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INTERDISCIPLINARITY IN EDUCATION

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Education is like a double-edged sword.
It may be turned to dangerous uses if it is not properly handled.
Wu Ting-Fang

Questions about the nature of the teaching/learning process originate in ancient Greek philosophy. What is the role of language? What is the relationship between the individuals? Are we free in our choices? Important ancient philosophers, Democritus, Plato, Aristotle and Lucretius answered these questions in different ways, while Descartes, Spinoza, Hume, Kant and many others continued where they left off. Even today in the Age of Technology, contemporary researchers from the fields of philosophy, cognitive science, neurobiology, and artificial intelligence ask similar, albeit technologically informed, questions. Among these, there are also questions about the relationship between humans and machines, and implications which they carry for solving traditional problems within philosophy, i.e. the mind-body problem, mental causation problem and the problem of consciousness.

Our overall aim must be to make the step towards the connection between different disciplines involved in cognitive modelling in education, that are built around philosophy of mind and artificial intelligence. The gap between neurochemistry, cognitive science, neurobiology and other rapidly developing disciplines on one side, and education as part of social sciences on the other, may seem wide and even unbridgeable except by analogy, metonymy and metaphor (Aber ek, et al., 2014).

Cognitive Neuroscience as a Solid Base for Education

In the last 500 years the development of science has contributed to a major shift in the way we think about the world, especially regarding the Western civilization. Man has explored space, pondered on the beginning of the world and started turning his attention towards mankind itself, and the things that lie within us. *How do we think*, *learn, remember and dream? Are we free? Where are feelings, emotions and moods? What is consciousness*? Cognitive science between all, also tries to answer these questions. It deals with different areas of human mentality by connecting discoveries of all disciplines that can explain cognitive phenomena: neuroscience, psychology, philosophy, linguistics, artificial intelligence and social sciences. It tries to deal with mental processes as a whole and in doing so attempts to achieve a deeper understanding of a field that is experientially the closest to us.

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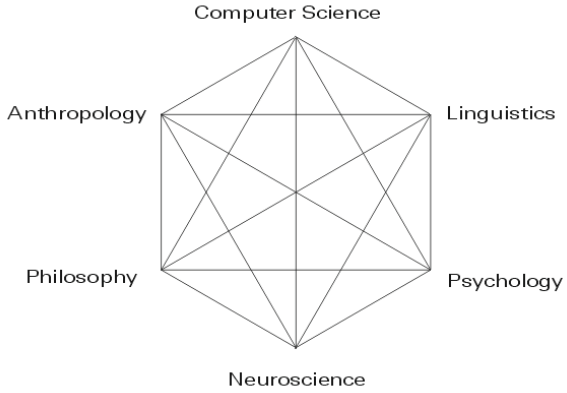

Figure 1: Scope of cognitive science.

Studies of cognitive science that have blossomed in the last thirty years in major universities are often linked with one of its constituent disciplines, e.g. cognitive linguistics, cognitive neuroscience, cognitive anthropology etc. But it is becoming increasingly clear that only equal focus on all fields will ensure a complete understanding of mental processes as seen in Figure 1.

The questions which cognitive scientists are trying to answer were asked historically, first by philosophers and later by scientists from various disciplines. They studied a chosen cognitive process on a level that suited their scientific field, and did that by using methods characteristic of their own disciplines. Cognitive science tries to overcome such problems by developing an interdisciplinary and transdisciplinary holistic approach in order to arrive at a more comprehensive insight. And this interdisciplinarity and transdisciplinarity is alo very important in education. We need holistic approaches which recognise the close interdependance of physical (body) and intelectual well-being (mind), and the close interply of the emotional and cognitive, the analitical and the creative arts.

In recent decades, cognitive science has experienced rapid progress, and especially because of the advancement of neuroscience (Morris, Filenz, 2003, OECD, 2007) can we start anticipating the possibility of scientifically exploring mental processes and even consciousness – an area which was until recently reserved for mystics (McGinn, 1999; Dennet, 2005). After two decades of pioneering work in brain research, the education community has started to realise that "understanding the brain" can help to open new pathways to improve educational research, policies and practice. It offers no glib solutions nor does it claim that brain-based learning is a panacea. It *does* provide an objective assessment of the current state of the research at the intersection of cognitive neuroscience and learning, and maps research and policy implications for the next decade (OECD, 2007).

A Look towards the Future

Our main objective in this issue is to bring to focus a form of learning that transcends logical and rhetorical appeal. If we want to make substantial changes in the process of education the current process must be drasticly reformed in terms of cognitive paradigm and strategies. If we want to bring innovation to the process of education then every aspect of the educational process and the system must be studied and reconsidered in the light of new and different social expectations. We must define the appropriate architecture of the educational process on the basis of contemporary educational sciences, as cognitive and neuro sciences and methods of artificial intelligence, thus, we must also take into account that a school system is a dynamic system which follows the dynamic systems theory. The adequate architecture includes a cognitive model that adopts both information-processing and the structure of the human mind

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Education is currently undergoing a major transition in modern societies, especialy in connection to new information and communication technologies. Europe has been losing its edge in teaching mathematics, science and arts to other countries in recent years. But currently, a change in education is under way; it comes in the form of computer-assisted learning tools, which is so effective that the need for a major reconceptualization of the learning process has emerged. The goal of education must focus on reinstalling that vital desire of 'learning to learn' in today's students. To accomplish this, teachers must involve students as active, self-directed and reflective learners. Through the use of intelligent tutoring systems, students will be (must be) placed in an active role, as opposed to a passive role (one-way lecturing) in which they are more or less placed today. The teacher can then act as a facilitator instead of merely a one-way communicator. Presented contribitions are a small step in this direction (Aber ek, et al., 2014).

New discoveries in the field of cognitive science, neuroscience and computational science hold great promise for the improvement of current teaching methods (Anderson, 2007). Yet there remains a significant gap between the scientific discoveries that could improve our education system and the application of this knowledge. In this issue we will show, how to bridge this gap. Every knowledge and competence implementation in the 21st century requires the development of *core subject knowledge* and understanding among all students. Those who can think critically and communicate effectively must build on a base of core academic subject knowledge. Within the context of core knowledge instruction, ***students must also learn the essential skills for success in today's world, such as critical thinking, problem solving, communication and collaboration.*** In the presented issue of this journal, mentioned knowledge and skills will also be the subjects of our attention (Aber ek et al., 2014).

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PROBLEMS
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IN THE 21st CENTURY
Volume 61, 2014
8

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