

Cognitive performance and learning, related to motivation, psychosocial & emotional factors: Position paper for the conference on Emotion, Learning and Education (Copenhagen 2004)¹

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Introduction on the ‘Brain & Learning’ viewpoint.

A conference on ‘Brain & Learning’ and the implications of a new learning science as proposed by OECD-CERI has been organized in the Netherlands in february 2004. J.Jolles was the chairman of the organizing committee which was installed by the Dutch Science Foundation (NWO). A report has been made which gives the direction in which the field should develop in the next five years. The committee has the opinion that an important place should be taken by research into emotional and motivational mechanisms underlying learning and by evidence-based interventions in an educational setting. According to the committee, it is essential to take the whole life-span into consideration, according to the motto ‘A Life Long Learning for All’, as has also been proposed by OECD-CERI.

With respect to the Netherlands, NWO has started the development of a strategy document describing the research in the period of 6 years to come. ‘Cognition in relation to development, education and emotional/motivational factors’ has great potential of being a major topic in this strategy. The researchprogramme in the domain of cognitive development and cognitive aging in Maastricht (Brain & Behavior Institute) has quite some possibilities in this respect. The Maastricht group participates in the international LifeLongLearning Network under the auspices of OECD. We run several large crosssectional and longitudinal studies on the domain of cognitive development and aging. The Study of Attentional function Maastricht (SAM) and the Maastricht Aging Study involve several thousands of healthy subjects aged 5 through 85. These studies are ideally suited for the extension into education-based research in the following years. In the next paragraph, some statements are given as starting point for a strategic discussion in the Copenhagen meeting (8/9 november 2004).

Summary of major statements on emotion/motivation, learning and education

Cognitive versus social learning in adolescence and the role of emotions and motivations.

The adolescence is the period in which the brain is optimally suited for cognitive learning. However, the adolescent boy or girl is much more interested in social interactions with peers. Negative attitudes and perceptions can develop in that period with respect to the importance of learning ‘(learning is for nerds’, arithmetic is totally unimportant’). This has major

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implications for the learning trajectory which the student follows. Brain research, on the other hand, shows that individual differences in brain maturation could determine the way the subject copes with environmental stimulation. Psychosocial circumstances thus could modulate further maturation of the brain and thereby 'tune' further learning in positive but also negative direction. It is of major importance to study the role of emotions and motivations in this target group, especially in relation to optimizing learning motivation. Learning could be stimulated in settings which favor the social interactions which adolescents are interested in.

Motivational processes and learning attitudes. Animal and brain research on the basic mechanisms underlying learning have shown that particular emotional stimuli but also motivational factors are essential for optimal learning. Memory consolidation is dependant upon a minimum level of emotional or motivational stimulation. Likewise, recent cognitive psychological research is compatible with this notion. This research suggests that better incentives could be developed for the stimulation of motivation and learning attitude. It is suggested that particularly 'negative emotions' should be changed. The learning context should be changed in such a manner that learning and knowledge acquisition induces a positive emotion in the learner. Dedicated 'applied' research should be performed in this direction.

Negative emotions and stress can disrupt optimal learning. The emotional development of the child and adolescent is of crucial importance for the development of an optimal information processing ability. Knowledge acquisition is dependent upon an optimal 'rewarding' atmosphere in which the knowledge is presented. Stress and associations with 'negative' character are known to disrupt learning. This is known from animal experiments and learning in humans. The OECD report on Brain & Learning is compatible with this notion as 'selfcontrol' and 'selfcompassion' are of importance, in which emotional factors play a major role. Emotional and motivational factors are especially relevant in subjects with a learning disability or brain dysfunction and in aging subjects beyond the age of 30 years. Motivational/emotional factors are especially important in these groups because learning does not proceed as 'automatic' in these subjects as in young or young adult subjects. It is deemed of utmost importance to develop and evaluate learning interventions in these groups and apply them in practice. Both cognitive factors and psychological factors are relevant in this respect. Cognitive factors have to do with the nature of knowledge acquisition, psychological factors have to do with the 'attitude' towards change (eg 'This is too difficult, why would I try?').

The developing brain needs an 'external' motivator up till adulthood. Recent neuroscientific research shows that functional brain maturation proceeds up into the third decade of life. Adolescents are thus not fully 'ready' to take their role in society although many adolescents think they are. From a brain research point of view, this finding suggests that didactic/educational concepts which state that the educator should retreat and that education should change into 'facilitating' the autonomous learning process in children/adolescents should be considered with caution. It can be questioned whether children and adolescents are already able to find their own way in the diversity of knowledge domains. The role of a good teacher but also that of the parents as external 'motivator' should be reconsidered in a positive way. Research suggests that the educator should not only be the

passive facilitator and 'tutor' who can give directions when asked, but should have a more pro-active attitude and motivate the student to engage in fields or domains in which he/she would never have started on his/her own. More evidence-based research should be performed where self-initiated learning and leaning based upon external motivators are directly compared.

Motivational problems in students could be due to inappropriately organized education.

Brain areas which are involved in planning, problem solving, social learning, self-monitoring and social monitoring as well as self-initiation and impulse-management develop until well in adulthood. They have to do with the anterior areas in the brain. Environmental factors, learning experience, culture and other psychosocial factors could therefore be of major importance for optimal learning. It is therefore probable that motivational problems are especially due to insufficiently organized education which does not take inherent motivations and interests of the student and 'culture' into consideration. Important issues to evaluate in new 'evidence based' educational research are 1) the role of information processing styles (language thinkers versus perception thinkers), 2) the role of diurnal rhythms, 3) the role of emotions and stress ('angry children can not learn'), 4) the possible use of 'gaming' and social interactions via the computer, 5) hormonal changes in the adolescence but also the difference between boys and girls in motivation, 6) the effects of movement on learning and individual learning styles.

Motivational processes, learning attitudes and curiosity. A possibly very relevant role is that of 'curiosity' which according to quite some brain research is innate. Quite some indications exist that curiosity is not stimulated by the present school systems. The curiosity appears to be related to brain-based attention to 'novelty'. New research should be performed in the educational setting which is directed at finding strategies to stimulate curiosity. It is important in this respect to change the educational system from 'knowledge-centred' into 'learner-centred'. It is relevant in this respect that the brain circuits underlying emotions are different from those underlying the primary motivations, but that they overlap in anterior brain areas. Use of insights from brain research and cognitive research should be relevant in this respect.

On the role of emotional distress. Quite some children develop a negative attitude towards learning. They have negative experience with respect to some aspect of cognitive learning (eg problems with reading or arithmetic), some aspect of motor learning (being 'clumsy', bad performance in sports, or some aspect of social learning (not being able to make friends). These negative experiences can have a major influence on behavior, emotions and attitudes. Quite some children can develop a phobia towards cognitive or motor learning or social interactions. The prevalence of anxiety or depression in children is high and this can have a major influence on their further development, choice of school type and thus determine their whole life. This is the more important because of the fact that individual differences appear to exist in brain and cognitive development. Children who are 'late' in development of a particular function could reach an asymptote later and even reach a higher asymptote than children who have a faster development. More research should be performed into these aspects of individual development and into strategies to preclude the development of emotional problems, anxiety and depression.