

EDUCATION, CONTEMPLATIVE PRACTICE AND
NEUROSCIENCE: TOWARD A SYNTHESIS

RICHARD J. DAVIDSON

Waisman Center, University of Wisconsin-Madison

It is an honour for me to be here, I would like to thank the organisers and the honourable delegates and especially His Holiness for the inspiration to continue this work and to foster the dialogue that this meeting very much represents between the contemplative traditions and modern Western science.

What I would like to do in the short time we have today is to give a little bit of background on the topic of neuroplasticity which we've heard a little bit about, to talk about some specific areas of the brain such as the prefrontal cortex, which I will say more about in a few minutes which is important for the regulation of the quality of attention and emotions. I will also talk about a very critical issue for education and development which is adolescence, a time of life where individuals are particularly vulnerable but also a time of great opportunity. And finally, I will talk about the capacity to change our brain through secular practices that can also facilitate the development of qualities of the sort that Professor Wallace described; qualities like happiness and equanimity. And the key message of my presentation is that we can change our brain by training the mind.

So let me say a few words about this topic of neuroplasticity and indicate why it is relevant for social and emotional learning. The environment, particularly the emotional environment early in life, produces changes in the brain. These changes are changes involving both the structure of the brain as well as how the brain functions. The brains of our children are constantly being shaped by the environments in which they reside. Some of those environments are nurturing, they are positive environments, some of those environments are destructive, they are negative environments. But those environments are always shaping the brain, and one of the key messages of this presentation is that we can take more responsibility for the brains of our children by cultivating intentionally positive qualities of the mind.

Now there are sensitive periods in development and I would like to give you one example of a sensitive period which is a period for learning a second language. Research shows that in the early years of

life, the capacity to learn a second language is tremendously enhanced and this capacity declines as life unfolds. And so this indicates that early in life there may be special sensitive periods for learning particular types of skills.

Research indicates that social and emotional skills are more important for life success than traditional academic and cognitive skills. And moreover, that the sensitive period for cultivating these skills is more prolonged than for a skill like learning a second language. The circuits in the brain that underlie the capacity to learn social and emotional skills continue to develop well into adolescence. Research indicates that these circuits show plasticity through the period of adolescence. And one of the key regions that exhibits this prolonged development and that undergoes plastic changes is a region near the front part of the brain that we call the prefrontal cortex. There are sectors in this part of the brain that have shown the most development over the course of evolution compared with other brain regions.

There are ways that we can probe in children the functioning and the structure of the prefrontal cortex. We can now very safely test children to measure their brain function and structure. We can also use electrodes that we place on the head, with children, very easily to measure the electrical changes in the brain and through this method make inferences about what is going on inside. Research using these methods illustrates that the utilisation of the prefrontal cortex increases as we get older from young children to adolescents and then to adults.

Now why is that adolescence is so important? There is a very important paradox about adolescence. Adolescence is physically the healthiest period of the lifespan. Prior to the adult declines, beyond the frailties of infancy and childhood. We can see in adolescence improvements in the strength, in the speed, in the reaction time of different kinds of human abilities. There are improvements that we see in immune functions during adolescence. During adolescence there is also an increased resistance to cold, to heat, to hunger, dehydration, and most other forms of injury. In other words, this is a very healthy time of our lives. However, the overall morbidity and mortality rates increase between 200 and 300 percent from childhood to late adolescence in western countries today. It's really quite astounding.

Data from the United States that have recently been made available illustrate that in the period from 15 to 24 years of age there is a 300% increase in death among adolescents compared to the age period that is 10 years earlier. 300% increase in death! And this is all attributed to choices that these individuals make. It's due to drugs, it's due to drunk

driving, and other types of adolescence specific problems. And also due to suicide which tremendously increases during this period. So this is really a very challenging paradox, with adolescence being a time in life when physically children are the most healthy but they show all this tremendous increase in mortality that is due to poor behavioural choices.

Now the age in which puberty occurs is consistently growing younger and younger over the last period of time. In the most recent comprehensive data set available, if you look roughly over the last 100 or 150 years, you see that puberty is around age 15 or 16 in 1860 and has gone down to below age 13 in many countries in 1960. And if you look at the most recent data for the last 50 years, it is declining even further.

Now brain maturation has not changed. The prefrontal cortex is not fully mature until at least age 25 years and this timing has likely not changed much in the past 1000 years. So puberty is getting shorter and shorter, and the prefrontal cortex continues to develop at its normal rate and so this is leading to a longer period, the longest period yet in history, of adolescence where puberty has already occurred but the prefrontal cortex has yet to fully mature.

Now in our laboratory as well as in scientific laboratories now throughout the world there are increasingly refined methods for examining the connections between the prefrontal cortex and other parts of the brain. We can use what is called diffusion tensor imaging to visualize a very important pathway that goes from the prefrontal cortex to parts of the brain that we call subcortical that are especially important in the control of emotions. And this pathway is called the uncinate fasciculus. And it turns out, that in recent researches, it's been found that this pathway which we believe is critical for the regulation of emotions and also in the regulation of all kinds of behaviour in children, shows the strongest age-related changes of any pathway that has been examined in the brain.

So the question we are left with is: Can we teach our children to better regulate their negative emotions, cultivate more positive social skills, and better focus their attention? And the answer is, I believe, yes. And this is where the field of social emotional learning plays such an important role. Social emotional learning is said to facilitate five important competencies that we can see developing in children. One is self awareness. A second is social awareness; the awareness of others around us. The third is self-management; that is managing your own behaviour. A fourth is relationship skills; learning how to facilitate

positive interpersonal relationships. And the fifth is responsible decision making.

Social emotional learning (SEL) programs have been found to change behaviour and also to improve academic performance. In a recent meta-analysis that was done on 207 studies that involved more than 288,000 students from around the United States, this study found that these programs do improve social and emotional skills, children develop more positive attitudes for themselves, for others and towards school, there are improvements in social and class room behaviour that occur, there are decreases in classroom misbehaviour and in aggression, there are decreases in emotional distress, such as stress and depression, and finally, there are actually improvements in standardised test scores and in school grades that are produced by these methods that focus exclusively on social and emotional qualities.

Now we can ask whether interventions can be based on the contemplative traditions more directly that can facilitate some of the changes that we have observed with social and emotional learning. Recent evidence indicates that these contemplative practices when taught in a secular way, can be taught to children and adolescents, they can improve attention and emotion regulation skills, and they may help children and adolescents to make better choices since these practices can help children better regulate their impulses.

I would like to give two illustrations, one is in the area of attention, and this is a quote from a great American psychologist William James that was written in 1890. William James said “the faculty of voluntary bringing back a wandering attention, over and over again, is the very root of judgement, character and will. No one is *compos sui* if he have it not. And education which should improve this faculty would be *the education par excellence*. But it is easier to define this ideal than to give practical directions for bringing it about.” If William James had more exposure to contemplative traditions, I think he would have seen that these represent ideal training grounds for educating attention.

I would like to illustrate this with selective attention where selective attention is a feature of attention where a person might choose to focus on certain features of his or her environment and not other features, to develop a concentration. Children with attention deficit hyperactivity disorder show more variability in their response times during a selective attention task. In other words, they are not very focused and they are not predictable from one moment to the next, their attention wanders and they show variable response times. Their capacity to respond to events in the environment is scattered and because of that

they show variation in their response times. So the question is whether training in mindfulness meditation can lead to more focused attention and more consistency in response times. We tested this over the course of three months of practice and what we reported recently is that the variability of responding decreases over the course of three months of practice. This indicates that meditation is improving the consistency of responding which is one of the hallmark problems of children with attention deficit hyperactivity disorder leading to the possibility that these practices can be very helpful in a very practical way.

We also ask the question whether compassion can be trained in teen-agers. We recently completed a study examining the impact of just two weeks of training in compassion; individuals were practicing for 30 minutes a day; the elements of the compassion training included contemplating and visualising the suffering and then wishing the freedom from that suffering for different classes of people, beginning with a loved one, then they moved on to themselves, a stranger, a difficult person, and then all beings. The phrase that is most often used is “May you be free of suffering, may you experience joy and ease.” Participants are instructed to notice visceral sensations particularly around the area of the heart when they engage in this practice, and participants are instructed to feel the compassion emotionally and not simply repeat the phrases cognitively. And one of the ways we probe the impact of compassion training is by measuring their altruistic behaviour on a task that economists and psychologists both use to assess this quality. And what we see, is that after just two weeks of compassion training, participants, teenagers, can actually show enhanced altruistic behaviour, which is really pretty remarkable after such a short period of practice. And what is even more profound, is that in this study, we measured their brain function before and after just two weeks, and what we see is neuroplastic changes that are induced after just two weeks of practice. One of the areas that is changed is the amygdala, it’s an area that is frequently linked to stress, and we see the amygdala goes down in activity over the course of two weeks. The amount that it declined predicts how altruistic participants are on our measure of altruistic behaviour. And the control group shows changes that are non significant.

A second area that changes is the prefrontal cortex. Activity in this area is enhanced with compassion training, and the amount that it is enhanced also is associated with their altruistic behaviour. And again, we see no significant changes in a comparison group.

To summarise and conclude,

- The brain is plastic. Modern evidence indicates that it is built to change in response to experience and in response to training.
- I have also shown that adolescence is a time of both risk but is also a time of opportunity. The age at which puberty begins is earlier and thus the maturation of the prefrontal cortex is lagging further and further behind pubertal development.
- Social emotional learning and contemplative training are both empirically verified strategies that can improve skills of attention, emotion regulation, and social adaptation.
- Social emotional learning and contemplative training likely produce beneficial changes in the brain.
- Education literally shapes our child's brain and likely produces alterations that lay the foundation for all future learning, emotion regulation and social functioning.
- Qualities such as patience, calmness, compassion, cooperation, and kindness are all best regarded as the product of skills that can be enhanced through training.
- Research is critically needed to document the impact of contemplative training, particularly in children and adolescents, and also social emotional learning and reveal its impacts on the brain.

I want to end by expressing a very deep bow of gratitude to the many people in my lab who perform all this work and especially to Your Holiness for your inspiration and support through many years of collaboration together.

I would like to end now with one of my favourite quotes from the very famous scientist Albert Einstein. And this is something Einstein wrote to a friend of his for a daughter. It was written in 1921, and Einstein said:

A human being is part of a whole, called by us the Universe, a part limited in time and space. He experiences himself, his thoughts and feelings, as something separated from the rest, a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circles of compassion to embrace all living creatures and the whole of nature in its beauty.

Thank you very much