

## Towards a New Learning Science *for* the Reinvention of Education A Trans-disciplinary Perspective

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**Abstract:** At first the question will be addressed why a new learning science is needed. The field of education may be considered as an uninventive discipline, still waiting to become a real science. History has shown the general problem of social sciences to become scientific in its method and approach. Various authors have emphasized the crisis we are in as a result of this historic development. It is a crisis one seems not very much aware of. Actually it is a crisis which is neglected. To escape this situation we really have to reform our thinking (Morin, 2001). This is also true for learning and education. Actually a rethinking of educational psychology seems needed (Bruner, 1996). Only then it will be possible to get “closer to the complexity of the actual world” (Dennett, 2003). The real challenge is to escape dear old habits of thought about learning and education, and shift the focus. In trying to build a new science of learning for education it seems necessary to take a complex, trans-disciplinary approach. This approach implies a shift of paradigm. The shift needed leads to a fundamental process of rethinking: not only of interaction, but also a rethinking of the concepts of complexity and causality. Interaction, then, may be described as a complex, potential nonlinear process. All of this rethinking can lead to a fundamental reinvention of the reality of learning and education (Jörg, 2004). Learning, then, may be described and explained anew as complex, causally connected processes of inter-action between learners and intra-action within each learner. It can be shown that these connected processes, may generate potential nonlinear effects in time. Learners, then, may ‘bootstrap’ each other in time. The focus is on the ‘transitory child’, and the unexpected complex process of developing in time of that child. The new learning science may be the foundation stone for a new interactive, generative, and transformative pedagogy.

**Keywords:** learning science, paradigm, interaction, trans-disciplinary, nonlinear

### Introduction

The question “How people learn?” is still an open question (see Bransford et al., 2000). The answer is open as well. Actually there is not a single answer. On the Internet one can find more than fifty theories of learning (Atherton, 2006). One may wonder why this is the case. What does this situation may tell us about the nature of learning and about the science of learning? The question “How should we study learning?” seems to be still open as well! It is, therefore, no surprise that the formulation of an adequate science of learning is still lacking. One may speculate about the reasons for this rather awkward situation (Jörg, 2005). The main reason seems to be the lack of recognition of the complexity of learning in the field of learning and education. This lack of recognition has, of course, also elements of denial of that very complexity. The science of learning was not able to deal with all of the complexities involved in the practice of learning. It is also this very complexity which may explain why so many theories of learning have evolved in history. Many of them looks very adequate at first sight. The science of psychology, i.e. of educational psychology, seems not able to be corrective in the development which has taken place on this subject of learning. Actually the field of education may be regarded as an uninventive discipline. History has shown the general problem of social sciences to become scientific in its method and approach. To escape this situation we have to really reform our thinking (Morin, 2001), and open our minds. Only then, we may be able to get “closer to the complexity of the actual world” (Dennett, 2003); the complexity which is *real* (see Axelrod & Cohen, 1999). But what do we

*really* need to be able to develop a more adequate theory of learning. Or, even better: what do we need to develop a new science of learning *and* education? This is also the very question and ultimate goal as formulated in recent reports of the Organisation for Economic Co-operation and Development/Centre for Educational Research and Investigation (OECD/CERI, 2002), the American National Academies of Sciences (NAS), and the Dutch Organization of Scientific Research (NWO). Actually these questions go back to the basic question of what a science is really about? (Chalmers, 1982; Kuhn, 1970) This is a question which cannot be easily answered from the field of the very science itself, as Kuhn has shown (1970). Science may be myopic in its operating as activity and/or become the victim of a kind of imprisonment of meaning. The field of science may, however, develop an awareness about how adequate a science really operates in the field. Scientist in the field may ‘simply’ recognize its shortcomings, and notice its blind spots. In a sense, one may speak about the blinding of paradigms itself (see Morin, 2001). As a consequence, one can even become aware of the ‘self-inflicted wounds’ of how a science operates in a field (see Burkhardt & Schoenfeld, 2003). On a higher level, from a trans-disciplinary perspective, one may recognize how a science operates in the field of *all* the sciences. This brings us to the paradigmatic question, linked so strongly to the problem of the connection between science and reality. Are we, as scientists working in a field of science, able to think and talk about the paradigm in use? More importantly: why should we do so? And would such thinking and talking possibly lead to a change: to a paradigm change, or even to a system change (see Chalmers, 1982)? In this paper a vision of the possibility of such a new system of a new science will be given, i.e. of a new learning science. This challenge is fully in line with the aims as proposed by committees of the OECD, NAS, and NWO, mentioned above. The vision presented in this paper is, because of lack of space, a programmatic vision, limited to the social sciences. The focus is mainly on the fundamental conditions, and the building stones for a new science of learning.

### **Framework for a new science of learning**

Speaking about science it is somewhat unusual to speak about the limits of a science. Being too busy with ‘normal’ science (Kuhn, 1972), most scientists evade a discussion on this topic. It is not experienced as very practical, which is very true in one way. But, at the same time, not having a discussion on these limits does not mean or guarantee that the science one is involved in will grow incessantly (cf. Chalmers, 1982). History has shown rather dramatically that this is not always the case. On the contrary: one may easily discern the limits of our sciences at different places in the history of science. Chalmers states openly that research programmes may be *degenerating* because “they persistently fail to lead to the discovery of novel phenomena” (Chalmers, 1982, p. 80). It seems even a characteristic of science operating as usual, of what Kuhn has characterized as ‘normal science’, that a fundamental innovation is excluded from such a normal science: “Normal science does *not* aim at novelties of fact or theory and, *when successful, finds none*” (Thomas Kuhn, 1970, p. 52; emphasis added). Consequently, one may say, therefore, that the science itself is ‘simply’ *not* able to aim to the innovation needed. One may, partly, ascribe such a lack of innovation to the scientists themselves: to the fundamental problem that “a typical normal scientist will be unaware and unable to articulate the precise nature of the paradigm in which he/she works” (Ibid., p. 93). On a more basic level one may ask what reality may mean for a scientist: for his operating as a scientist in the field of a science. This is a philosophical question. A question which is really basic for a field of science and the scientists operating in that field. It was the Russian psychologist and philosopher Lev Vygotsky who stated that to be a scientist, one should be aware, that a first principle of a science is “the principle of [what is] the real” (Vygotsky, 1926/1997a, pp. 328-329). However, what happens in practice is, that

one seems to fix a perspective on reality (Saljö, 2002). Not being aware of this situation may lead to what Piaget has described as ideas and thinking of scientists which could be characterised as containing *unquestionable* beliefs (Piaget, 1928, p. 232), and their understanding as *un-analytic* (Ibid., p. 228). The situation nowadays seem not very different from Piaget's in his days. Most scientists have no clear idea of the link between science and the philosophy of science. So, it may seem still to be true that many scientists do not realize that "There is no such thing as philosophy-free science; there is only science whose philosophical baggage is taken on board without examination" (Dennett, 1995, p. 21). It seems true as well that "The absence of a philosophy is itself a very definite philosophy" (Vygotsky, 1987b, p. 80). As a consequence, scientists in the field concerned may get imprisoned in meaning, operating as a community, not being able to escape their ideas and habits of thought. The science and the scientists in such a community, then, not being able to fundamental innovation, may show the seemingly inevitable process of degenerating in time (Chalmers, 1982). A process of degenerating, leading to deadlocks, as shown for example by the conceptual deadlock in the study of consciousness (EUROCORES Programme, 2005).

At present, it seems that the situation in the field of learning and education is one of real confusion. This situation has recently been described eloquently by David Olson: "while practitioners complain that research findings lack direct applicability, theorists *despair* of integrating them into any general *explanatory* framework" (Olson, 2003, p. 21; emphasis added). According to various scholars one may even speak about a crisis in the field of (educational) science (e.g. Westland, 1978; Egan, 1997; Vygotsky, 1926/1997a; Vygotsky, 1986, 1987; Olson, 2003). A crisis which is there already for a long time (Vygotsky, 1926/1997a). A crisis which is a crisis of different specialized scientific disciplines (Olson, 2003, p. 6). Starting with this very crisis, one may wonder if this is the pre-paradigmatic state education is in at this historical moment in time (Olson, 2003, p. 6, referring to Kuhn's view on scientific revolutions). Maybe unexpectedly, and surprisingly for a 'normal' scientist, this could be the very condition for a change of paradigm. Are we at this moment really at a point of a rather dramatic historical change of our science? Would it be possible to have a new framework, an explanatory framework, as a foundation for a new science, the science of learning and education, which is able to 'solve' the very crisis of our time? A new science which enables the possibility to escape old ideas and habits of thought and offer a solution for the different perspectives, the unsolved problems, the blind spots and myopia of the different disciplines of our days? How would such a change look like? What would be the conditions and implications of such a change? How could this change of paradigm take place, be fostered by scientists? It is clear that you cannot design a paradigm change, in the same way that you cannot design evolution. It may be clear, therefore, that such a change will not take place without some real tension. Kuhn has convincingly shown that a change of paradigm will regularly meet quite a lot of resistance from the scientists in the field (Kuhn, 1970, p. 7). Such resistance may partly be ascribed to the inability of scientists to tolerate crisis (Ibid., p. 79).

### **Innovation**

It can be stated that to develop as a science, a science needs real innovation. But how does such innovation looks like? History has something to tell about this process of innovation. It shows how innovation is linked with fundamental changes in thinking about the nature of the science itself: of the principle of science, about what is real. Only along this path, which is the path of philosophy, it seems possible to change the paradigm in use in a field of science. It may seem, therefore, no wonder that the need for a paradigm change and

the corresponding effects may be described as (the need for) escaping old ideas and habits of thought (Vygotsky, 1926/1997a; Dennett, 2003).

All of the thinking above may lead us to the nowadays situation of our science of learning and education. What may we derive as social scientists from that discussion on paradigms, innovation in science and paradigm change? What kind of aim could or should we have in mind?

Firstly, we may become aware of this situation, and of the need for a change in this field! Secondly, we may develop the courage needed for that change which may imply a reform of our thinking. Thirdly, we may find the start to that change needed. Fourthly, we may develop the vision of how to foster the change.

The ultimate aim of innovation we may focus on, then, should be the rather ambitious aim of a new science of educational psychology (Vygotsky, 1926/1997b; Bruner, 1996), and the reinvention of the science of learning and education in particular (Jörg, 2004). The new science should become a science of being through becoming (see Prigogine & Stengers, 1984). The subject of study should be the new reality of fluid being, as an emergent phenomenon, as emerging reality through becoming.

The reader, now, may be able to give an answer him/herself to the question “what we need innovation for?” The next question, then, is “what does it mean for us as scientists?” For the individual scientists, being busy in his/her field of science as a so-called ‘normal science’, this question seems too demanding. History, again, has shown that this is almost too difficult for individuals, even for scientists such as Darwin, or Einstein (see e.g. Hoffmann, 1972). You really need a lot of courage to be able to do so (Kuhn, 1970, p. 66). Both scientists needed more than 10 years to get to the answers on their basic questions, and become convinced of these answers themselves at first.

To answer the question on innovation, one may reason that it is the recognition and the acknowledgement of the surprising inefficiency of learning (Midgley, 2001), and the surprising inefficiency of the illusion of the individuality of mind (Stacey, 2003) which are decisive factors. These may have contributed to the conceptual deadlocks in the field of learning and education (cf. EUROCORES Programme, 2005, on the study of consciousness). It is this very deadlock which asks for a rethinking of educational psychology (Bruner, 1996). Such rethinking of the field may find its inspiration from thinking about paradigms in use, and “the growing feeling that there is much more to be learned than we currently are aware of about the processes of learning and instruction and the organization of environments for effective learning, and instruction (Dills & Romiszowski, 1997, p. xxiii). This growing feeling may as well imply the growing feeling that for such an innovation a change of paradigm is strongly needed (see Kuhn on innovation in scientific research, in Kuhn, 1970, p. 79).

### **An Agenda for Innovation**

The main aim of this paper is to strive toward an innovation of the field of science concerned. The focus is therefore on the recognition of the possibility of a *reinvention* of this field, by changing the paradigm in use. As history has shown, it seems that such an innovation of the field is only possible through a paradigm change. Only then, it should be possible to recognize the conceptual deadlock in the field concerned, and open up the possibility of escaping this deadlock. The ultimate reason for this is plainly to foster

innovation, in terms of changing the world, i.e. the world of scientists, in a Kuhnian sense (1970, p. 121). To do so, we focus on the changes as proposed by the different initiatives in the field of the science of learning, and elaborate on the conditions for a new learning science. How can these initiatives be integrated into a common agenda for innovation of the field concerned? How will a new science of learning look like when it arrives? And what will be the potentiality of such a new science *for* the field of learning and education? In especial for a new theory of learning!

At first one should become aware of the different perspectives of these initiatives. Some, like Jolles et al. (2005) focus on the goal of a new learning science, while others speak about the possibility of new theories of learning (Biene, 2005). Biesta (2006) has a somewhat different perspective: he makes a strong plea for the development of a new language of learning for education, a language which may be considered as essential for scientific knowledge of scientists operating as a community (Kuhn, 1970, p. 210). Davis & Sumara (2006) demand for a real change in thinking, in their sketch of the need for complexity thinking. Morin (2001) makes a plea for a more general reform of our thinking, which is based on the recognition of the blinding of paradigms in use. So, one may wonder if it is possible to give a sketch of a new paradigm. What are the conditions for change in these proposals of change in the field of learning and education? Are these also the necessary and sufficient conditions for a real change of paradigm in the science of learning and education? How far could the changes go to be convincing and be accepted by scientists in this field of study?

### **Conditions and implications for a paradigm change**

It should be clear, now, that the process of transition for the change needed is not a simple cumulative process: it will certainly not be an articulation or extension of the old paradigm (see Kuhn, 1970, p. 84). Below a preliminary programmatic view of such a transition may be delineated. This view may be considered as the hard core of a new scientific programme.

At first, one should recognize and acknowledge the core problems in the field, by reflecting on the deadlocks, the anomalies of our science, and the fallacies of instructionism, rationalism, methodological individualism, and of interactionism. One should also reflect on the unsolved problems linked to these core problems. All of them may be considered as constitutive of the confusion of many scientists in our time; a confusion which is to be regarded as manifestations of a crisis which is real. A crisis both in the field of science itself as well as in the field of education.

Secondly, one should recognize the limits of our disciplines, with its blind spots, learned incapacities, and blinding paradigms, and consider the unexpected possibilities of a real trans-disciplinary approach for the future of our sciences.

Thirdly, one should recognize the unexpected potential of learning in the field of learning and education as a new science: a science of the transitory, of the being through becoming, with a primary focus on the transitory child as the new foundation stone of that science (Vygotsky, 1987, p. 91; cf. Toulmin, 1990, p. 34). The emphasis of the new science of learning should be on the *transitory* child with all his/her potentiality; *not* on the *deficit* child (see Vygotsky, 1987, p. 53; emphasis added).

Fourthly, one should be prepared to rethink the basic building stones of our science: even of its view of reality, its ontology as foundational for this science. This rethinking implies the

rethinking of the basic building stones, such as the concepts of interaction, of causality, and of complexity (see Jörg, 2005ab). This rethinking may lead to new tools and the retooling needed for a new science: a retooling which is foundational for an integrative and trans-disciplinary approach.

Finally, one should be aware of the possibility that, based on these new tools, education may be really reinvented, starting with the recognition of the daunting complexity of learning and education.

The fulfilment of all of these conditions may foster the development of new tools *of* science *for* a new science, and *for* the reinvention of education. These ambitious aims are to be enabled with new tools like thinking in complexity, and thinking about nonlinear causality, both of which are grounding a new causal, generative complexity theory (Jörg, 2005b; Jörg, 2006). A new theory which can be used for rethinking interaction as *causal* interaction. Such rethinking may lead to a nonlinear view of learning through interaction: showing the potential of multiplier effects, fostered by (dialogic) interaction as a process of reciprocal influencing and reciprocal causation of effects on the partners in that interaction. A process like this may be described as learners ‘bootstrapping’ each other in small (sub) communities, i.e. the small communities such as dyads (see Bruner, 1996; and Kauffman, 1995, p. 288). Thinking along these lines may open the notion and possibilities of a new fluid, nonlinear reality, with seemingly unlimited potentials. This reform of our thinking offers the possibility of description and understanding of the complexity of learning and education which seems ‘simply’ beyond scope, now. Ultimately the new scientific programme, with the new tools sketched above, may open our eyes to a very different answer to the basic scientific question of pedagogy: “is it possible to connect the *future* of the pupil with the *educator’s present*?” (see Luhmann & Schorr, 2000, p. 247, with reference to the work of the German Pedagogue Johann Friedrich Herbart). The answer, now, is basically inspired by “The American Question” mentioned by Jean Piaget: “is it possible to accelerate the learning and development of children?” (see Bruner, 1986, p. 141). The answer is to be ‘yes indeed’! But one should really *understand* the complexity involved: the complication as the *key* for understanding the complexity of the processes involved (Dennett, 2003). The focus should be on the understanding and explanation of “the unexpected complexity of simple reciprocal dynamics” of interaction (Van Geert, 1994, p. 195). But one should also understand that the trajectory of learning and development of the ‘transitory child’ is essentially *unpredictable*. This trajectory may develop in time, although being unknown in advance and unpredictable, as a trajectory in a space of possibilities. This trajectory in transition may show the very acceleration enabled by the nonlinear processes and effects of amplifying and multiplying in time. This may be an acceleration which can even lead to transformations in development: of reciprocal transformations through the very process of interaction (Nakkula & Ravitch, 1998). So, it seems really necessary “to change our expectations of how development takes place” (Van Geert, 1994, p. 272). It may be hoped for that the new answers actually open up a different future of education: an education of the unexpected, of the seemingly impossible effects of learning, based on interaction as reciprocally influencing. Based on this new paradigm and new science of learning a new complex, interactive, and generative pedagogy can be build (see Jörg, 2006). A pedagogy which is simultaneously to be considered as an essentially transformative pedagogy. This new pedagogy should bring with it the new language of learning and education needed for this field (cf. Biesta, 2006).

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