doing a rote memory exercise on this piece of information: it fits a well established conceptual structure, and you remember it without effort. That's how learning ought to be, and it is the instructor's responsibility to provide that rich, functional conceptual structure.

How does one learn? How does one instruct? Answer: there are many kinds of learning, many different kinds of students, many different situations, and therefore, many different educational procedures. Dave Rumelhart and I once argued that there were three different kinds of learning: Structuring, accretion, and tuning. Each required very different instructional procedures.

Structuring is where one develops the proper internal representations--the structures. This requires reflection, deep thought, This is where simulation-based instruction is superior, where tools that help students contemplate different courses of actions and different approaches are needed. Tools that let students reflect upon this and that. This was the focus of my discussions in my book *Things That Make Us Smart*. 
Accretion is the sheer accumulation of knowledge. (Not facts--ugh!) This can be done by demonstration, or lecture, or by reading, or watching films. Here is where I show you how to juggle, or that $5 + 3 = 8$. (The understanding is part of structuring.)

Tuning is what is required to transform knowledge into automatic skills. This requires practice--considerable practice. I can teach you 3-ball juggling in 30 minutes. It will then take hundreds of hours of practice to be comfortable. I once argued (and still believe) that it takes 5,000 hours of practice to become expert. A little over two years of full time effort. This is tuning.

Learner-centered education means that the learner is the center--an active center. Kent Thomas, in his reply to me, seemed to think that learner-centered somehow could be done through lecture and demonstrations.

No.

Kent tells me he is a trainer. What an interesting term. I guess I am not sure what that is or how it differs from teachers. He said:

[quoting Thomas, 1 Apr 96] As a trainer, I believe in "learner-centered" simulations in CBT/MM absolutely, but I use simpler tutorials (equivalent to demonstrations or lectures) for most of the content. A typical skills training course might include:

- 50% "linear tutorials" presenting introductions, basic facts, background information, demonstrations, etc.
- 30% "path simulations" or "prompted simulations" (actually a complex, branched tutorial in most cases) providing guided practice as the learner begins applying the information, and
- 20% "free-play simulations" to provide the learner independent or unguided practice in applying the information, with a critique of performance at the end.

By the way, the second method costs roughly twice the amount of development time as the first, and the third costs roughly twice the development time as the second.

Sounds horrible to me. That's the kind of course that bores the hell out of students. As for the cost structures--well, the whole point of the CACM articles was to try to develop instructional methods that reduce the costs. Just because the first method is cheaper than the others doesn't mean we should do it. Actually, I would never use the second or third methods. Branched tutorials are murder to develop and prepare. And it is the rare one that truly stimulates: they are just too hard to do. As for the last, free-play is seldom appropriate. I believe in adding much more structure. I so structure the situation that the students have to discover exactly the information I want them to learn. "Free-play" is not learning. (In skill training, we distinguish between playing a sport and practicing a sport. In the former, little learning may occur.)
My philosophy is to instruct through problems. Present a problem that the students are to solve, one that is intrinsically interesting. Structure the problem so that along the way, they have no choice but to encounter exactly the issues you want them to learn.

Provide learning material: demos, lectures, reading material for them to use when they have become motivated to need that material. Provide them with environments that support their exploration of the problem space--this is where simulations might be useful, but only where appropriate.

Clark Quinn [1 Apr 96], from down there in Australia, revises our classification scheme. Clark's proposal makes a good deal of sense. But once again, we have the problem that Jim and I were trying to make sense of the papers and to provide a gentle critique along with our encouragement: hence our choice of engagement, effectiveness, and viability. We were very concerned that these papers were, yet again, promising the moon but, in fact, simply demonstrating that they could climb trees. We were extremely concerned with how well the ideas would actually work in a real instructional environment, with real material. Hence our classification. Clark's is superior for overall instructional purposes.

Back to Kent Thomas who says: "As a trainer, I believe in "learner-centered" simulations in CBT/MM absolutely" but who also states "a total "swing" toward learner-centered education is a big mistake."

Well, who ever said we wanted a total swing toward anything? Moreover, our views of LC education seem to differ. I believe strongly in providing a lot of structure, and in making the environment guide the student to exactly the points that need to be explored and learned. Exploratory learning works if the teacher has set up the situation that the exploration always happens upon just the concepts to be acquired. Otherwise it fails.

As my colleague Alan Kay loves to point out. Students won't invent science, or the calculus, or Beethoven, or Shakespeare. We have to guide them to discover these, to study them, and to enjoy them. Traditional education, however, rubs the students' noses into the material, often diminishing the enjoyment, and thereby minimizing what gets learned.

[quoting Thomas, 1 Apr 96] In my humble opinion, we as practitioners desiring to consider ourselves professionals should not limit ourselves to any one theory, strategy, method, or technique. We should select what we think is most appropriate from as large a "tool kit" as possible.

Yup. Absolutely correct.
2 Apr 96
T. Kent Thomas

[quoting Norman, 2 Apr 96] Learner-centered education means that the learner is the center--an active center. Kent Thomas, in his reply to me, seemed to think that learner-centered somehow could be done through lecture and demonstrations.

No, this is an obvious misunderstanding, but I'm not sure how it occurred. This long post is my "best attempt" to clear up the misunderstanding. I didn't state that learner-centered could be done through lecture and demonstration. I was questioning the focus on learner-centered at the same time I was trying to caution that there is still a very valid place for lecture and demonstration. Donald stated in his original paper "The lecture and textbook are still the most effective ways of presenting a large array of material rapidly and efficiently. After all, they have been with us for several thousand years: this is the way that most of us were trained." I agree. I was merely cautioning against "evangelizing" learner-centered instruction, if this means a complete endorsement of constructivism or exploratory learning methods. Donald introduced his paper with the statement "The basic issues can be described through such key words as "constructivism," "learner-centered," "problem-based." I was responding to the term constructivism and the extensive use of "exploratory" or "exploration" throughout the remainder of the paper.

Kent tells me he is a trainer. What an interesting term. I guess I am not sure what that is or how it differs from teachers.

The best distinction I've ever heard is "Training is for an immediate, defined need. Education is for a future, perceived need." I don't teach, I train. As a trainer, all my content is problem-centered. If there weren't a problem, I wouldn't be developing training. All the training is "task-centered." If the learner cannot apply the training content to a specific task or set of tasks, I have failed, not the learner. This perspective is clearly communicated to the learner, providing a "real-world, practical" context that carries through the entire design of the instruction. Yet, the methods that I use to provide the training are not exploratory or learner-selected or learner-controlled. They are very structured and as direct as they can be, and as directly relevant to real-world tasks.

Donald went on to quote me, as follows below. I meant to make the point that one of the primary reasons that more simulation-based learning is not available is because of the complexity and expense involved, while also illustrating the "mix" of instructional strategies that I routinely use:

[Norman quoting Thomas, 1 Apr 96] As a trainer, I believe in "learner-centered" simulations in CBT/MM absolutely, but I use simpler tutorials (equivalent to demonstrations or lectures) for most of the content. A typical skills training course
might include:
50% "linear tutorials" presenting introductions, basic facts, background information, demonstrations, etc.

30% "path simulations" or "prompted simulations" (actually a complex, branched tutorial in most cases) providing guided practice as the learner begins applying the information, and

20% "free-play simulations" to provide the learner independent or unguided practice in applying the information, with a critique of performance at the end.

By the way, the second method costs roughly twice the amount of development time as the first, and the third costs roughly twice the development time as the second.

Sounds horrible to me. That's the kind of course that bores the hell out of students.

Perhaps your misunderstanding of my points led to this "harsh" statement. I would hope so. By the way, this basic "mix" of strategies has won several industry awards for me (3 Invision awards--2 Silver, and 1 Bronze; 4 Nebraska Interactive Media Awards or "Nebbies", etc.), so I don't think they're necessarily horrible to all who have seen or experienced them--Perhaps just different!

As for the cost structures--well, the whole point of the >CACM articles was to try to develop instructional methods that reduce the costs. Just because the first method is cheaper than the others doesn't mean we should do it.

As a trainer, having to constantly justify the expense (both direct and indirect expenses) of training, I "beg to differ." Unless the material being taught requires a more complex strategy, I must use a less expensive (i.e., more cost-effective) strategy.

Actually, I would never use the second or third methods. Branched tutorials are murder to develop and prepare. And it is the rare one that truly stimulates: they are just too hard to do.

I'd refer anyone wanting to develop effective, yet complex-seeming path simulations to the text: Gibbons, A.S. (1996, Designing Computer-Based Instruction, Educational Technology Publications). It's not all that difficult, if it is based around a specific task or set of tasks, instead of exploration. I think both Donald and I are "revolting" against "topic-based" instruction, both of us focusing on problem-based, but from different perspectives--I value a more direct instruction, experiential (simulation-based) approach, he appears (to me) to value a more indirect, inquiry or exploratory approach.

As for the last, free-play is seldom appropriate. I believe in adding much more structure. I so structure the situation that the students have to discover exactly the information I want them to learn. "Free-play" is not learning.
I agree. The free-play simulation is ONLY for assessment or independent practice (with delayed feedback) in a controlled environment. These are the complex ones and by far the most expensive strategies to implement! One set of simulations I helped design had over 40(225) possible paths, a 40-plus step troubleshooting procedure with over 225 possible actions that could be taken at each point in the troubleshooting procedure.

The basic instructional strategy that I implement in CBT is the "age-old" strategy of good skills training:

- Introduce the task, including a problem-based context
- Provide any needed background facts or concepts needed to perform the task, including why it's important
- Demonstrate the task, and why the facts and concepts are relevant
- Provide guided practice as the learner performs the task, with feedback and remediation as needed (i.e., coaching)
- Provide independent (unguided) practice as the learner performs the task un-aided, then critique the learner's performance
- Assess the learner's ability to perform the task, with only the aids that naturally occur in their job environment

I don't think Donald and I are too far apart on our views of problem-centered instruction or simulations.

I believe strongly in providing a lot of structure, and in making the environment guide the student to exactly the points that need to be explored and learned. Exploratory learning works if the teacher has set up the situation that the exploration always happens upon just the concepts to be acquired. Otherwise it fails.

I agree that structure is required. I probably include far more structure in my CBT designs than Donald would or does. But I also feel that structure and exploratory are almost a dichotomy of terms. How do I truly explore in a structured (i.e., either controlled or limited) environment? Why not limit my exploration and show me direct cause-effect, action-reaction types of relationships? In fact, I've presented papers on the instructional value of limiting the free-play and "realism or fidelity" in simulations. Realism is complex, expensive (especially when including media treatment) and time-consuming to develop.

As my colleague Alan Kay loves to point out. Students won't invent science, or the calculus, or Beethoven, or Shakespeare. We have to guide them to discover these, to study them, and to enjoy them. Traditional education, however, rubs the students' noses into the material, often diminishing the enjoyment, and thereby minimizing what gets learned.

I also tried to make the point that I didn't enjoy spending a whole school-year diagramming sentences, but I certainly value that today. Neither was I in a position at that point to decide or select what I needed to know. My concern with the term learner-centered, especially when used with the term exploratory learning, is that the learner is often the LEAST QUALIFIED person to decide what they need to learn.
and when they need to learn it. Perhaps Donald and I differ in who should be the guide--the teacher, or the computer. The computer can also do this, consistently and patiently, just as the computer can be patient and persistent in drill and practice or tutorials.

[quoting Norman/Spohrer paper] Learner-centered design addresses the need for learner engagement, but other stockholders need designs which address the issues of effectiveness and viability.

I was trying to address these issues of effectiveness and viability. That must not have been clear. In my humble opinion, and as well supported as the counterpoint in the literature, learner-controlled exploratory learning is not nearly as effective as other more structured methods. In training, learning time is money--money spent on salaries while the learner is in training and money lost while they're away from their job. Learning time in our education system is also very limited, students are graduating with limited knowledge, and I feel that efficiency is important in education also. Donald acknowledges that point, also in the original paper:

But because any single problem requires considerable time to allow the students to discover and work through the critical components, this approach is weakest in covering a wide range of materials and in establishing the ability to use the skills automatically, without cognitive effort. These aspects of education are best left to the textbook, the lecture, and drill and practice.

Further, I'd add that exploratory learning environments are so expensive to develop that it is not very economically viable for widespread use. Economics has definitely limited the implementation of good CBT. Finally, I'd ask what additional demands it would place upon the "average teacher" to effectively implement an environment where the computer is used as a tool to explore these learning environments. The students seem to already know more about many of these uses of the tools than the "average teacher." Just as CBT has been poorly designed and implemented in the past (and is only now becoming widely accepted), I fear the same can and likely will happen with these exploratory methods--and the results compounded by the teacher's ability (or lack thereof) to utilize them effectively.

Do we need more "exploratory learning environments" to be poorly implemented when put into practice, or do we spend our limited technology budgets on more structured, self-contained, and consistent problem-centered CBT? Life is full of choices. Pay your money and take your choice.
3 Apr 96
Doris Shaw

You [Norman, 2 Apr 96] have referred to "conceptual framework," "rich, functional conceptual structure," "structuring," and "internal representations" in your discussion of your views on instruction:

How do these relate to the "mental models" that you discuss in earlier work? I'm curious about the reason why you do not use that term in the current exercise.

Doris Shaw, Ph.D.
Construction Engineering Research Lab.

Phone: 217-373-6729
Fax: 217-373-6724
E-mail: shaw@bambi.cecer.army.mil
3 Apr 96
Jeff Oliver

[quoting Thomas, 2 Apr 96] ...the methods that I use to provide the training are not exploratory or learner-selected or learner-controlled. They are very structured and as direct as they can be, and as directly relevant to real-world tasks...

In general, training will only be sponsored if it addresses a need, is perceived as cost-effective, and does not remove an employee from the work-place for any longer than is needed. Placing the onus on the trainee to acquire competencies by exploratory methods is not likely to find favor. That definition of "learner-centered" is insufficiently focused on learning outcomes and performance improvement.

[quoting Norman, 2 Apr 96] Tuning is what is required to transform knowledge into automatic skills. This requires practice...

It makes sense but is rarely acknowledged and incorporated into training schemes. The formal learning environments that we create, whatever their flavor, are unlikely to achieve in the novice the performance of the expert. But how many training schemes recognize this and ensure that, upon returning to the workplace, a trainee is offered opportunities to practice or given proper coaching and support? It is at that point that much traditional training fails to complete what is started during courses--it fails to facilitate tuning. Offering that facility is where the term "learner-centered" could be applied without changing the way we train on courses and in a cost-effective way.

Not exactly Don's "revolution." Not a giant leap for mankind. But a small step.
3 Apr 96  
Johan Viljoen  

[quoting Norman, 2 Apr 96] I so structure the situation that the students have to discover exactly 
the information I want them to learn... My philosophy is to instruct through problems. Present a 
problem that the students are to solve, one that is intrinsically interesting. Structure the problem 
so that along the way, they have no choice but to encounter exactly the issues you want them to 
learn.

My question: Is this LEARNER-centered? If the INSTRUCTOR/TEACHER poses the problem, HIS/ 
HER problem?

Especially the last sentence above worries me: "...exactly the issues you want them to learn." How 
learner-centered could that be? Isn't this just a later model of the same car we have been driving since 
the previous century? Surely a learner-centered approach should have the STUDENTS find/identify 
problems and pose solutions, with guidance from the teacher perhaps.

I believe strongly in providing a lot of structure, and in making the environment guide the student 
to exactly the points that need to be explored and learned. Exploratory learning works if the 
teacher has set up the situation that the exploration always happens upon just the concepts to be 
acquired.

Again some questions: Is this exploration? How finely is the target area delimited before the student is 
let loose to "explore" what is left? Isn't it much like letting a dog loose in a kennel of 4x4 meters? Or is 
the area demarcated by the teacher at least the size of a respectable ranch? Much more fun and intrinsic 
interest in exploring a ranch than a kennel, I would say. But how does one simulate a ranch adequately?

This is not a critique! I merely have more (dumb?) questions than I have answers for. And--funnily 
enough I agree with Don in many respects, simply because I am faced daily with situations that force 
one to be teacher-problem-centered rather than learner-centered (the 200-student classes referred to 
earlier), with no technological support except an OHP and chalk. I then do exactly as Don does--throw 
problems at them that I think will let them explore and learn. (Only to find out too late that those were 
not their real problems.)

Finally, from painful experience I have to concur with Kent:

[quoting Thomas, 2 Apr 96] My concern with the term learner-centered, especially when used 
with the term exploratory learning, is that the learner is often the LEAST QUALIFIED person to 
decide what they need to learn and when they need to learn it
[quoting Viljoen, 2 Apr 96] How does one practice what is preached in this regard if you are faced in a lecture hall with classes of up to 200 students who are supposed to learn...

We have just received a directive from Those Up There to increase our "throughput" of students, i.e., our pass rates. All of us know that this is done simply to obtain more state funding for the institution.

Ah yes. Now we pass out of the realm of theory and move to the realm of practice. Real teaching takes place in a complex atmosphere of social and organizational demands. There are multiple pressures upon the system, one of the largest being cost: the desire to minimize the expense of education. Education is still one of the most costly of enterprises, primarily because it is so labor-intensive. Most industries have changed dramatically over the past 1000 years, using more and more technology to increase productivity. Teaching is still a person-to-person process, where the best teaching is still done with a low faculty-student ratio. Probably the most effective technologies in use in the classroom today are: books, paper and writing implements (pen, pencil, typewriter, word processor), and blackboard (which was introduced over wide controversy and debate about its utility).

I have done much more high-tech things in my classes, but without much impact and possibly even some detriment. On-line, live projection of computer-generated material. Videos. I have even taught several classes in England while sitting in various offices here at Apple (California). The Open University is doing the most interesting work on education at a distance (one of my classes was for the OU, and I will do another in a few weeks), but even for them it is a struggle.

Meanwhile, administrators do--and should--worry about the high costs of education. Of course, insisting on larger lectures and higher pass rates does bring down costs. It simultaneously brings down effectiveness.

How does one cope with the reality of education? I am not sure. My work has been to try to understand the learning process, the better to develop instructional methods. And to try to develop technologies that enhance learning and understanding (and all kinds of learning, with all kinds of students). But the technology I seek is not yet available. The computer technology of today is very primitive and not very effective--although there are clear exceptions to this statement.

Worse, in addition to the cost pressures, there are strong cultural pressures. In the United States, this gets translated into immense pressure by the thousands of individual school boards to make sure that subjects X, Y, and Z are taught and that subjects A, B, and C are not taught, and that subject R, S, and T are only
taught in a well-defined manner. And then there are the social issues of dealing with students who do not want to be in school, and who have a dysfunctional home environment, and who may suffer from all kinds of ailments--from hunger, to crime, to disease, to drugs, to...

Not an easy problem to tackle.

I certainly do not want to proscribe a "solution" to the complexities of education.

My main approach has been to try to understand the cognition of education and then to try to understand how to take the educational theory and apply it in the realities of the world. In similar way, I have tried to take design principles from Cognitive science and try to get them into computers and products, subject to multiple constraints, such as cost, complexity, and the problem of consistency with the installed base.

At Apple, we have struggled with the difficulty of getting innovational instructional products in the marketplace. Products that are welcomed by our test teachers and that seem to us educational researchers to be just what is needed in particular settings have failed to get through the product process because the sales organization has--correctly--pointed out that school boards are not yet ready for the innovations: school boards want more traditional approaches.

As I travel the world (Most nations in Europe, Russia, Japan, China, Singapore, Australia, Hong Kong, and, in a few weeks, India) I am stuck by the diversity of teaching methods, of cultural differences and yet one universal perception: every nation seems to think that their school system is failing and that some other school system is superior. Truth is, all produce some truly excellent students. All fail with some number of students. Which should give us all pause to think that there is any single method to succeed.

Indeed, I was trained by the very methods that I now resist and find inadequate, yet I--and my very skilled research staff--are clear success stories.

[quoting Reeves, 2 Apr 96] Later this week, I'll be starting the Spring '96 version of my Multimedia Design course, a graduate level course that I intend to be learner-centered. The fifteen students in the class are divided into three five-member teams with each member playing a different role (project manager, designer, evaluator, graphic artist/videographer, and programmer).

Fifteen students. These methods work well with small classes. How does one deal with hundreds. I know what I did at the University: I gave lectures. I would even give lectures explaining why lectures were not good methods of learning. They are easiest for the instructor, least satisfactory for the learner. But they are the most efficient way of conveying a large amount of knowledge quickly (surpassed only by the book).

Of course, having only 15 students, most of whom are highly motivated, is a luxury that makes
this approach possible. It would be extremely difficult to scale this up to the scores or hundreds of
students, many unmotivated or ill-prepared for self-directed learning, faced by Johan Viljoen and
most other teachers around the globe.

With respect to Norman's second question, I think that the main reason learner-centered education
hasn't taken hold is that it appears to threaten the established bureaucracies in education and
training.

I would like not to believe this. But I have no evidence, one way or the other. I think one reason it does
not take hold in Universities is that Professors are too lazy: it is far easier to give lectures than to do the
hard work of preparing learner-centered material (remember how much structure is required if it is to be
effective).


Yup, a most interesting book. Neil is an interesting person (Yes, I do know him).

[quoting Buckner, 2 Apr 96] ..but what exactly is learner-centered education? Is anything that isn't
lecture, learner-centered?

No. And the Socratic method is learner-centered, even though it is a kind of lecture (dialog).

Or in addition to being a "constructive activity" does it mean that students get to have some
control over what activities they do in class?

Yes, although as I said earlier, the clever instructor has structured the situation. But different students
have different backgrounds and different conceptual approaches and learning styles. They have to be
free to explore the material in the manner that works best for them. Note that students might not know
what works best they need guidance on learning styles and methods.

[quoting Padgett, 2 Apr 96] When I first began to take smaller classes, here in the IT program at
UGA, I recognized that there was a significant difference ... echoing Terri's question, is a mere
lack of lecture enough? Now that I have taken a number of these courses, I've begun to look at the
difference less as a paradigm shift, more of a room where it's still sorta hard to learn, if your
learning style doesn't elide well with the instruction style. I'm wondering if this will always be a
problem with groups. Some of us enjoy hearing the teacher talk, some of us itch to get on with
playing with the ideas.

Yup.

[quoting Cassidy, 2 Apr 96] It seems to me that the evolution to learning-centered education
follows the move from the Industrial Age to the Information Age. The skills needed in the
Industrial Age were "assembly-line" skills. Most workers needed to follow orders and most organizations were top-down in structure. Information Age organizations are web-structured and need individuals who are more creative and self-motivated.

Well, I'm not sure I buy that. One difference, however, is that up to recently, only the elite were educated. Even in early America, a high school education was considered sufficient (and was not universal). The real difference over time is how much education is required just to keep up with the ever-expanding cultural knowledge of the world. Today it takes 20+ years to be educated. In 50 years it might take 30 years. Then 40. (And even an "educated" person knows remarkably little.)

[quoting Reardon, 2 Apr 96] Or, more to the point, is the "learning" and "retention" any different? It's singularly interesting to me that the generation (mine) who experienced the un-centered baby boom educational cycles, managed SAT and GRE scores higher than today's averages.

The problem is: why do we measure ability by grades and test scores?

You know, most work in the real world is done by groups of people, cooperatively, where asking for help and looking up information is encouraged. The only place where one has to work alone, without help, without being allowed to look things up is in school tests. So why do we think this is representative of anything? Answer: it isn't. (Yeah, test scores correlate sort-of with school performance. And how well does school performance correlate with real-world performance?)

Retention is not a good measure. Understanding and the ability to apply knowledge to new situations, or the ability to discover what knowledge is needed, and then to apply it, these are better measures.

The best measure of performance of a person is performance itself, not retention, not artificial, abstract tests.

I hate tests. I would prefer an educational system in which there were no tests. Instead, the material would come packaged in large numbers of small modules. People would have to pass a performance evaluation after each module. This would be graded P/NP. And the person could take it as many times as necessary.

At graduation time--which would have some minimum number and assortment of modules as a requirement--one could evaluate people by what kinds and how many modules they finished. The good mathematician or scientist would have finished more modules of math or science than the person not so good in these topics. But everyone would have the same grade on the modules they did pass.

Finally, Kent Thomas [2 Apr 96] sent a long, thoughtful expansion of his earlier comments.

I really appreciate the time and energy he took to clarify his position, and I thought that we were in reasonable agreement with the issues. (But I still remain suspicious of how much he really got out of a
year of diagramming sentences.)
3 Apr 96
Martyn Wild

[quoting Shaw, 3 Apr 96] You have referred to "conceptual framework," "rich, functional conceptual structure," and "internal representations" in your discussion of your views on instruction...

How do these relate to the "mental models" that you discuss in earlier work? I'm curious about the reason why you do not use that term in the current exercise.

Without wishing to step on Don Norman's toes here, its probably of some value to point out that Doris almost answers her own question: the terms she has highlighted as used by Don, are generally, alternative descriptors (albeit less precise) for "mental models" (or at least the mental models of Johnson-Laird's characterization).

Martyn Wild
Department of Multimedia Learning Technologies
Edith Cowan University
Pearson Street, Churchlands
Western Australia 6018

Phone: 619 273 8022
Fax: 619 387 7095
E-mail: m.wild@cowan.edu.au
3 Apr 96
Tom Reeves

A couple of participants in this forum have mentioned Don Norman's significant contributions to the development of mental model theory (cf. Norman, 1983). A typical taxonomy of internal learning states as defined by contemporary cognitive psychologists includes constructs such as "simple propositions, schema, rules, general rules, skills, general skills, automatic skills, and mental models" (Kyllonen & Shute, 1989). The authors of these taxonomies imply that mental models are the richest constructs of learning states that have been conceptualized to date.

It also appears that many (most?) participants in ITForum would agree that a wide variety of learning strategies, including memorization, direct instruction, deduction, drill and practice, and induction, may be required in education and training depending upon the type of knowledge state to be constructed (Schank & Jona, 1991).

My first question to Don is: What is your current thinking about mental models and learning? (In 25 words or less.) I realize that you may simply prefer to refer us to more current references.)

My second question is: Does learner-centered education provides a better basis for the construction of sound mental models than other forms of education? I think you'll say "yup," so please tell us why!


Ah yes. Now we pass out of the realm of theory and move to the realm of practice. Real teaching takes place in a complex atmosphere of social and organizational demands. There are multiple pressures upon the system, one of the largest being cost: the desire to minimize the expense of education.

I suggest you look at the work that Professor Jack Wilson is doing at Rensselaer Polytechnic Institute in New York State. They have instituted a "studio" teaching model for Physics, maths, and (soon) chemistry. Class sizes are of the order of 700. This learner-centered model is both more effective educationally and costs less to run. Traditional classes were 2 hours lecture, two hours tutorial, and 2 hours lab, and were replaced by 4 hours in a studio. The studio is a large room which accommodates over 60 students at over 30 computers. Experimental work, discussion work, and mini-lectures are mixed in each 2 hour session.

The model may not work so well in areas other than Science.

Jack visited Curtin University recently, and his arguments in favor of the model seemed to catch the interest of the highest decision makers, as well as faculty interested in effectively teaching their students.


The conclusion is that it IS possible to obtain a cost-effective learner-centered educational environment for large classes. The key issue is change management and being able to convince senior management to cough up the initial investment.

Dr. Rob Phillips, Lecturer
Computing Centre
Curtin University of Technology
GPO Box U1987, Perth 6001
Western AUSTRALIA

Phone: 0061 9 351 3101
E-mail: r.phillips@info.curtin.edu.au
4 Apr 96
Clark N Quinn

[quoting Wild, 3 Apr 96] Without wishing to step on Don Norman's toes here, its probably of some value to point out that Doris almost answers her own question: the terms she has highlighted as used by Don, are generally, alternative descriptors (albeit less precise) for "mental models" (or at least the mental models of Johnson-Laird's characterization).

I'd have to disagree. Not to say that Martyn's characterization of Johnson-Laird's use of the term "mental models" is wrong, but to argue for a tighter meaning for mental models. Obviously, I'm not speaking for Don (he's welcome to agree with me, of course :-), but I'd reserve mental models specifically for cognitive (qualitative) models of dynamic systems, and use "conceptual frameworks" as higher-level representations that organize disparate bits of knowledge, including mental models.

For instance, your conceptual frameworks for nuclear reactors may include a mental model of heating of a liquid to a gas to drive a turbine, but it may also include knowledge about the safety factors, a few specific incidents, the potential for spent fuel conversion to weapons, etc. As such, conceptual frameworks may incorporate a variety of knowledge, including declarative knowledge, causal knowledge, knowledge of common events, etc. In short, these conceptual frameworks are the organizing structures known variously as "schemas" or "frames" in the psychological literature.

While the overarching schemas are necessary, I'd like to argue that good mental models are a most powerful reasoning mechanism. They allow us to understand systems, and as such they provide qualitative bases for prediction and explanation. And this is a capability that's been hard to address in the past but technology gives us new means to address.

Many systems are too dangerous, expensive, etc., to experiment with. With technology, however, we can create a simulation that allows safe exploration. Even more, we can provide building tools to construct our own models, which allows us to test our understanding in a different way (see my comments about exploration vs. construction in the my previous message [1 Apr 96]).

As a second issue, Don's notion of assessment is an issue I'm coming right up against.

[quoting Norman, 3 Apr 96] The best measure of performance of a person is performance itself, not retention, not artificial, abstract tests.

Yes, the idea of a nice competency-based assessment of performance sounds great. However, the biggest problem (which echoes what Kent was saying about training vs. education) is far transfer. In training (in my definition), we have a clear context and performance indicators. But for certain areas, design for
instance, what is the performance indicator? What is a good measure of ability? In teaching my HCI subject, I can't know whether my students will be facing designing small utilities, large industrial systems, or household appliances. I can't train them, I need to educate them. What are useful measures of performance (for that matter, what are useful practice tasks) to ascertain whether they can transfer to many different areas? I can't test them all. I hardly have time to provide good practice, given 14 weeks and the need in such iterative design to provide for a cycle of feedback and revision, as well as have a finite amount of marking to do (I have 80 students, not 15).

At graduation time--which would have some minimum number and assortment of modules as a requirement--one could evaluate people by what kinds and how many modules they finished. The good mathematician or scientist would have finished more modules of math or science than the person not so good in these topics. But everyone would have the same grade on the modules they did pass.

But is this right? Do we want students to do this without some interaction with people (currently known as counselors, tho' there are lots of problems with the current version thereof) who can advise on how the different choices mesh with desired areas of endeavor? Certainly high school graduates shouldn't be expected to know what they want to do. I changed major several times while in uni (and took six years), let alone the diversions in post-grad study (Don may painfully remember this :-).

As an aside, the Open Learning agency here in Oz almost meets this criteria. It packages a number of subjects from different uni's and makes them available through distance mode. You can actually get a bachelor of arts degree from one of the uni's after completing a set number of any of the subjects! You get marks, but you only have to pass the subjects. The question then becomes, what is the degree worth? Will industry recognize it? Etc.?

We're traipsing all over the landscape here (which is what makes this such a great mailing list). We're addressing the realities of the learning environments (hey, I still lecture), the underlying components of learning, the changing context in which this is happening, and how technology can be adapted to the pedagogical goals. I'd argue that the bottom line, however, is to design good learning activities, and then see if technology can make them happen. We'll end up compromising, but the technology can make a lot more possible if we throw off our blinders about what'd been done and start with an approach I call the "no limits" approach: if there were no limitations at all (except mind-reading, for hopefully obvious reasons) what would be the ideal activity-reflection cycle? It'll be different for all sorts of learners/content/contexts, but from that spec, we are increasingly able to approach it with the increasing capability of technology.
[quoting Quinn, 4 Apr 96] ...but I'd reserve mental models specifically for cognitive (qualitative) models of dynamic systems, and use "conceptual frameworks" as higher-level representations that organize disparate bits of knowledge, including mental models.

[quoting Reeves, 3 Apr 96] A typical taxonomy of internal learning states as defined by contemporary cognitive psychologists includes constructs such as "simple propositions, schema, rules, general rules, skills, general skills, automatic skills, and mental models" (Kyllonen & Shute, 1989). The authors of these taxonomies imply that mental models are the richest constructs of learning states that have been conceptualized to date.

In respect to Tom's [Reeves] comment: As a simple taxonomy, this one works as well as any. But we need to remember that mental models theory is a coherent theory that seeks to explain thinking. In this respect, it is different from other cognitive theories, and is not consistent with theories that explain cognition by reference to rule-based formalisms (and Tom, I feel, appears to package both, indiscriminately, in his taxonomy). Let me expand on this.

Certainly there is much confusion arising over the idea of mental models, simply because accounts differ from one theorist to another. But basing our understanding on Johnson-Laird's considerable and most recent work in this area, mental models are essentially cognitive tools that have predictive and other cognitive properties. A mental model is a mediating intervention between perception and action--it provides a representation (of, for example, functions, systems, and processes) which, in turn, provides the means to interpret, to remember, to communicate information, and to control performance (Gentner & Stevens, 1983; Montague, 1988). Johnson-Laird explains mental models by providing the following context:

Understanding certainly depends on knowledge and belief. If you know what causes a phenomenon, what results from it, how to influence, control, initiate, or prevent it, how it relates to other states of affairs or how it resembles them, how to predict its onset and course, what its internal or underlying "structure" is, then to some extent you understand it. The psychological core of understanding, I shall assume, consists in your having a "working model" of the phenomenon in your mind. If you understand inflation, a mathematical proof, the way a computer works, DNA or a divorce, then you have a mental representation that serves as a model of an entity in much the same way as, say, a clock functions as a model of the earth's rotation. (Johnson-Laird, 1983, p. 2)

But the theory of mental models and their role in thinking is somewhat incompatible with the belief in
the central role of formalisms (e.g., rules of logic) in the process of thinking (the latter being heavily represented in earlier cognitive theories of learning, beginning with Piaget's work). The structure of a mental model corresponds to the structure of reality, as we perceive it, and represents that reality rather than representing the linguistic structure of discourse (which is characteristic of formalist approaches). In this sense, mental models theory offers an alternative explanation of the way in which people think, and in particular, of the way in which they reason by the processes of both deduction and induction (Johnson-Laird, 1983; Johnson-Laird, 1993). So whereas, Piaget and others of his tradition, for example, consider that formal reasoning is achieved by using rules of logic, Johnson-Laird suggests that reasoning is rather a process of building mental models. [However, there is some similarity between Piaget's account of concrete operational reasoning, where children at this cognitive stage think in terms of concrete representations (objects and events), and Johnson-Laird's mental representations--and both, of course, are concerned to describe tools for thinking (Bliss, 1994)... but I now digress].

So, whilst I would agree with Clark to some extent (regarding his categorization of mental models and conceptual frames), I think we have to be careful about accepting Tom's views, based on Kyllonen & Shute, in so much as mental models provides an alternative theory of cognitive processing to other, rule based, approaches. Thus, mental models and rule-based formalisms, as explanations of thinking, simply cannot sit easily in the same theoretical framework.

[quoting Quinn, 4 Apr 96] We're traipsing all over the landscape here (which is what makes this such a great mailing list). We're addressing the realities of the learning environments (hey, I still lecture), the underlying components of learning, the changing context in which this is happening, and how technology can be adapted to the pedagogical goals. I'd argue that the bottom line, however, is to design good learning activities, and then see if technology can make them happen.

An alternative and perhaps somewhat controversial if more realistic bottom line, is to design instruction, involving or based on information technologies, and then explain why it works (or doesn't work) by reference to learning theories.
I had an original impulse to respond to Don and Jimis' article on Learner-Centered instruction, but I hesitated until I saw my name taken in vain in one of the messages, so now I want to chime in. What I have to say is a bit long, but I would like the responses of others, so I am sending it in full.

I have seen the *Communications of the ACM* (*CACM*) issue, and it is of greatest interest to someone who has not read extensively in this area. The examples are well chosen, the articles are short, and they mix the concrete nicely with the theoretical. I look forward to the second half of the articles next month.

I agree fully with the assessment Norman and Spohrer make of the trend toward problem-centered forms of instructional experience. There is a sea change afoot in our area of instructional technology. New, more precise, and more controlled instructional techniques will become the standard. Surprisingly, they will be embedded within environments that look less structured and less deliberately contrived than the ones we are used to today, but a reading of the articles in this first installment of the *CACM* series reveals that those are false impressions: the seemingly unstructured environments conceal carefully designed problem structures which the student eventually finds and uses to learn the intended knowledge.

I found it ironic that Kent Thomas found any conflict with Don and Jimis' writing, because I know him and have seen his products. They are of very high quality, and in many respects are examples of the type of instructional environments that Don and Jim describe in the abstract. I believe it is a case of mutual misunderstanding due to terminology.

I personally believe that the type of instruction Don and Jim describe is the direction the future will witness. I constructed computerized, problem-based instructional tools with my colleagues for several years in industry and continue to do so in the academic world. Currently Joel Duffin and I are working on systems capable of providing intelligent feedback, and Joel has built one in which the content and extent of the feedback message can be controlled parametrically, by the throw of a software switch.

I take only one exception to what Don and Jim wrote in their preface. I would like to suggest a term other than "learner-centered." I believe that appellation is not fully descriptive of the fundamental change which is taking place—not only in how we instruct but in how we build instructional products. I suggest that we use the term "model-centered education" or "model-centered instruction," and I will try to explain my reasons.

"Learner-centered" education or instruction is positioned in the Norman-Spohrer preface in opposition to "content-centered" educational or instructional practices. From the preface: "In the past, the focus has been on the content: the curriculum is structured around the basic topics of literacy, history, social
The phrase content-centered, then refers to the topical discipline structures which have come to provide the central organizing framework within which are defined the more subordinate curriculum structures--units, lessons, etc.

The shift we are witnessing today is away from these static, non-process-related structures, toward environments and models--which are more aligned with mental processes--as the basis for defining instructional events. More particularly, the shift is toward problems and activities which take place within these modeled environments (which may also contain models of systems).

The best description of the shift, then, is to say that it is away from "content-centered" instructional structures and toward "model-centered" ones. By structures I do not mean the containers we place the instruction in, I mean the structures we expect the student to learn. We are shifting away from learning static discipline-related structures and toward learning dynamic performance-related structures.

This distinction is more than window dressing, for the shift is not just in the type of performance we want the learner to learn. It is a shift in the way we design and construct new instructional forms. More significantly, all of this betrays as well a shift in the underlying model we use to characterize the instruction-learning process.

I would like to express this instructional view, because it is the real reason for my preference of the term "model-centered." It also lies close to the heart of the constructivist interpretation of learning which the Norman-Spohrer preface invokes.

Consider the learning process, which normally (and for the majority of our personal learning) takes place as a learner (L) acts upon some real-world system (S)--a natural or manufactured system--and receives a response in return. The learner pokes the world and the world pokes back.

The learner's interpretation of the response-poke leads to conclusions which are somehow added to a body of personal knowledge. (I like the Norman-Rumelhart terminology more for their intuitive feel than anything.)

This learning-by-poking or learning-by-experiment is the natural pattern of learning. It is the method by which the overwhelming majority of our personal knowledge originates, even taking into account the mass of knowledge we acquire through formal studies. This pattern of learning is how we learn to shave, ask for a date, hammer a nail, or debug a computer program.

Without some form of assistance, this experience-based pattern of learning (the self-guided form of problem-based learning) is prone to erroneous conclusions, gappy knowledge, and superstition. It has therefore become common practice for a learner to seek the aid of a companion (C) in learning (I avoid the term "teacher" intentionally, why you will see later). This companion--perhaps a peer, perhaps an expert--can communicate with both the learner and the natural system, supplying a variety of services in support of the learner's intentions to learn--which learning comes mainly in response to the learner's
decision to learn and from the learner's own interactions with the system.

The companion's services may be no more accurate or complete than the learner would supply himself or herself, but the companion does have an influence on whatever learning takes place to the extent permitted by the negotiation of the learner and companion wills. The companion may take the initiative, but the learner will learn only what he or she decides or accedes to.

As sensory communications to the learner become more complex and harder for the learner to sense (atomic forces, galactic motions), it becomes difficult to provide the learner direct experience with the system as a basis for learning. In western education, the response to this has been to take the economical route of substituting verbalized experience or just plain verbalizations for first-hand experience. This involves reducing the experience of the companion (or an expert) to verbalisms and having the student learn from them. This and the perceived need to supply a "complete" set of knowledge are the origins of the content-centered or discipline-centered curriculum.

As the shift toward content-centering took place, the role of the companion also changed: from companioning to dominating. The companion became the directing force in instruction. I believe this shift was due largely to economic reasons. To increase the efficiency of instruction, just formalize the knowledge, catalog it, and verbalize it to the student through the companion, expect a verbalized response as a measure of effectiveness, and call it quits.

The teacher was invented, and the triangular relationship which existed before between the learner, the system, and the companion evolved into a two-way relationship between the learner and the teacher-dominated by the teacher. The premise of teacher certifications is that a teacher has first-hand experience with natural systems and is therefore prepared to verbalize on personal experience. Unfortunately, most certifications are poorly defined, and many teachers today teach verbalisms which they themselves have accepted from others because they have had no personal experience with the (natural or manufactured) systems they teach. Several colleagues and I (Vic Bunderson, Jim Olsen, and Greg Kearsley) wrote a paper in 1981 in which we referred to this phenomenon of a verbalized instructional catechism the "lexical loop." Our educational system today is caught in this loop. Our students are good at writing about but not at learning from experience as a result.

The shift we observe today consists of the substitution of computer models for real-world systems--computer models of environments or of systems themselves--as the basis for learning experiences. This makes possible the restoration of the triangular relationship between the learner, the system, and the companion which provides an experiential basis for learning. This is not a restoration of former educational practice from a previous period of history but a restoration of the practices we each had in our youths but which have been lost to us through formalized educational practice--a practice in which we are told that verbalization, not experience, is the root of learning.

As this change takes place, we are having to learn again the appropriate role(s) and function(s) of the now-restored companion and the learner and negotiation of initiatives between them. To the extent that
we can automate these roles and functions, we are able to create intelligent tutors and intelligent instructional features to support a companioned learning experience rather than relying solely on live companions. It has also become important again for us to know how to use designed sequences of problems to support learning long a desired path.

I see the shift toward new forms of instruction as a migration back to a system-centered and experience-centered mode of learning, except that now it is not real systems from which we will learn, it is models of them. These models may be models of environments or of systems, and every problem-based learning experience has as its backdrop either an environment, a model, or a combination of models situated within environments. I have tried to describe this in a recent book chapter (Dills and Romiszowski, Eds., 1997, Educational Technology Publications).

This model of learning and instruction has enormous implications for the way we design and build instruction. Just as instruction will become model-centered, our instructional design activities will now center first on the creation of environmental and system models and secondly on the creation of intelligent companions (instructional functions) to accompany the student in the use of those models as learning tools. This impacts not only the selection of development tools but the internal structural designs of the products themselves at many levels.

I hope that I have made a reasonable case for describing the transition we are experiencing as one from content-centered instruction (and designs and development tools) toward model-centered instruction (and designs and development tools). The term "learner-centered," though it signals our reformed intentions toward the learner, does not tell the whole story.

Dr. Andrew Gibbons
Department of Instructional Technology
Utah State University
Logan, Utah 84322-2830

Phone: (801) 797-2393
Fax: (801) 797-2693
E-mail: gibbons@cc.usu.edu
4 Apr 96
Phil Reeves

I share Don Norman's view of tests. As a result I have consistently used performance assessments to determine how well students have met the objectives of my courses. (Unfortunately, I was compelled to give grades rather than P/NP and there were no opportunities for unlimited repetitions for those who did not do well.) Nevertheless, judging by course evaluations and later conversations with alumni, the efforts were effective, engaging, and efficient from the students' point of view.

Viability is another matter. In addition to the work involved in creating this type of learning situation, the effort required to provide comprehensive feedback on complex assignments for which there is no single correct outcome is daunting. My experience is limited to graduate courses in a business school and a medical school where class sizes never exceeded 30. With larger classes, I might have reverted to the traditional testing process as a matter of survival.

A related issue not addressed so far is the countervailing pressure on faculty to maintain an aggressive agenda of research and publication. Often, these activities yield more recognition and rewards than teaching accomplishments.

Phil Reeves
George Washington University

E-mail: reeves@gwis2.circ.gwu.edu
4 Apr 96
James C. Spohrer

[quoting Oliver, 1 Apr 96] Meaningless tosh, of course.

Things have gotten dramatically better in the past few years, and only an extreme cynic would think otherwise. Are you truly unaware of the hundreds of millions of dollars savings, better performance, lower defect rates that major corporations have realized due to cheaper, more available computers with learning/training software, and better authoring tools? If so I will send you the references from Business Week, Newsweek, InfoWorld, as well as technical journals. But perhaps you were just trying to be entertaining. Normally I have a really good sense of humor. If I sound unamused perhaps it because I have just taken the red-eye to DC to continue to lobby the government (NSF, ARPA) for increasing funding to universities to do research on improved learning technologies. After 48 hours of no sleep working hard to get grant money into programs that may benefit the person who wrote this note, I hope you are as good at doing great learning research as you are at making cynical comments. I know, I know--cynicism is an art form.

[quoting Quinn, 1 Apr 96] ...the three "dimensions":

Now here is productive, thought-worthy material! Certainly these three "dimensions" can be improved. However, here is how we arrived at them. In analyzing many "failures" of learning technology, it was clear that failures could occur because some "stakeholder" was not satisfied with the technology. Learners might not want to use the system ("not engaging"--not enjoyable enough to use), Teachers/Parents might not want the learners to use the system ("not effective"--learners may want to use it, but it does not achieve its educational objectives), Developers might not want to build the systems ("not viable"--too expensive to build for adequate ROI). So the dimensions deal with stakeholder reactions to the learning technology. Nevertheless, all the points you raise seem like valid criticisms. However, I would suggest that the dimensions of collaborative systems, exploratory systems, constructivist systems, etc., really deal with different pedagogical approaches or learning architectures. I have a research report in the works that deals with this.

[quoting Thomas, 1 Apr 96] ...a total "swing" toward learner-centered education is a big mistake.

Precisely, there are many stakeholders with a vested interested in what the learning technology does, is about, etc. If you just please the learner (student) you have probably built an engaging system (like the examples in the special issue). Learner-centered is just one dimension to optimize, but does not mean the technology is a success--though failing to be learner-centered is probably the most basic mistake in many ways.
...we as practitioners desiring to consider ourselves professionals should not limit ourselves to any one theory, strategy, method, or technique. We should select what we think is most appropriate from as large a "tool kit" as possible.

I really enjoyed these comments, and your approach to balance effort of production with useful learning results. Right on! Check out: http://www.atg.apple.com/areas/EW_Groups/ to see how much I agree with you. We need a tool kit approach with many strategies.
5 Apr 96
Steve Tripp

[quoting Reeves, 3 Apr 96] A typical taxonomy of internal learning states as defined by contemporary cognitive psychologists includes constructs such as "simple propositions, schema, rules, general rules, skills, general skills, automatic skills, and mental models" (Kyllonen & Shute, 1989).

I would like to start a discussion of this topic: General skills do not exist.

My argument: Skills are always specific, and the more skilled you are the more specific they become. Let me illustrate. I can drive. This is a skill. When I rent a car I have certain problems. Like I can't find the windshield wipers, etc. Some of my skills from driving my own car transfer, but only when they are identical in the rentacar. I reach to turn on the windshield wipers but nothing happens. (I follow J. Anderson on this. Transfer is the transfer of specific productions which are a component of an overall skill.) When the car (or country) is different I rely not on skills, but on knowledge of driving to get by. Thus, I reason, "This is a car, therefore there must be a windshield wiper thing here somewhere. Usually it is a button on the dashboard or it is somewhere on one of these damn levers. Let me try a few. Watch out for that bus! Aaaah! etc.) Thus knowledge has generality, but (true) skills do not. Skills don't transfer to unfamiliar situations, but knowledge does.

I raise this issue because I think it has wide implications.

1. If skills are not general (only knowledge is general) then an educational system that emphasizes skills and stigmatizes ("I can always look that up.") knowledge, will have serious shortcomings.

2. People who are trying to teach general thinking skills are trying to do the impossible.

To let you know my perspective:

I am trying to learn Japanese again. In order to do this you probably need to know at least 100,000 words and expressions, plus maybe 10,000 ways of writing those words and expressions. I am annoyed when people minimize the importance of learning "facts." You cannot just "look these up." This is serious educational work.

Steven Tripp, Professor
Center for Language Research
University of Aizu
Tsuruga, Ikki-machi
Aizu-Wakamatsu City
965-80, Japan
Phone: +81-242-37-2584
Fax: +81-242-37-2599
E-mail: tripp@u-aizu.ac.jp
5 Apr 96
T. Kent Thomas

[quoting Tripp, 5 Apr 96] I would like to start a discussion of this topic: General skills do not exist.

You may be interested in some of Dr. Sherrie Gott's research on mental models specifically applied to troubleshooting (i.e., problem-solving) skills--she found, and I corroborated in my own experience later, that expertise is very very domain specific. It is based upon a very robust set of facts, concepts, and rules that are almost automated. I guess they're "well-tuned" to use Don Norman's terms. An expert in one domain can be a poor performer in another, where this foundation knowledge does not exist.

[quoting Tripp, 5 Apr 96] I would like to start a discussion of this topic: General skills do not exist.

This reminds me of a perpetual argument I have with our local community college. I have been teaching various computer courses there on and off for 10+ years and they are very high on teaching specific application programs (Word Perfect, Lotus 1-2-3, Paradox, etc.) and don't allow instructors to stray from this list. My argument is that they should be teaching word processing (knowledge) NOT Word Perfect (skill) so that the knowledge will transfer more easily to other programs. I believe it is important to use skills as the hands-on component to support acquisition of knowledge. In other words, I present the concepts of word processing in a lecture/demonstration format and then we're off to the lab to see how it works with a real program. Does it make any difference which program we use? I think not.
5 Apr 96
Beverly Anne Garcia

[quoting Reeves, 3 Apr 96] It also appears that many (most?) participants in ITForum would agree that a wide variety of learning strategies, including memorization, direct instruction, deduction, drill and practice, and induction, may be required in education and training depending upon the type of knowledge state to be constructed (Schank & Jona, 1991).

[quoting Quinn, 4 Apr 96] What would be the ideal activity-reflection cycle?

The articles in the January/February 1996 *Educational Technology* magazine, "Special Issue: Perspectives in Change" introduced by Gordon Rowland and David Shapiro, seems to emphasize the role of conversation in effective instructional design. Conversation that builds relationships seems to be an underlying construct implied within instructional designs.

One of the most long-lasting, century-tested instructional designs--an educational training manual for life itself--is the Bible. I've attempted to identify components of this "ideal activity-reflection" model as the basis for designing instruction. What makes it a time-tested standard for increasing far transfer?

**The Instructional Design of the Bible**

**Being**

WHO is more important than HOW. Relationships are more important than how-to know-how. The total lifestyle permeates the design of instruction. Far transfer depends more on character than technique.

**Actions**


2. Love the sinner, but hate the sin. This is the climate for instruction.

3. Forgive. Forgiveness is self-healing: It transforms the person who forgives more than the person who is forgiven.

4. Increase performance by minimizing fear.

5. Value diversity that contributes to the function of the whole body.

7. Listen. Reflect together.

8. Reflect alone. Take time to meditate, not just read, not just act, not just hear.

Words

1. Simplify language.

2. Allude to commonplace things that are relevant to the listeners.

3. Limit content to the capacity of the learners.

4. Use analogies (similes, metaphors, parables, comparisons in proverbs).

5. Repeat.

6. Warn about consequences.

7. See more than one side by stating paradoxes.

8. Sing songs with embedded content messages.

These principles may help to unite what Andy Gibbons [4 Apr 96] mentioned as the triangulation between the learner, the companion, and the system.

For a more extensive and scholarly use of paradox in instruction, read any writings by C.S. Lewis, especially the short book, *Mere Christianity*. Lewis, a former long-time professor at Oxford and Cambridge, where he often lectured to overflowing crowds, also describes the source of any knowledge. "Authority, reason, experience; on these three, mixed in varying proportions all our knowledge depends. The authority of many wise men in many different times and places forbids me to regard the spiritual world as an illusion."

Beeverly Anne Garcia

E-mail: beverly-garcia@uiowa.edu
6 Apr 96
Richard Swerdlin

Good teaching stimulates sound thinking. There are many angles to that gem stone however. Various "direct" and "indirect" teaching methods cab be used. There is no single magical key.

Unfortunately, the term "constructivism" adds nothing new. It is like reinventing the wheel. The same is true of the related term "learner-centered" education. Sadly, it may be used to justify near-bedlam in a classroom. After all, this is "modern," and of course anything "traditional" cannot work in 1996!

The above nonsense was encountered just the other day, when a student thought that eating and drinking in a classroom are essential to "self-esteem" and a "learner-centered" atmosphere. Since I enforce the house rules against turning carpeted classrooms into lunchrooms, I was told that my own behavior was "too traditional," especially since "now it is 1996." I told the student that I was well aware of the calendar showing 1996. However, I added that changes are not necessarily synonymous with improvements. Not surprisingly, the student claimed that her "style" is not really to listen to "lectures" and to "take notes."

In plainest English, the above was a form of student crap. The same student had boasted that she got "91" on the first test I gave. I doubt however if she is now boasting of her "68" on the second test. Perhaps she should concentrate more on "learning" than "politicking." The fact of the matter is that she has trouble with certain aspects of mathematics and associated teaching methods.

In brief, professional politicians are not the only politicians in the halls of ivy.

Richard Swerdlin

E-mail: swerdlin@coefs.coe.unt.edu
Well, my time with you has come to a close (although I'll lurk in the background until my workload prevents even this.)

I've enjoyed it. At the University of California, Santa Cruz, when I arrived to give a guest lecture, the instructor handed out copies of the *Communications of ACM* article by Jim Spohrer and me that started this discussion going. I tried to describe the controversy generated here--the UCSC class could not understand it. Too many believers, I guess.

The real point I hope everyone takes home is that human learning and understanding are two of our most complex behaviors, and no single approach nor single explanation will suffice. Not only are there apt to be multiple brain mechanisms involved, but the huge differences among people and cultures translates into huge style differences. No single approach will suffice.

Actually, that is a good place to start with my responses to the last topic on this forum: mental models and the generality of knowledge and skill.

> [quoting Tripp, 5 Apr 96] I would like to start a discussion of this topic: General skills do not exist.

My argument: Skills are always specific, and the more skilled you are the more specific they become.

Well, says me, strong statements are usually useful in clearing the air, but seldom hold up in practice.

Once upon a time, psychologists believed in general intelligence and general knowledge (many still do). The "g" of IQ test fame was a measure of general ability. One could train people how to study, how to think, how to problem solve. Today, the pendulum has swung to the other extreme: most skills and abilities are very domain specific. Expertise in one area has little to do with expertise in another.

My view, wouldn't you know, is in-between. In fact, take the specific hypothesis for a moment. Dissect any two areas, skills, or educational or practical domains into their constituent parts and I bet that there will be considerable overlap, even if very specific components, even if the two topics are chosen to be very different from one another. Thus, learning to focus attention or to practice, or dissection of complex problems into simpler ones will apply across domains.

Indeed, Steve's discussion of auto driving made the point by relying upon general knowledge:
I rely not on skills, but on **knowledge** of driving to get by. ... Thus **knowledge** has generality, but (true) skills do not. Skills don't transfer to unfamiliar situations, but knowledge does.

Not clear that I could distinguish between skills and knowledge. Nor that I would want to.

Thus, I agree with half of his conclusion:

1. If skills are not general (only knowledge is general) then an educational system that emphasizes skills and stigmatizes ("I can always look that up.") Knowledge, will have serious shortcomings.

Well, this is why Rumelhart and I said tuning was necessary. I may know that multiplication is repeated addition, but that won't help me solve a complex multiplication problem: the specific algorithm and multiplication table will help. (Or better yet, the skill to use a calculator or computer.)

He also states:

2. People who are trying to teach general thinking skills are trying to do the impossible.

No, I disagree, but probably what I will call General thinking skill you will call knowledge, so that means we do agree. (?)

I am trying to learn Japanese again. In order to do this you probably need to know at least 100,000 words and expressions, plus maybe 10,000 ways of writing those words and expressions. I am annoyed when people minimize the importance of learning "facts." You cannot just "look these up." This is serious educational work.

Why would anyone disagree? The only thing I would add is that the learning of those thousands of vocabulary items (such as Kanji) is dramatically simplified by having a conceptual framework. In fact, the more terms you know, the easier it is to learn yet another. There are numerous frameworks. One is to build on similar terms, such as the relationship between the "Kyoto" and "Tokyo." Another is to provide a conceptualization of the shape of the Kanji character and the meaning of the item, as in the shapes for sun, moon, man, woman, river. Note that the conceptualization does not have to be historically accurate. It just has to be something that the mind can grab hold of and build upon. The very same principles hold for teaching English spelling. Just sheer recitation is guaranteed to be inefficient.

[quoting Cassidy, 5 Apr 96] This reminds me of a perpetual argument I have with our local community college. I have been teaching various computer courses there on and off for 10+ years and they are very high on teaching specific application programs (**Word Perfect**, **Lotus 1-2-3**, **Paradox**, etc.) and don't allow instructors to stray from this list. My argument is that they should be teaching word processing (knowledge) NOT **Word Perfect** (skill)...
skills argument is 100% correct--in fact, especially if it is correct--this is a bankrupt policy. One update of the program, or a company merger, or failure, and poof, the knowledge is wasted.

In one sense they should really be learning general skills. But you know, usually too abstract to be useful. It is also unmotivating (that is, boring). This best way I know to teach general skills is to teach several specific ones first, then reflect upon the common principles. Teach *Word Perfect* and *Lotus 1-2-3*. Compare a word processor with a spreadsheet. Say, "Oh, I see." Learn that there are a tiny number of basic principles that any application observes, and then thousands of arbitrary procedures.(This also helps the student by preventing them from feeling stupid. Don't feel stupid that you can't learn that key F25 does this, or that control-shift-escape-P does that.) General principle: the designers needed some way to do it, and at 3 a.m., someone came up with that. No wonder it is weird. The students need where to look up the weird methods when they need it.

So I would still teach the specific applications, but I would emphasize the weirdness, the arbitrary nature of the commands, and emphasize the general activities that are there and some general procedures for figuring out how to figure out how to work a new application, or a new platform (Unix, OS/2, Windows, MacOS, ...)

In closing, take home the general principles that I have stated: don't worry too much about the specific statements.
7 Apr 96
Merle Vogel

[quoting Tripp, 5 Apr 96] My argument: Skills are always specific, and the more skilled you are the more specific they become. Let me illustrate. I can drive. This is a skill. When I rent a car I have certain problems. Like I can't find the windshield wipers, etc. Some of my skills from driving my own car transfer, but only when they are identical in the rentacar. I reach to turn on the windshield wipers but nothing happens.

Steve's assertion may be correct but he needs a better example. It may take a moment in a rental car to find the windshield wiper control but permit me to suggest that finding the wiper switch is not really a driving skill. The important skills are starting, stopping and steering a car. We all do this in a rental car with no trouble. That is because the human/machine interface is so standardized in most cars that it takes a marketing guru to differentiate one car from another.

[quoting Cassidy, 5 Apr 96] This reminds me of a perpetual argument I have with our local community college. I have been teaching various computer courses there on and off for 10+ years and they are very high on teaching specific application programs (Word Perfect, Lotus 1-2-3, Paradox, etc.) and don't allow instructors to stray from this list. My argument is that they should be teaching word processing (knowledge) NOT Word Perfect (skill)...

In the days of DOS, as in the early days of the automobile, there was a great difference between various word processors, databases, etc. In the early days of the automobile there were all sorts of steering devices. Macintosh and Windows (GUI interfaces) have diminished these differences. When one has been taught to word process, as opposed to typing on a word processor, one develops certain expectations about what can be done on a word processor, or database, or spreadsheet. I would think the fundamental skills can be taught on any brand of application. I find myself using one or another because of some highly specific feature but they all perform all the basic functions, and quite similarly.

Could it be that the high cost of licenses is what makes the administration keep to a short list of applications programs?

Merle Vogel

E-mail: vogel@nprdc.navy.mil
[quoting Wild, 4 Apr 96] Certainly there is much confusion arising over the idea of mental models, simply because accounts differ from one theorist to another. But basing our understanding on Johnson-Laird's considerable and most recent work in this area, mental models are essentially cognitive tools that have predictive and other cognitive properties. A mental model is a mediating intervention between perception and action...

I agree about the confusion, and I would just like to make a small observation about the conceptualization in the last sentence. There seem to me to be quite close, though certainly not fully overlapping, similarities between Johnson-Laird's mental models, Rumelhart's "schemata," Minsky's "frames" (in Howes, 1991), Schank and Abelson's "scripts" (1977), and Mezirow's "meaning perspectives" (1991). They all deal with expectations (Martyn refers to their "predictive" properties) and seem to determine that a perception "is" (NOT "represents") such and such. In other words, I find it difficult to think usefully of an "interface" between a perception and a mental model of whatever if (as I understand to be the case) it is IN TERMS OF the mental model that the perception is what it is and not something else. I guess the test is that if some influence (learning) modifies your mental model, it shifts your perception in parallel. If "mental model" and "perception" always shift in a parallel and co-occurring way, where is the space for an interface, or intervention? This leaves us with a two-stage rather than a three-stage process. I acknowledge what this view owes to constructivism.

David Frampton
Griffith University
E-mail: D.Frampton@ins.gu.edu.au
Following Don Norman's paper, Steve Tripp [5 Apr 96] and he discussed specific versus general skills versus knowledge. I have two points to propose. My second point is probably more important than my first.

Their discussion seemed to be driven by the issue of generalization, with them trying to fit ideas of learning, skill, and knowledge to that issue. Actually generalizability may be almost independent. Consider reflexes (as Rodney Brooks has made us consider in robotics and Artificial Intelligence) such as jerking your hand away when it touches something very hot. If forced to choose, you have to say that this is skill not knowledge. It is also very general, in that it is applied by your reflex system (your spine?) to all situations, and furthermore it is probably right more often than not (so it does "apply"), even though it probably has a higher error rate than a more thoughtful approach that understands the specific situation before acting. In fact skills are judged, even defined, by their fast execution times: if someone does something slower than you, you wouldn't call them skillful, although they also have to succeed (have an adequately low error rate). Conversely knowledge is defined by its general applicability: if it isn't true across many situations you wouldn't call it knowledge, although if the knower is very slow retrieving the information we often wouldn't count it (is it knowledge if it can't be accessed?). So the suggestion here, inspired by Rodney Brooks, is to focus on a tradeoff spectrum between accuracy vs. processing speed (knowledge vs. skill), to suggest that this is closest to the skill-knowledge contrast, but that it is largely independent of the generality (breadth of applicability) issue. One way to get a speed increase is to store ("cache") redundant facts that will come in useful: when I was taught my multiplication tables, this was the implicit rationale that knowing that 6*7 was 42 saves having to do 6 or 7 repeated additions. However given procedures for doing calculations such as 46*77, the cached fact turns out to be "general" and is re-used in many different cases.

My second point concerns another issue that cuts right across these distinctions in what I believe is an illuminating way, and certainly one that is relevant to education. In her 1993 book *Rethinking University Teaching* Diana Laurillard suggests that all subjects have two levels that should be taught and learned: the level of public, formal descriptions and concepts, and the level of personal experience and action. In chemistry this would be learning formulae vs. knowing what copper sulphate looks like. In English Literature, this would be knowing how to read and write critical essays vs. the emotional experience of seeing a good play performed. In language learning this would be knowing how to answer questions about the subjunctive form, vs. communicating successfully with a street vendor. I am more and more convinced of its usefulness, although even now I can still find this distinction quite hard to apply.

(For instance how exactly should it be applied to math? Is the personal level that of "conservation"
issues: e.g., becoming convinced that 5 objects are still 5 even when moved into different spatial
cconfigurations? Or is it to do with the fundamental step of believing that written digits really can
represent real quantities, and that after the purely abstract transformations of paper arithmetic, the
answer will then really correspond to the world? Or is it just the speed-from-practice issues of learning
multiplication tables, or getting hours of practice with different forms in integration problems?)

In standard teaching this approximately corresponds to lectures vs. labs. It corresponds still better to the
issue, so prominent in the last decade or two in the education literature, of the pervasive nightmare in
science teaching of producing students who pass exams in the conceptual level, yet reveal in simple
interviews or other probes that they have made no connection between this conceptual knowledge and
everyday personal experience and often still exhibit the same "misconceptions" as the uneducated do.
Obviously the "neo-constructivism" (as I will call it) described in the Norman and Spohrer paper seems
to address this in part by teaching through real world cases and personal learner activity. However I feel
Laurillard's distinction is insightful because it points at a fundamental underlying distinction, too often a
divide, between public knowledge and private experience.

Perhaps the most important implication is that learners are implicitly faced with two different arenas in
which to exercise what they learn: two quite different kinds of task. The public formal aspect is
exercised in public communication tasks: passing exams, writing reports, teaching others, getting advice
and information from reference books and other experts. The personal aspect is exercised in perception
and action: in accomplishing material tasks personally. If you consider professions such as medicine or
civil engineering you can easily see the importance of both aspects.

Laurillard's distinction has many other aspects (for instance, its echo of the Piaget/Vygotsky contrast in
perspectives on learning). Here however it could be used to give a penetrating critique of particular
attempts at neo-constructivist software. Consider trying to teach basic economics, and the law of supply
and demand, through specific real world cases. You could pick cases from the stockmarket and try to
engage students with references to enormous sums of money and the attractions to them of a Yuppie
lifestyle. You could pick the example of a loaf of bread: why does it cost 30 pence (say) in the UK at the
moment? Or you could pick the example of dividing up household chores. The first might seem the most
"engaging," and would probably attract a multimedia producer the most. The second will look boring,
but at least the learner has daily experience of what a loaf of bread is. The third however is probably
what should be chosen to connect to the learner's personal actions and experience: few will have fixed
the price of a loaf, but they will all have had to negotiate chore apportionment in some local climate of
supply and demand, and this skill of determining prices by taking full account of the particularities of
the situation is what real businessmen need. These examples show how "engagement" and "motivation"
may determine what people choose when going to a movie, but may not address the educational issues.
They also show that simple personal familiarity may not be the issue in itself: learner action is what is
important, and multimedia may struggle to make this connection however effortlessly it can achieve
glamour.

Steve Draper
Dept. of Psychology
The recent paper by Don Norman and James Spohrer was about, and was titled, *Learner-Centered Education*. This is an accurate reflection of the pervasive neo-constructivist view. What I would like to hear reactions to is the following view: that learner-centeredness is an unbalanced and out of date view, and should be replaced by a conversational model of learning (as proposed by Gordon Pask and supported by Diana Laurillard) in which teacher and learner are given equally emphasized roles.

I can depict a simple progression of 3 views:

1. The transmission theory, a teacher-centered view, often called the "instructivist" approach, which holds that teaching causes learning, with the teacher's actions as crucial and the learner as a passive receiver.

2. Constructivism, a learner-centered view in which the learner is crucial and teachers cannot cause learning.

3. The conversational model, in which teacher and learner are equally important and must both be active.

In this version of history (!), constructivism is out of date; a useful reaction to the failure of the transmission theory (which refuses to die and so must still be actively combated), but like all reactions an over-reaction from the viewpoint of the search for an accurate theory of the teaching and learning process.

Learner-centeredness seems obviously, crazily, wrong. If it were true, then learners with any choice would avoid teachers and get on with it themselves: but in fact, this is not what we observe. Industry pays for courses with a lot of personal instruction. Students go to institutions where they can encounter instructors: they do not just study alone. Institutions are not under pressure to provide accreditation for students whose only encounter is the examination. Schools could not for a moment function without teachers, and almost everyone agrees that more teachers per pupil would be highly desirable if we could afford it. Almost every study in the literature that measures teacher effects finds that the effect of which teacher a group gets is larger than the effect of the educational treatment. The message most people take from the literature on *Logo* is that Papert had a big effect on learners, *Logo* did not. To a learner-centered theorist it has to be merely an amazing coincidence that children in an English speaking family happen to learn English rather than some other language, because of course what is learned depends on the learner, not the teacher.
In the light of this evidence surely we must look for a theory that admits that what the teacher does is as important as what the learner does in determining learning outcomes. The only things to be said for a learner-centered theory are that (a) it is better than the transmission theory, and (b) it is politically correct both to liberals (children should be the center of protection and attention) and right-wingers (in this context the learner is the consumer who pays for the teacher). But to anyone interested in a rational understanding of teaching and learning, or indeed in maximizing learning outcomes, then surely a learner-centered theory is as unbalanced and out of touch with the most obvious facts as would be a "north-pole-centered" theory of magnetism.
Andy Gibbons [4 Apr 96] sent a long message to ITForum. In my view (not his) it had four separate components:

1. He didn't like the phrase "learner centered" as a characterization of new-wave instructional approaches. I have my own objections, expressed in an earlier message, but they are different from his.

2. He thinks experience is primary, and that verbal concepts are derivative. I think that this is deeply mistaken, as I shall try to justify below.

3. He sees new wave instructional techniques as being a shift back away from a controlling teacher to a companion. I think this is a very interesting view. For instance it is compatible, as many theories and practices are not, with the extensive evidence that peer interaction promotes deep learning, yet does NOT depend on the peer knowing more in advance; in fact people can learn by interacting with less knowledgeable people. I don't have much to say about it, although I shall go on thinking about it. I think actually it is compatible with my quite different views on (2): in other words, I think it may be an enduring idea that does not depend on the particular justification for it that he gave.

4. He thinks the shift is also from static, discipline-related content structures, to dynamic performance-related model centered structures and instruction. I also don't have much to say on this, though again it is clearly important.

Andy Gibbons made clear that he thinks experience primary, verbal concepts secondary. (e.g., "This learning-by-poking or learning-by-experiment is the natural pattern of learning. It is the method by which the overwhelming majority of our personal knowledge originates, even taking into account the mass of knowledge we acquire through formal studies.") I'll give four arguments for a different view: (a) Putnam's arguments that even everyday concepts like "gold" and "water" are not grounded in our personal experience but are socially distributed: we mean what others mean; (b) the nature of science as a socially distributed enterprise; (c) the example of buying a house; and (d) Laurillard's model of the teaching and learning process, and in particular its distinction between the level of public, formal descriptions and concepts, and the level of personal experience and action. The idea here is that both are important, as are learning the relationships between them: not that the latter is primary. In fact if I could only have one, I would go for the former.

(a) Putnam's argument that there is a sense in which we don't understand most of what we say: much of our knowledge is really socially distributed and not in our personal grasp. The philosopher Hilary
Putnam argued in an essay that if you really ask yourself what you mean by words like "water" and "gold," then although we do know quite a lot about them, when faced with stuff that looks just like what we expect and yet might be simulated stuff (e.g., platinum or a cunning alloy for gold, or "heavy water," i.e., deuterium oxide, for water) we end up by saying that we mean whatever the ultimate expert means by those terms, e.g., the official government chemist. Putnam H. (1975) "The Meaning of Meaning" in Mind, Language and Reality (Cambridge, U.K.: Cambridge University Press).

(b) Science is a socially distributed process, in line with the above. As the over quoted remark of Newton about standing on the shoulder of giants indicates, the nature of science is that each individual adds a little bit to the shared accumulation. A scientist does not even check, much less reinvent, previous discoveries. There is debate about whether each new fact should be tested once or thrice: but certainly not by most scientists. Ideas of evidence and so on can be viewed as limiting science to what can be shared socially by having a checking procedure. But the whole point of science is to discover things once, then everyone can exploit it. This means that the body of science is transmitted, not by personal experience, but by other means: typically the printed word. The rest of our culture is rather similar. What is so distinctive about humans is that we so successfully share the results of experience without having to experience it ourselves. And as Putnam argues, we typically do not learn all that others know, but leave the knowledge socially distributed. When education is reduced to Gibbons' "lexical loop," it may have fallen below the ideal, but it is still empowering the learner with the keys (the index terms) to this socially distributed network of knowledge that is the essential heart of human power. This, for me, is an important point. If we teach students the official names for things, then they can participate in this socially distributed knowledge even if they don't understand much about it, e.g., they can look it up in the library, ask experts about it, etc. So much of the use of knowledge comes from knowing the public names for things, and not from complete personal understanding. (Though having both would be even better.)

(c) Consider the example of buying a house: one of the most important activities we undertake. If learning-by-experiment were the paradigm, I could only buy at random, and would not learn much in a lifetime. What I do, like most others, however, is to learn through words from others: this affects almost everything about this task. For instance, I have never had a fire in my home, nor witnessed one close to: instead I read about this (to me) theoretical risk and act accordingly. Similarly I hope to learn from other people's experience of burglary without having to try it for myself. Similarly for the beds, clocks, cookers, etc. that I will buy. In other words, Putnam's and not Gibbons's description seems to me to apply to this non-academic activity, and to the mode of learning that then determines my actions.

(d) In an earlier message to ITForum [Draper, 28 Apr 96], I described Laurillard's distinction, from her 1993 book Rethinking University Teaching, between the level of public, formal descriptions and concepts, and the level of personal experience and action. See that message for examples and a longer discussion. The former level corresponds to Putnam's point, while the latter corresponds to how Gibbons describes his viewpoint. The point is that all academic subjects have components at both levels; the ideal teaching and learning process will cover both, and in addition the links between them. Instruction most often emphasizes the level of public descriptions. Redressing the balance may be in order. But to swing to the opposite one-sided view is, in my view, deeply mistaken for the reasons I have given.
Finally: Gibbons gives this interesting view about replacing a controlling teacher by a "companion." The Laurillard model does not cover this, and it might perhaps with advantage be extended to incorporate Gibbons' idea. However it does emphasize a conversational model, with iterative interaction between teacher and learner at both levels (public and private, descriptive and material action). Gibbon's phrase of "learning by poking" is a close match to the Laurillard level of personal experience and action on tasks. But an analogous interaction at the conceptual level is also in that model, where the learner gets feedback on their attempts to express and re-express the concepts and descriptions being learned at that level. So I think progress will be served by applying Gibbons' approach to the full Laurillard model.
30 Apr 96
Ron Oliver

Your [Draper's] criticism of learner-centered education seems to come from a very narrow view of what is meant by this and other related modes of teaching and learning. Learner-centered instruction relies heavily on the presence and influence of a teacher and in all instances, the teacher is extremely important. Whether the level of importance is equal is something people on this Forum could take years to decide. The teacher's role is extremely important in constructivist learning environments in planning, designing and implementing the required learning opportunities. The role of the teacher is different, but not less important.

While I think the conversational model of learning has many strengths I don't think you can justifiably argue that it is the only way to go. It seems to me that in the hands of the wrong person, a learning environment based on the conversational model could go as badly wrong and attract as much criticism as any other poorly implemented model of teaching and learning. And then we would all be arguing again on what the next best model would be.

Ron Oliver, Senior Lecturer
Department of Library and Information Science
Edith Cowan University
2 Bradford S
Mt Lawley, 6050
Western Australia

Phone: 09 370 6372
Fax: 09 370 2910
E-mail: r.oliver@cowan.edu.au