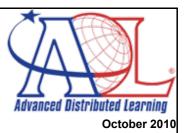# ADL Newsletter for Educators and Educational Researchers

Advanced Distributed Learning for Educators and Educational Researchers   **October 2010**

Constructivist Pedagogy Is Superior – It Is a Matter of Definition

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A Constructivist's Creed

I am an educator, who considers himself to be a constructivist in terms of thinking about teaching and learning. I am strongly committed to (what I understand as) constructivist principles for making sense of learning (Taber, 2006), and I accordingly believe that effective pedagogy must be informed by constructivist thinking about learning. I do not think that we yet have a fully worked-out theory of what good constructivist teaching is, but we are making progress in that work. Certainly in my own area (of science education) I'm confident that we have the basis of a progressive research program to develop better pedagogy (Taber, 2009b). Given my acknowledged (or as some might consider, admitted) position, I assume I have been invited to contribute to the debate about constructivist instruction versus direct instruction (Tobias & Duffy, 2009) as someone seen to be in the constructivist camp. I am certainly happy to defend a constructivist position. However, as a good constructivist, I must point out that the understanding of constructivism I would wish to defend must be the one based on my own personal construction of what constructivist pedagogy is.

David Klahr (2010) prepared a response to my review (Taber, 2010) of the Tobias and Duffy edited volume on Constructivist Instruction (Tobias & Duffy, 2009), where he offers some useful observations on my own reading of that collection of chapters. Klahr makes a number of helpful points, that contribute to the discussion. I have been invited to comment on Klahr's response, and I hope to do so in a similar vein: not seeking to simply dispute Klahr, but rather to respond in a way that facilitates (rather than seek to close down) dialogue.

Paradigms in Physical Science and Social Science

In my own review I argued at some length that in reading the various contributions in the Tobias and Duffy volume, I felt that the proponents of constructivist teaching and direct instruction were talking across each other, as though representing two incommensurable Kuhnian paradigms. Klahr points out, quite rightly, that in the physical sciences such situations tend to be settled with the championing of one paradigm over another – so the oxygen theory defeated the phlogiston theory. Indeed Kuhn's argument was that most of the time, in 'normal' science, there is only one camp to join, and the scenario of competing paradigms is limited to those

response led to an interesting, spirited email exchange of views about constructivist and explicit instruction among some of the volume's authors.

A bit of the ensuing discussion is reproduced in this issue. It begins with Taber's article, reproduced on the right, reacting to Klahr's Education Review piece. The discussion continues in this issue with John Sweller's response to Taber. Sweller, the originator of cognitive load theory, is a leading critic of constructivist approaches to learning and a proponent of teaching problem solving with the use of worked examples. His comments suggested that perhaps our conversations had narrowed some of the differences in this controversy. The Taber and Sweller pieces reminded me of some findings in clinical psychology, described in my short note below. All of that began to sound like we were reaching some kind of consensus between constructivists and their critics, until Klahr points out that things are not so rosy and there is still a lot of work to be done. Finally, Sweller's and my brief responses to Klahr are reproduced in this issue.

Surely, there is a lot more to be said about constructivism, explicit instruction, and the other issues addressed here. I welcome hearing your comments/reactions/ or suggestions so that we can consider publishing them in future issues.

As always, please send me

rare times of revolutionary uprising (Kuhn, 1996). Eventually the empirical evidence becomes overwhelming for one view, although it may be that the time and effort involved in learning to see the greater merits of the other side means that even great scientists like Priestley can nail their colours to the wrong mast and go down with the ship (Thagard, 1992).

In the social sphere, however, such decisive victories are harder to come by. There are many Marxists, despite some-well known and rather major failures of the Marxist experiment. There are also many Freudians, despite the documented failings of that system. Piaget seems to be alive and well in some enclaves of academia, despite his central ideas being considered long-refuted in others. So, whilst I agree that in the natural sciences paradigm wars tend to be relatively short and clear-cut, this does not seem to be so in the social and human sciences.

A Constructivist Perspective

It may seen strange that an empirical scientist such as Joseph Priestley was throughout his life able to continue to judge the phlogiston theory as superior to the alternative chemical framework developed by Lavoisier (Thagard, 1992). We cannot explain this as some aversion to radical new ideas: Priestley was hounded from Britain for his support of revolutionary France (whereas it is well known the chemical revolutionary Lavoisier was executed there as an enemy of the revolution!)

Yet to someone who thinks about learning in constructivist terms, this is not so strange. We all see the world through the biases of the cognitive systems we have iteratively built through our life experiences, and although change is certainly possible, it is neither easy nor readily identified as necessary. We each construe the world in our own way, and so can often (like Priestley) make sense of a great deal of data in terms of our existing interpretive frameworks (Thagard, 1992) - it may not be easy to appreciate why it would make sense to seek a different perspective.

We know there are built-in biases in the human perceptual system: we can stare at optical illusions and still see the illusion although our rational functions are telling us that what we are seeing cannot be so (Gregory, 1997). If that is the case when we know our percepts are misleading, how often are we unaware of such biases in operation? Natural selection has equipped us to survive, and that seems to have been furthered by a limited working memory which makes it easier for us to give priority to existing ideas (Sweller, 2007), and the ability to develop quick-operating pattern recognition processes that act at a preconscious level (diSessa, 1993). Of course we can learn to see beyond, and even to modify, our mental frameworks (Popper, 1994), but presumably in the environment in which most of our ancestors lived there was an advantage in not doing so too readily.

Effective teaching has to take these biases into account. However, that is quite a challenge. Intuitive theories about force and motion seem to readily survive teaching (McCloskey, 1983); teaching analogies that base chemistry on social interactions between atoms become adopted as strongly held commitments (Taber, 1998). When teachers demonstrate that current is conserved around a circuit, seeing may indeed be

any comments, questions, or suggestions and they will be considered for inclusion in future issues of the Newsletter.

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Prior Articles:

About CORDRA (Dec. 2006).

ADL Introduction (Jan. 2006).

ADL Instructional Objects for Educational Use (April 2007).

ADL Object Registry and Repository Infrastructure (Feb. 2008).

Constructivist & Explicit Instruction Debate Followup (April 2007).

Constructivist & Explicit Instruction Debate Postscript (Sep. 2007).

Effectiveness of Web Based Training (April 2006).

E Learning and ADL in Korea (April 2006).

Games for Learning and Weak Vs Strong Instructional Guidance (Sep. 2006).

Games, Learning, and Society Conference (Sep. 2006).

KERIS Introduction (April 2006).

Kirschner et al. Discussed by Rosenshine (Sep. 2006).

Kirschner, Sweller, Clark Paper Discussion (Sep. 2006).

Knowledge Economy,

believing; but later, pupils may remember being shown that current decreased around the circuit (Gauld, 1986). As a result of a considerable amount of work on student thinking and learning, and their responses to teaching, science educators have come to accept that simply telling students what we want them to know seldom works when we want them to understand abstract scientific ideas (Taber, 2009b). Constructivist pedagogy needs to provide extensive personal exploration of ideas, and – at least with most school age children – opportunities to engage in argumentation and dialogue about their ideas with other learners.

The Problem of Definitions

In his commentary, Klahr picks up on my comments about how the different sides in the debate about direct instruction and constructivist teaching are unlikely to be able to have a useful dialogue whilst they are not even able to agree about what constructivist teaching is, or the nature of the most important learning outcomes that might be used to compare different teaching approaches. Klahr is quite right to chastise me for being negative here, and I would not wish to deter any useful dialogue between the camps which could help move forward our understanding of what makes good teaching.

However, I do reiterate the problem, as I think it is a rather severe constraint on making progress in the debate. For example, it is easy to find peer-reviewed research published in journals which claims that constructivist teaching is more effective than more 'traditional' approaches. Lord (1999, p. 27) reports how "in an environmental science course intended for non-majors" students who received "constructivist-styled teaching...outperformed their control group colleagues on all of the unit exams on the material". For Lord the constructivist teaching was student-centered, and contrasted with 'teacher-centered (traditional) classes', but I wonder if adherents of direct instruction would accept such classes as examples of what they are advocating? This example could be repeated many times over.

Despite being a constructivist, I would be very critical of some of the studies I have seen 'demonstrating' the superiority of constructivist approaches: some of this research completely ignores the possibility of expectancy and novelty effects. (For example, the researcher may teach two classes by two different approaches, as a form of 'control', completely ignoring his or her own prior assumptions about which approach will be more effective!). It is easy to be critical, but some of these potential effects are difficult to allow for. Teacher and pupil beliefs about what is good teaching, and what makes for something interesting and out of the normal, are going to play a part in how much is learned in any comparisons we might want to make.

Klahr (2010, p. 3) is well aware of the difficulties of pinning down what is meant by constructivist or direct instruction, but more optimistic about making progress through studies that can acknowledge the complexity of teaching and learning. Perhaps. He cites three examples of "the comparisons with which I am familiar [where] the contrasting instructional approaches are combinations of features". One of these papers reported that "various findings across 138 analyzed studies indicate a clear,

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positive trend favoring inquiry-based instructional practices, particularly instruction that emphasizes student active thinking and drawing conclusions from data" (Minner, Levy, & Century, 2010, p. 474). These authors conclude that "teaching strategies that actively engage students in the learning process through scientific investigations are more likely to increase conceptual understanding than are strategies that rely on more passive techniques". I read that as a clear advantage for constructivist pedagogy: but I wonder if those in the direct instruction camp consider their approaches as passive techniques?

A second study Klahr cites found that learning gains were greater when students experienced both an interactive lecture and group-work, than just the lecture, or just the group-work (Lorch Jr et al., 2010). Moreover pupils just receiving the lecture outperformed those just doing the group-work. The subject matter was control of variables. To my mind, a combination of an interactive lecture and group-work seems a strong constructivist teaching approach (Taber, 2009b). We know that most youngsters have problems setting up combinations of conditions to test variables, so why would anyone think that group-work not supported by strong teacher input was likely to be an effective basis for pedagogy? That does not seem like a sensible constructivist strategy.

Similarly, the third study Klahr cites reports that "many more children learned from direct instruction than from discovery learning, [and] also that when asked to make broader, richer scientific judgments, the many children who learned about experimental design from direct instruction performed as well as those few children who discovered the method on their own" (Klahr & Nigam, 2004). Again there is little here to worry the constructivist teacher. Part of the impetus for the international constructivist movement in science education was the recognition that students find it very hard to 'see' what teachers want them to in practical work, as they interpret their observations through their existing conceptual frameworks (Driver, 1983). The constructivist science teacher would expect most pupils to learn more from a skillful teacher exposition than from being left to discover scientific ideas for themselves. Minimally guided discovery learning was discredited in the UK at the end of the nineteenth century, and no genuine constructivist teacher should expect it to work in the twenty-first. As I have pointed out before, it is quite false to associate constructivist science teaching (as understood in many parts of the world) with discovery learning,

> "an effective constructivist science education is neither teacher-centered, nor student-centered, but rather is focused on the interaction between teacher and students. The typical constructivist classroom involves students in much mental (and sometimes physical) activity, and in particular in much dialogue. There are periods of eliciting and exploring student ideas, but there are also periods of teacher exposition. The teacher structures activities, and scaffolds learning, but is constantly checking for student understanding and seeking to link teaching to student interests and thinking" (Taber, 2009a).

Open-ended, minimally guided, discovery learning is not a modern

constructivist approach. Constructivist pedagogy is quite distinct from either 'direct instruction' or 'discovery learning' because it is not about presenting preformed knowledge, nor about letting learners find out for themselves, but rather guiding students towards accepted knowledge in ways that take into account their starting points and personal ways of making sense of teaching (Taber, 2009a).If the adherents of direct instruction wish to claim that actually describes what they are doing, then any meaningful distinction evaporates, and we are just all involved in developing good pedagogy!

A Way Forward

I suspect I have few substantive differences with Klahr, or indeed many of the proponents of direct instruction. I doubt many of them want silent rows of passive children listening to an uninterrupted and unquestioned teacher voice, any more than most constructivist educators want young people to have to rediscover all human culture from first principles for themselves. I suspect that in practice we all want a healthy mixture of teacher input, and pupil activity; we all want to develop pedagogy that works with the characteristics, limitations and biases of the human conceptual system; we all want school learning that balances learning about currently accepted knowledge, and developing imagination, critical thinking, and argumentation skills; we all want individual learners who can demonstrate by themselves that they have learned things, but are also able to work cooperatively in groups. As Klahr points out: we all value learning that transfers beyond the immediate study context.

Where I perhaps disagree with some other colleagues, is how we proceed to develop effective pedagogy. The constructivist-direct instruction characterization is a false dichotomy, and trying to operationalize something as complex and contextually varied as teaching in such simplistic terms seems to me a mistake. What is needed is not coarse labeling of artificially grouped approaches to instruction; but an iterative program of studies that enables us to better characterize specific features of effective teaching in different learning contexts. Indeed, I have argued that to some extent, such a program is already underway within constructivist work in science education (Taber, 2009b) - but that may not be how some people wish to understand constructivism.

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Consensus?

John Sweller
University of New South Wales

If the common view of constructivism now matches Keith Taber's views, then there is nothing to debate. For me, his critical sentences are: "The constructivist science teacher would expect most pupils to learn more from a skillful teacher exposition than from being left to discover scientific ideas for themselves. Minimally guided discovery learning was discredited in the UK at the end of the nineteenth century, and no genuine constructivist teacher should expect it to work in the twenty-first. As I have pointed out before, it is quite false to associate constructivist science teaching (as understood in many parts of the world) with discovery learning." "Open-ended, minimally guided, discovery learning is not a modern constructivist approach." If there is no longer an objection to explicit instruction then, as far as I am concerned, we have a consensus. Having spent 25 years being alternately ostracized or ferociously attacked for demonstrating that students can learn more from studying worked examples than solving the equivalent problems, that consensus would be more than welcome. Regretfully, I am still not at all certain that Keith Taber's views are widely shared. I hope they are.

Paradigms, Experts, Novices, and Lessons

Sigmund Tobias
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In the articles appearing above Taber, who identifies himself as a constructivist, and Sweller, a well known critic of that paradigm, appear to reach some consensus about what a good lesson should consist of. That reminds me of some research by Fiedler (1950) conducted more than a half century ago. My graduate work was in clinical psychology, and at that time there was a controversy between different styles of psychotherapy, i.e., Rogerian non-directive, Adlerian, or psychoanalytic psychotherapy. Fiedler asked expert and novice (though he did not use those terms) practitioners from various camps to rate the effectiveness of psychotherapy sessions. He found that that there was greater agreement between experienced practitioners from opposing camps than between novice and experienced practitioners in the same camp. Fiedler's work

preceded the wave of expert-novice studies by about two decades. His findings suggested that experts, irrespective of theoretical orientation, were in substantial agreement about the essential characteristics of psycho therapeutic practice. I hope someone does a similar study using videotapes of lessons. They could get lessons rated by highly experienced and novice teachers from both the constructivist and explicit instruction camps. My prediction is that there will be greater consensus between experienced instructors of differing camps, than between novice and experienced instructors in the same camp. If these predictions are verified, the results could usher in research to identify the essential features of lessons, followed by studies about the generality of such features across different student age groups, or student and teacher characteristics.

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More Research Needed

David Klahr
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This discussion is drifting in precisely the wrong direction. Rating tapes of classroom teaching would tell us something about instruction, but not about learning, and isn't that ultimately what we are interested in? That is, the focus should be on the output, not the input. It is certainly a non- trivial task to specify some assessment criteria for when kids are learning and when they are not, but the difficulty of the task is not an excuse to keep focusing on the wrong end of the process. I'm afraid that we will be blathering at one another to no avail until we start to do the hard empirical work of figuring out what our instructional objectives are -- that is, what do we want kids to know -- and to what extent do they know it after our instructional interventions. This is not an easy task. For example Minner, et al (2010) just reported on a major effort to assess the effectiveness of "inquiry-based" instruction. While I could fault many aspects of their assessment methodology, their paper is a rare example of explicit, detailed, and replicable procedures for defining and assessing different aspects of inquiry-based instruction and its effects. It is a very rare bird in the rhetorical hothouse surrounding constructivist discussions. We need many more such efforts in the hope that ultimately, the signal will emerge from the noise.

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Sweller & Tobias Agree

Good point. The input should depend on previous experimental outputs. Theories permanently without data are next to useless and that applies equally to instructional procedures as to any other area.

John Sweller

Point well made. It should be noted, however, that if results show that constructivists and their critics agree on the characteristics of lessons, succeeding research could identify learning outcomes for different types of lessons. Wouldn't that be exactly the type of emphasis Klahr advocates?

Sig Tobias