Learning and knowing with artifacts

an interview with Donald A. Schön

by Thomas Binder

Donald Schön is professor emeritus and senior lecturer at the Department for Urban Studies and Planning at Massachusetts Institute of Technology. He has taken active part in the debate about professional competence and professional education. In his book: *The reflective practitioner* (Basic Books, 1983) he rejects the idea that professions such as Architecture, Medicine or Law can be seen as applied sciences, and argues in dispute with a.o. Herbert Simon that the professional constructs competent action through engaging in conversation with a problematic situation. He develops his core concepts of knowing-in-action and reflection-in-action further in the book: *Educating the reflective practitioner* (Jossey-Bass Publ., 1987). In this book he delivers a strong argument for, why teaching is basically impossible. He demonstrates through a number of case studies from architectural education how coaching is the only workable approach to professional education, because learning must always stem from the learners personal encounter with the problems of the profession. In dealing with the issue of learning with artifacts one of the very interesting things about Donald Schön’s work is that he directly addresses the question of how the individual engage with the physical world around him. I started the interview by asking him if he could think of learning that takes place without engagement with the physical world?

DONALD SCHÖN: It is very interesting to think of learning or thinking without objects. For example, I often find it very important for me to be able to picture things: to make diagrams to show relationships. When I think without objects, then my impression is that I am trying to recreate in my mind the experience of having them still, as a kind of: holding them in my mind. So I would say that learning with objects, if you include diagrams as objects, or pictures as objects, may be a kind of prototype for learning without objects, since I seem to be trying to reproduce that experience, when I am deprived of the things which I need to anchor my thoughts.

Take this experience that the thought gets away from you - you can't hold onto it? It's a very strange thing, because you are trying to control something which is not quite controllable.
Even if you could control it, you wouldn't want to control it completely, because if you control it completely, you never get anything else than what you were using to control it with. I think the conversational metaphor is a good one for what's going on here. You want to let the object control you, in a way, at the same time as you're trying to control it. I think that's not unlike my experience with thought. When I was much younger, I was very interested in invention, trying to understand more about creativity and invention, and I was myself an inventor in a small way. I worked with a group of technologists inventing products and I remember paying attention to my wanderings and fantasies, and discovering that fantasy was very important. Having fantasies of doing things often became the basis of suggesting the directions that I would pursue, or other people would try to pursue.

What I'm fishing for, I think, is a certain kind of experience of being engaged with something. To be making a diagram and paying attention to the diagram could be an example. Playing a piano, when you're trying to learn a piece, that's also an example. And so is trying to think something through when you don't have anything to think with, an example. They're all examples of this process of engaging with something, seeking to control what happens when you do so, but being unable to control it, and not wanting to control it fully. Hence the power of the image of your conversation with that 'something' came out: creating the diagram, engaging thoughts, which you partly control and partly allow to control you, ...leaving room for surprise, and the metaphor of the conversation as knowing that what you are engaging has "its own mind", seems here to me to be very powerful.

THOMAS BINDER: When we talk about things to think with or engaging with objects, someone could hear it as a purely cognitive issue. But is it not so that objects in e.g. the educational setting actually transport or convey important aspects of the competence that we are trying to acquire.

DONALD SCHÖN: I have two thoughts in response to what you are saying. One is that if you ask the question, "where is knowledge?", one answer is: it is in the objects. In other words: where is your knowledge about how to operate that video recorder? In your head? In your hands? It is when you actually touch it and position it and look at it and move it that you get access to what you know. If I'm typing, and if you ask me the question, "Where is the T?" I may have a hard time telling you. But if I'm beginning to type, I go through the actions, I get access to the knowledge. And ah... I get access to it in the sense that I could perhaps not have told you ahead
of time what I know. And if I think about a typewriter, that's a kind of discrete object in front of me. If I think about a setting, like this office or like this corridor, or like MIT as a setting, then engaging with the object is more like engaging with the environment. I know how to negotiate this environment, it's not strange to me. Now, I remember, when I once spent a year in Israel, the strangeness of the place, and my not knowing how to negotiate it, and not having the sort of "unthinking conscience" about how to deal with it, that was very troublesome. It took time. Six months actually, for me to get to the place where this relationship with the setting was evoking what I knew.

That's one whole line of thought that comes out of your questions. If you ask: how do we design artifacts to promote learning?, one starting point is to say, "How do we understand the way people hold knowledge to begin with?".

The other line of thoughts that your questions stimulate in me, is this issue of how learning happens as a result of commerce with an artifact? And specifically, commerce with a computer program. I find that the people who write computer software with the aim of promoting learning have a peculiar blindness about what they do. For one thing, they tend to over-value their intentions. They tend to assume that the meaning of the object is what they intended it to be and that its capability of generating learning is what they take it to be. In Project Athena at MIT, we studied two programs that were called, Computer Aiding Teaching Systems. Both of them are based on the use of finite element methods, and both of them are related to statics and teaching statics.

The one was seen by its designer as a teaching program. It was designed as an intelligent tool so that if you came to it, it would ask you a series of statics problems and if you didn't produce the right answers it would stop you and give you an explanation and ask you to do it again. The other program was not conceived as a teaching program at all, it was conceived as a design tool. You had a screen, you could draw a structure on the screen, like a truss or a bridge, and if you did, you could then specify what material it is made of, what are its dimensions and what is the loading? Then you could "load it" and you could observe it deflecting. You could also see shear diagrams, and all that would happen very quickly. You could re-design and iterate very quickly. The effect was that when we interviewed the students about these two programs, with the first programme - the so-called intelligent tutor - the effect was that the students here at MIT found it very boring, very dull, and they subverted it, so that instead of coaching them, it just gave out the right answer. And then for the second program, which was not intended to be a
teaching program, a third of the students we interviewed, said that it showed how they really learned. For example, they would set up a structure like a bridge, they would load it and they would be surprised by what happened. Like they might say: it got stiffer when I took material away. How could that happen? How could it get stiffer when I removed something? And that would make them think about it and try to build hypotheses and test the hypotheses by redesigning the construction. One of the students said, "I took the basic static course, and I understood all the formulas, but I never understood the structure, the behaviour of structures until I tried this" So, for many students - about one third of those who interacted with the design tool - that turned out to be an extremely educational program. It enabled them to get surprised in terms of what they expected as they designed, and then to raise puzzles about the phenomenon, and in order to resolve these puzzles, they had to re-think the meaning of the formulas they had learned. And the program had not been designed to do that. So it isn't so much a matter of humility on the part of the designer, as blindness to anything that falls outside of his intent.

Another example, someone had designed - this was in Israel - a program to make rooms. There were pieces of furniture. Each one had a sort of view of it in plan and then you had to set that into the room, meeting certain criteria. It was seen as educational, and what they were focusing on was how you went about the process of solving the problem of design. You had to get all of these pieces in there, and the space and the shape of the space constrained you, as to how you could do it. But there were other issues in the program. For example, seeing the meaning of certain objects in plan. And seeing if that was a chair, or if this was a chair - the idea of looking at something represented in plan and seeing what it means in terms of the object seen when you are face to face with it, turned out to pose a real difficulty for the students.

THOMAS BINDER: a difficulty so great that the application did not work?

DONALD SCHÖN: For some. But for others the difficulty was great, but they could overcome it, in other words, so that they could get to the place where they could learn, that this is a chair. But that learning was not included in what was build into the software. The program was not seen as being about that. It was seen as being about something else.

THOMAS BINDER: And do you then think that it would have been worth while to address that directly?
DONALD SCHÖN: What I think is that the software designer needed to take the view that he didn’t know what he had until he found out what they made of it. He should have been interested in the question of what do they make of my stuff - and he should have been aware that the object is not anything until the users make something of it. What’s there depends on how the user calls it. The meanings constructed by the user are the key things you need to worry about.

THOMAS BINDER: But the programmes seem to make some kind of educational sense for you after all?

DONALD SCHÖN: It makes some sense, but I think it is very important to try to discover what sense it makes; and that is where the blindness that I thought I was detecting among the designers seems to be. One of the things you’re doing, when you think about the computer as creating an environment in which you could learn to do something, is that you are saying that we are talking about the computer, or especially the computer program, as an artifact. You’re deliberately blurring the distinction between the real world and the computer world. You’re saying: that representation of a room is a room. That representation of a chair is a chair. But it is not a chair. It is not a room. It is a representation of a chair. A representation of a room. And therefore you have all of these issues about representation, both what representations can capture and what they can’t capture, and what it means to interact with a representation vs. what it means to interact with the “real” stuff. That doesn’t mean to me that it’s not a promising enterprise. It just points you in the line of certain things to think about when you pursue the enterprise.

Take the diagrams which I find so useful: You make a drawing [constructs a diagram] and you say: well, here we are on this project, and we have these clients. And here’s the boss, and then we have these two engineers, and there’s a marketing person and he’s a little bit further away, and here we are. Now, if we do that, we can say, well, what kind of a relationship do we have with him? But is it not important that this is the person who has a very strong linkage, and this one not? And if that’s true, what is our relationship with these people, and why are we ignoring him? So the diagram immediately engages you with a set of relationships which it evokes only because of its presence as marks on space.

THOMAS BINDER: And by taking that example, you’re also saying that this issue of representation is not a question of creating an illusion. When you point to the diagram, you say
that one of the important things is not that it creates an illusion. The important thing is to acknowledge that it is a representation and to see what we can get out of it.

DONALD SCHÖN: Yes, I think there are a lot of things you could say about that. One of them is that it leaves almost everything out. There's almost nothing there, which is why it's good, because then I can deal with it. Another thing is that just by being in space - two-dimensional space, it has a kind of - you might say grammar, you might say logic, or you might say, physical structure, as though it were a field of forces. So that whether I wish to or not, certain ideas and questions come to mind. For example, once I make these two things and I give them a referent, I say: that is the box, this is us, we are entering into the post office, what is the nature of our relationship? Okay, then this spatial relationship [between actors in the situation] immediately comes up. You might then even say: Shouldn't we be closer? So that the idea of the amount of distance is there, the spatial distance signifying some social distance - it's all there. You don't have to invent it; it's there for you. So the fact that he's over here, and there's some kind of an obstacle, some kind of a boundary, a barrier between him and the rest, that idea of a barrier or boundary is there. If you have a boundary, you also have a possibility of penetrating the boundary or going around the boundary, that's also there. The size of these things, signifying importance; what kind of importance is there? You see, everything is there the moment you put your pencil to the paper. And that's extraordinary. Not only is it all there. It will stay there. It is in time in the sense that I apprehend it in time. But it stays there for me. I don't have to work to hold it steady. I have to work to change it.

THOMAS BINDER: My last question concerns the process of designing artifacts for learning. Do participatory design approaches in your view make sense here?

DONALD SCHÖN: Maybe the issue should rather be participation and conversation and the difference between those things.

THOMAS BINDER: In what sense?

DONALD SCHÖN: The movement toward participatory design, I think, really did have a Scandinavian origin. Or: It didn't have a Scandinavian origin, it had a Scandinavian flowering after World War II, through the Tavistock Institute and in places like Norway where Einar
Thorsrud's work was important, as well as in Sweden. And there, it had connotations of industrial democracy. It was definitely a political act, maybe as I think about it now, as a reaction against the authoritarianism of the fascist regimes. The notion of participatory design, or collective design, or co-design says something about the formation of governments. It's a microcosm of the creation of the state. You want to create a social world of designers, so you have all the issues that a state has: Authority, how is it exercised; power, how is it contained; control, how is it distributed; justice, how is it managed, how is it protected; goods, how are they distributed; reward, who gets them; competence, where is it, how do you find it - I mean, all of the issues that Plato's "Republic" presents are there in the problem of managing participatory design. I think that helps to explain why most participatory design exercises have not been of durable satisfaction.

THOMAS BINDER: But you mentioned earlier that the designers seemed not to be paying enough attention to how the artifacts were actually used. Couldn't that call for some kind of participatory process?

DONALD SCHÖN: Well, I was trying to make a distinction between the conversational approach to designing and the participatory approach to designing. They are not the same. In other words, if you are designing a video camera, and you are concerned with a lot of issues about how people will actually use it, what it will mean to them, how they'll employ it, how the design of the artifact will support or fight against the kind of uses that people will actually want to make of that, what features are there that will be seen as precious or endearing or as problematic or ugly - if you want to address those issues, you will need to be in conversation with users. In conversation in the literal as well as the figurative sense of the word conversation. You'll need to be understanding of what it means to them, how they perceive it, what they do with it, how it fits in to their world - as you say, how they appropriate it as part of that process, how they make sense of it, how it is in their hand and what they think about it, and so on. You can get that through conversation, including wordless conversation. You can get it by observing what people will do with it and then thinking about what you observe - perhaps feeding back what you observed; remaking, reworking your artifact perhaps using rapid prototyping that enables you to rework in response to what you think you are learning from going back to the people, who will be using it. This is what I mean by conversational design. Participatory design is something else. Participatory design says: Now you try to create a group. Maybe the group includes those who will use the object. You want
them to become designers. That means you want control over design to be shared. You want design to be co-constructed and co-managed.

THOMAS BINDER: And so, to my question: what is called for in the process of designing artifacts for learning, you're saying that we definitely need a conversational approach, and then you leave it open and say that, well, talking about participatory design is in your view something beyond that.

DONALD SCHÖN: Yes, it's well beyond that. And I think it poses a set of issues whose depths goes beyond what the participatory designers were usually prepared to cope with.