Fine motor skills and subtle thinking. Findings from kindergarten and primary school

By Sebastian Suggate, December 2014
Published in Erziehungskunst, Waldorf Education Today http://www.erziehungskunst.de

Both the progressive educator Maria Montessori and the German philosopher Martin Heidegger saw the hand as an instrument of intelligence. This thought, that movement is essential to the thinking also plays an important role in the education of Rudolf Steiner. Recently numerous empirical findings have also supported this fascinating idea.

One of the first achievements of the small child concerns motor development. As soon as the body has developed a little and gained in strength, expectant mothers notice small movements, sometimes as early as the fifth month of pregnancy, which are often experienced as butterflies in the stomach.

Even at birth newborns have so-called primary reflexes which have to be repressed in the course of development. For example, newborns have the strength to hold their body weight when gripping with both hands. Or directly after birth it appears as if they could swim in water (swimming reflex). But these primary or survival reflexes are lost soon after birth.

Although the occurrence of these primary reflexes is of importance, the first real achievement appears to be that these reflexes are repressed in the course of development. Small children who at the evening meal let their spoon and food fall to the ground do not, after all, do so to annoy their parents but for another reason: in doing so, they learn to inhibit their grasp reflex. Cognitive control processes are thus closely connected with motor development from the beginning.

It is therefore perhaps no great surprise that research findings both in empirical and experimental psychology as well as in brain research attribute a significant role to finger and hand dexterity (i.e. fine motor skills) and activity in thinking.

Resonance between thinking and action

In adults there is a so-called motor resonance. In this effect, thinking succeeds at greater speed if an appropriate action is carried out at the same time. If, for example, we say the sentence “Open the door John” to adults and then let them judge whether it was a meaningful sentence, then that assessment succeeds relatively fast if they turn a rotary knob anticlockwise when they hear the sentence. But if the subjects turn the rotary knob in a clockwise direction when they hear the sentence, the thought process is slower. Since we normally open a bottle top in an anticlockwise direction, there is a resonance between the action and the understanding of the meaning of the sentence in this experiment. In other words, a resonance between the thought and an action speeds up the thinking. There are interesting findings in long-term studies from research in developmental psychology, particularly from the United States. These show as a rule that kindergarten children with advanced fine motor skills do better in mathematics and intelligence tests in primary school.

Here researchers came across an interesting cultural phenomenon. Children from Asian countries living in the USA have an advantage in comparison to children with a European background when it comes to solving mathematical tasks. As a rule they also have better coordination in their fine motor skills. One study found that these greatly differentiated fine motor skills were a significant factor for higher performance in the mathematical field.

But the advantages of better fine motor skills in early childhood lie not just in the field of mathematics but also in general intelligence. Philipp Martzog, lecturer at the Freie Hochschule Stuttgart, was able to determine in his dissertation that better fine motor skills in the first years of kindergarten can lead to a higher intelligence level in pre-school children. This advantage did, however, relate to deductive thinking and not the acquisition of knowledge. This finding indicates in the first place that movement and activity using fine motor skills are crucial for flexibility in the thinking but not relevant for simply learning facts.

Follow-up studies at Regensburg University and Alanus University in Alfter examined connections between fine motor skills and further aspects of early childhood development. Kindergarten children who were more advanced in their fine motor skills

did better in developing their reading in class 1. A further experimental study found that children who had motor difficulties (produced by an experimental condition which meant that they had to use a heavy pencil) were slower in learning the letters and sounds when first learning to write.

The world is explored with the hands

Children with clumsy hands are at a disadvantage in exploring the world. We may assume that rapid and comparatively restricted movements – such as for example when playing computer games – do little to support cognitive development. Here the research by Martzog and others has shown that it is rather the more complicated fine motor tasks (e.g. threading beads) which are closely connected with intelligence level – whereas fine motor skills involving repetitive and monotonous finger movements ("tapping") do not influence the intelligence level. Another field which is of great importance both for the development of thinking and for socialisation is vocabulary development. A number of studies investigated the role of fine motor skills in vocabulary development. Here the complexity of the matter becomes clear. It looks as if fine motor skills are indeed important for vocabulary development, but above all for those words which are anchored in sensory experiences. Thus the meaning of abstract words such as "trust" are not understood more quickly by children with advanced fine motor skills. But words which indicate something which can be grasped with the hands such as "belt" or "chair" are grasped more quickly by children with well-developed fine motor skills.

How do we support fine motor skills?

There are unfortunately few scientifically sound research studies on this question. There are, however, support measures which have been practised for a long time in special needs education. From what has been set out above, it would seem plausible that an exceptional role accrues to music and craft activities. An initial study asked parents about the play behaviour of their children and their fine motor skills were subsequently examined in kindergarten. Children who spent a lot of time at home making things (painting, drawing, gluing) possessed measurably better fine motor skills.

The most difficult question which needs to be answered in this context is: why should thought processes and vocabulary development actually be dependent on fine motor skills? The findings from studies cited here do not support the view that children are better in the fields of fine motor skills and intelligence as the result of a privileged social environment (more stimulation and available activities).

Motor Homunculus

A second possibility which is often quoted in explanation is a kind of "brain training". The illustration shows an almost demonic-looking figure (photo above). The sculpture was made in such a way that each part of the body is proportionately the same size as the corresponding area of the brain. It therefore represents what a person would look like if

their body parts grew to the same degree as the corresponding area of the brain. We can conclude from this that a lot of activity takes place in the brain in talking when compared to walking – the legs of the figure are therefore small in comparison to the mouth. Pictorially it seems that the hand is an instrument of the brain!

If we include Rudolf Steiner's research on the connection between the brain, thinking and the hands, this picture immediately takes on a concrete form: the hands of the human being are not a purely utilitarian organ as in animals, they are free. It is only through the hands that all the things which the spirit can achieve can come to expression – all culture and art is created by the hands. For future development that would ultimately mean that the hands themselves would become a kind of organ of thinking (lectures of 8 June 1912 and 12 March 1918).

Yet the evidence that brain training has a positive effect on the thinking, because the brain is thereby trained like a muscle, is on the weak side. According to current theories and findings, the brain is highly differentiated, certain actions (e.g. walking) are very precisely connected with certain areas and neural networks. It is therefore questionable whether finger movements can train the brain in such a way that in the movement other non-motor aspects such as general intelligence are automatically trained as well.

There are also theories of "embodied cognition". According to these theories, thinking is highly dependent on the body. Extreme formulations of these theories claim that there is no thought which is not somehow anchored in the body. In very basic terms, the hand becomes an expression of the word, it uses gestures which express a great deal of the inner character of a person. In that context skilful fine motor skills also enable subtle thoughts.

It has to be admitted that there is currently no accepted and scientifically convincing explanation as to why fine motor skills are connected with intelligence, vocabulary and mathematics. Many educators – alongside Rudolf Steiner also the respected Russian psychologist Lev Vygotsky among others – have described child development in the following terms: walking – speaking – thinking. In this sense fine motor skills are surely also an important building block initially for speaking and subsequently for thinking.

I am convinced that the question as to the reason why and in what respect (fine) motor skills are important for the thinking can only be satisfactorily answered if a range of research fields are brought together; for example education, neurology, developmental psychology, philosophy and, not least, anthroposophical spiritual science. Because this set of problems touches on the age-old question primarily as to how the thinking, the world and human activity can be related to one another.

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