

## **Understanding Learning**

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Any discussion about the nature of learning in the future risks indulging in a false optimism – seeking to describe a Shangri-la. This is not the purpose of this discussion; rather it is to try to identify current knowledge and trends and extrapolate from them what our emerging understanding might lead to. We create the future, the decisions that we take now will determine the nature of schooling, educating and learning in the future. There can be little doubt that the past decade has seen an explosion of interest in the notion of learning. The historically dominant paradigm of learning as the product of teaching is being replaced by a recognition that teaching is a necessary, but not sufficient, condition for learning. This is being reflected in many ways in educational practice, not least in the Ofsted Framework, which has now separated teaching and learning as significant variables in assessing the effectiveness of classroom practice.

This discussion will focus on four areas where our understanding of the learning process is developing rapidly:

- learning as a process
- the scientific basis of learning
- learning as a social relationship
- intelligence and learning.

Each of these will be explored in turn and tentative conclusions drawn about their implications for educational practice. However, at the outset, it is necessary to explore exactly what is meant by learning. The term is ambiguous and used to describe a wide range of cognitive phenomena. If we are to understand personalised learning then we need to have an intellectually coherent model of what learning might be.

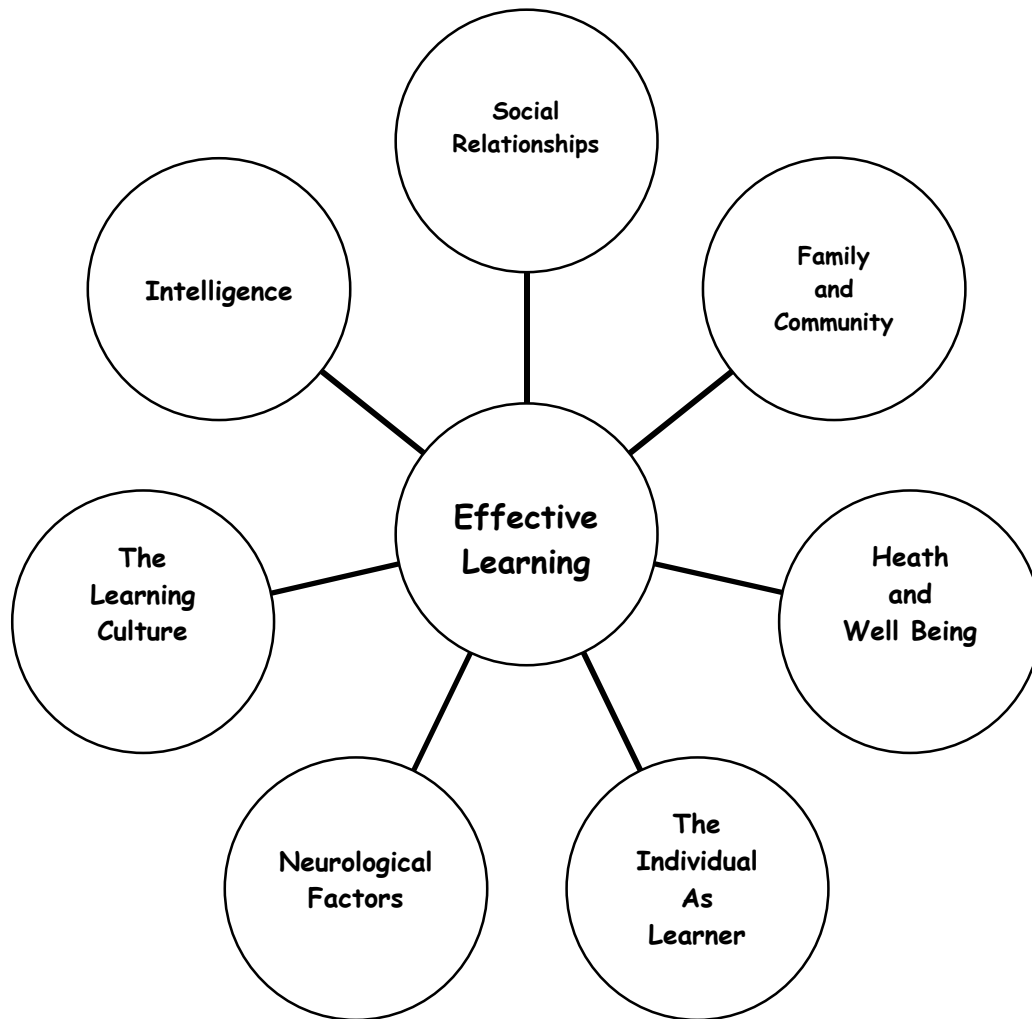


Fig 3.1 The Variables Influencing Effective Learning

Each component of Fig 3.1 is dealt with in detail in this and subsequent chapters. What follows is a summary of the essential characteristics of each component of the diagram.

Effective learning is most likely to occur when:

- There are high quality social relationships characterised by emotional intelligence, interdependence and high trust.
- The learner lives in an effective family and community in which there are shared values, high aspirations and economic security.

- The learner enjoys physical, psychological and emotional well being under pinned by a suitable diet, appropriate amounts of sleep and exercise.
- The learner understands herself/himself as a learner, i.e. is aware of their distinctive profile as a learner and is able to engage in meta-cognitive activities.
- There is awareness of the need to maximise neurological effectiveness – largely by optimising the other variable.
- School, community and family focus on the social aspects of learning, e.g. ensuring access to mentoring and working in effective groups.
- There is a strategy to enhance the potential of each person in terms of a model of intelligence which reflects a scientific and humanistic approach rather than social prejudice.

All learning requires the positive interaction of a range of complex variables; the movement from shallow to deep to profound depends on optimising the variables to maximise the possibility of effective learning taking place. The variables are shown in Fig 3.1 but it is essential to stress that the relative significance of each will vary from individual to individual and the diagram creates an artificial sense of balance and equity.

The diagram represents the strongest case for personalising learning. It is only by understanding the relative significance of each factor for any one individual that it becomes possible to be confident about their potential and capacity to learn.

### **Learning as a process**

For many educators the concept of learning is implicit and assumed. In some usages it implies what the learner does in response to teaching ‘If you don’t pay attention to me you won’t learn this’. A common usage equates learning with memorisation ‘I want you to learn this for a test tomorrow’. The paucity of our understanding of learning is often reflected in the lack of any shared or common agreement between teachers, let alone learners, as to what the process actually involves. Although the situation is now changing many schools do not have a shared vocabulary as to what constitutes learning – it is usually judged as a product rather than a process – ‘I have learned this’. What ‘learning this’ actually involves is elusive and not codified. There is little

doubt that this is, to a significant extent, the result of a curriculum that is focused on information transfer and means of assessment that value the 'correct' answer. Most national schooling systems focus on this narrow, instrumental and reductionist view of learning and this is reinforced by prevailing models of accountability, which value outcomes that allow for generic comparability rather than individual capability.

What follows is an attempt to develop a model of learning which provides the basis for meaningful dialogue about the learning process and its related outcomes.

	<b><u>Shallow</u></b> <b>What?</b>	<b><u>Deep</u></b> <b>How?</b>	<b><u>Profound</u></b> <b>Why?</b>
Means	Memorisation	Reflection	Intuition
Outcomes	Information	Knowledge	Wisdom
Evidence	Replication	Understanding	Meaning
Motivation	Extrinsic	Intrinsic	Moral
Attitudes	Compliance	Interpretation	Challenge
Relationships	Dependence	Independence	Interdependence
	(Single Loop)	(Double Loop)	(Triple Loop)

Figure 3.2 Modes of learning

It is important to stress at the outset that this model is not intended to be hierarchical; it is rather descriptive of the characteristics of different modes of learning. In some contexts shallow learning is entirely appropriate – my knowledge of how my car’s engine works is shallow; but I hope that the mechanic’s is deep if not profound. Equally, it is important not to impose academic values on this model; profound learning is about the more arcane branches of philosophy but it is also about the qualities of a counsellor, the skills of a joiner, and the moral insights of a child.

In many important respects, shallow learning is synonymous with the prevailing patterns of schooling – it is based on the memorisation and replication of information. While it does not preclude deep and profound learning, schooling does limit and inhibit the potential to move beyond the shallow. Shallow learning has been adequate for a world, which operated on high levels of compliance and dependence in the work place and society. If it is true that the world is becoming a far more complex place then it may be that the dominant mode of learning will have to change. Shallow learning may have been an acceptable foundation for life in a relatively simple world with fewer choices and greater hegemony but it is clearly inadequate in a world of complex choices and limited consensus. A simple illustration of this is the present place of sex education in the curriculum. It is taught as a subject but it does not really seem to impact on behaviour – Britain has the highest level of teenage pregnancy, abortion and sexually transmitted diseases in Western Europe. Surely, the basis for sex education has to be the creation of understanding and the confidence that comes with personal wisdom.

Shallow learning is focused on the memorisation and replication of information. We live in an age of information – more data is easily available to us than ever before – some of it is widely and openly available; some of it is specialised and arcane. In fact, the more arcane information is the more we esteem it. This perhaps explains the popularity and credibility attached to television quiz shows – on ‘Who Wants to be a Millionaire?’ the more arcane the information the higher the reward. ‘University Challenge’ is perceived to be serious because most of the information is highly arcane – but in essence, both of these programmes are just extensions of the pub quiz. Neither seeks explanation, demonstration or debate – just the replication of the right answer.

The emphasis on the ‘right answer’ inevitably produces a state of compliance and dependence. If a student wishes to be successful then they must produce the right answer, i.e. comply with the teacher’s view of what is correct – this inevitably leads to dependency on the teacher, which means that the student will inevitably be motivated by external factors. Extrinsic motivation is the weakest and most fragile sort of motivation and, crucially, it denies the autonomy of the individual.

Shallow learning is the basis of teaching and assessment in most education systems – even where there is evidence of personal understanding this will often be replication of the teacher’s understanding. A traditional curriculum will be a prescription of information and assessment will be geared to the amount of information that can be accurately replicated. Shallow learning is essentially binary, right or wrong but there is no guarantee that providing the right answer will enable usage of that information – a GCSE in German is no guarantee of being able to hold even a simple conversation in German; a GCSE in mathematics does not guarantee comfort in using mathematical procedures in daily life. Shallow learning, by definition, has a very short half-life – it decays rapidly.

The implications of shallow learning go beyond the individual go beyond the individual; in their study of organisational learning Argyris and Schön (1974) point to a similar manifestation in how organisations work:

When the error detected and correct permits the organization to carry on its present policies or achieves its present objectives, then that error-and-correction process is *single-loop* learning. Single-loop learning is like a thermostat that learns when it is too hot or too cold and turns the heat on or off. The thermostat can perform this task because it can receive information...and take corrective action. (p2)

Shallow learning is appropriate and valid in many contexts but if the experience of school presents it as the primary and dominant learning experience then learners will always be stuck at the ‘what’ stage and never learn for themselves the ‘how’ or ‘why’. The personalisation of shallow learning would undoubtedly lead to an improvement in performance, and as such is valid but it also needs to explore those dimensions of learning that allow us to be effective in dimensions of our lives.

Deep learning provides the means to move from the replication of information to the creation of knowledge. In this context, information is seen as public, generic and unmediated; knowledge is personal. The pivotal criterion for the creation of knowledge is the development of understanding. According to Perkins (1992)

The person who understands is capable of “going beyond the information given,” in Jerome Bruner’s eloquent phrase. To understand understanding, we have to get clearer about the “beyond possession.”

So let us view understanding not as a state of possession but one of enablement. When we understand something, we not only possess certain information about it but are enabled to do certain things with that knowledge. (pp76,77)

Perkins goes on to define the ‘certain things’ as explanation, exemplification, application, justification, comparison and contrast, contextualisation and generalization. The ability to engage in any of these ‘performances’ is to demonstrate deep learning. For example, the ability to replicate a list of the causes of the First World War is useful, but shallow. Nevertheless, more important is the ability of an individual to explain, prioritise, analyse, rationalise and justify them – this should be the basis of personalised learning. This approach moves the learner from compliance to the ability to interpret, from dependence to interdependent learning through debate, discussion, mentoring and the creation of the relationship that Steiner describes:

...a lust for knowledge, an ache for understanding is incised in the best of men and women. As is the calling of the teacher. There is no craft more privileged. To awaken in another human being powers, dreams beyond one’s own; to induce in others a love for that which one loves; to make of one’s inward present their future: this is a threefold adventure like no other.

Steiner (2003) pp 183/184

Deep learning is fundamentally concerned with the creation of knowledge, which the learner is able to relate to their own experience and use to understand new experiences and contexts. The deep learner is thus able to integrate theory and practice, to create holistic models and to distinguish between evidence and debate. Crucially deep learners know how to create knowledge, they are reflective about what they learn and how they learn, it is double-loop learning which:

...occurs when error is detected and corrected in ways that involve the modification of an organizations underlying norms, policies and objectives. (Argyris and Schön *ibid*)



Questioning the ‘norms and policies; means that processes are as important as product or outcome. The processes associated with deep learning are discussed in detail in Chapters 4 and 6. For practical purposes, deep learning involves the movement into metacognition and this is the essence of personalisation – the learner understands herself/himself as a learner. Intrinsic motivation requires a sense of personal control and this requires the ability to assume responsibility for every aspect of learning.

Profound learning is what makes us a person, it gives us a sense of uniqueness and determines our ability to think and act for ourselves. Profound learning is the way in which we develop personal wisdom and meaning, which allows us to be creative, to make moral judgements, to be an authentic human being who is able to accept responsibility for our own destinies. It is about moving from the ability to recite the catechism to having a genuine sense of ones own spirituality – from knowing the rules to having the confidence to apply them in new and complex situations. But it is also about the skill of the wood turner, the compassion of the nurse, the empathy and understanding of the counsellor, the skills of the athlete – in fact anything that makes us distinctive human beings. Profound learning builds on shallow and deep learning and is the ultimate expression of personalisation.

The nature of learning in the future will be substantially determined by the shared perceptions of the purpose of learning. This in turn might best be expressed in terms of the needs of the learner; a focus on deep and profound learning would produce the following definition of the learner in the future:

### ***The Autonomous Learner***

*The autonomous learner knows how to learn and has a disposition to do so. She can identify, on her own, and /or with others, a problem, analyse its components and then marshal the resources, human and non-human, to solve it.*

*She continuously questions herself and others as to whether she is employing the best methods. She can explain the processes of her learning and its outcomes to her peers and others, when such a demonstration is required.*

*She is able to organise information and, through understanding, convert it into knowledge. She is sensitive to her personal portfolio of intelligences. She knows when it is best to work alone, and when in a team, and knows how to contribute to and gain from teamwork. She sustains a sharp curiosity and takes infinite pains in all she does.*

*Above all, she has that security in self, built through a wide and deep set of relationships and through her own feelings of worth fostered in part by others, to be at ease with doubt, and to welcome questioning and probing of all aspects of her knowledge.*

(This definition was developed by Christopher Bowring-Carr)

Deep and profound learning occur in every classroom and school every day, but often this is in spite of the prevailing curriculum, patterns of assessment and modes of teaching. The issue is to optimise the likelihood of deep and profound learning being available to all as an entitlement and as the core purpose of the school. Deep learning occurs when understanding is achieved, and this is fundamental to any aspect of life, driving a car, medical research, writing poetry, preparing a meal, becoming a moral person all require personal understanding to ensure success and personal authenticity. The rest of this discussion focuses on how current research might inform practice in schools in order to maximise the possibility of deep and profound learning.

### **The science of learning**

There is probably not a science of learning at present. There is no synthesis available of the wide range of scientific research that may impinge on our understanding of the learning process. Research into genetics, neurological functioning and cognitive psychology do seem to point to the possibility of increased empirical knowledge about how we learn. However, it would be premature to claim that there is a holistic theory of learning in the offing. It is equally important to view with caution claims made on the basis of research, which was never intended to inform learning and teaching in schools. And then there are the panaceas promoted as the basis of limited scientific research but with no claim to universifiability – open access to water, brain gym, playing Mozart are not harmful, they may indeed be helpful but they are not based in scientific research. Inevitably, the picture is much more complicated in that our behaviour, and therefore our capacity to learn, is the result of a complex series of

permutations and interactions in the brain, which are in turn the result of our learnt experiences.

This tight orchestration of thought and feeling is made possible by what amounts to a superhighway in the brain, a bundle of neurons connecting the prefrontal lobes, behind the forehead – the brain’s executive decision-making center – with an area deep in the brain that harbors our emotions. (Goleman 1998 p24)

As our understanding of this relationship grows so do the implications for the management of the learning process and Pinker (2002 p40) argues that it is possible to identify three interacting components of the brain:

- It has distinct interaction processing systems for ‘learning skills, controlling the body, remembering facts, holding information temporarily, and storing and executing rules.’
- Secondly, there are mental faculties ‘dedicated to different kinds of content, such as language, number, space, tools and living things.’
- Thirdly, there are the systems for motivation and emotion, the ‘affect programs.’

Pinker concludes:

Behaviour is not just elicited or emitted, nor does it come directly out of culture or society. It comes from an internal struggle among mental modules with differing agendas and goals. (ibid)

From this perspective brain functioning, and therefore learning, can be seen as a complex interplay between information processing, mental faculties and the affect programs. These factors, what Pinker calls ‘combinatorial software’ are the essence of our capacity to learn and to use that learning. Our knowledge of these three elements is limited; even more uncertain is how they interact and how the multiple permutations they offer might be better understood and managed. What is clear, and available, is the potential to develop and enhance each of these elements and so enrich their ‘combinatorial’ capacity.

Hard scientific data about leaning is very elusive but there are significant developments, which may lead to profound changes in the conceptual framework that informs our thinking about the nature of learning. The completion of The Human Genome Project has led to equal outbursts of optimism and pessimism about the future of the human race. For some there is hope that genetic engineering will remove most of the ills that assail humanity and the positive attributes will be enhanced and extended. This prospect has led others to reinforce the centrality of human experience as the key determinant of our lives i.e. we come into the world as blank slates. Educational theory and practice has been very largely dominated by a view of the world that according to Pinker (2002)

.....divides matter from mind, the material from the spiritual, the physical from the mental, biology from culture, nature from society, and science from the social sciences. (p31)

Not surprisingly, educationalists have believed, and created an education system around the belief that the schooling process is the means by which the tabula rasa or blank state is filled. As Pinker caricatures it 'children come to school empty and have knowledge deposited in them' (2002 p222). For Pinker:

Education is neither writing on a blank slate nor allowing the child's nobility to come into flower. Rather education is a technology that tries to make up for what the human mind is innately bad at. (ibid)

Our genetic and evolutionary inheritance means that we have a predisposition to speak; we do not have such a predisposition to write. Education is a process of compensating for gaps in our biological inheritance and adapting natural predispositions 'to master problems for which there were not designed'. (p223)

And this offers priorities for educational policy: to provide students with the cognitive tools that are most important for grasping the modern world and that are most unlike the cognitive tools they are born with. (ibid p235)

This is an argument for both a better understanding of the impact of our genetic inheritance and recognition that the blank slate and genetic determinism arguments are both wrong.

Our capacity to learn is the result of complex interactions at the most fundamental level of what makes us human. The most powerful expression of this interaction is our neurological functioning. The brain is the most powerful example of the interaction between our genetic make up and the environment in which we live. The starting point for this discussion has to be a very simple but highly contentious proposition – learning is a physical process. There is no ‘ghost in the machine’.

So everything we think and feel can ultimately be boiled down to this alternating sequence of electrical and chemical events. The electrical signal arriving along the axon is converted into a chemical signal that carries it across the physical barrier, the synapse, between the neurons. Greenfield (2000 p39)

Although it would be wrong to claim any sort of direct correlation between neurological research and classroom practice yet; it is worth noting the range of neurological functions which have a demonstrable impact on all learning processes:

- attention span and concentration
- threat and stress
- motivation
- the emotions
- memory
- neural processing.

Jensen (1998) demonstrates the complexity and difficulties in relating our intentions in supporting the learning of others with what we know about how the brain functions:

In summary, we know the ingredients, but not the recipe. The ability to make meaningful patterns and use context seems to be activating frontal lobes. The ability to engage relevance uses our past experiences, and that domain is our temporal lobes. Meaning-making from emotional activation is more likely originating in the mid-brain’s reward circuit. Thalamus, amygdala, and even lower parietal areas are involved. Meaning-making is complex. Any one of the three ingredients can trigger it, but none is guaranteed. This suggests we ought to evoke all of them in our general practices. (p96)

Carter (1998) provides a similar link between our understanding of learning and brain activity:

The nuts and bolts of thinking – holding ideas in mind and manipulating them – takes place in a region of cortex on the dorsolateral (upper side) prefrontal cortex. This is also the location of the closely related activity called working memory. Planning takes place in this area, and it is here that choices are made between various possible actions. Some studies suggest that each type of information has its own special temporary storage niche. An area in the upper reaches of the right hemisphere prefrontal lobe, for example, has been found to light up when a person holds information about objects that are temporarily out of sight. Another spot nearby seems to hold the memory of how many times you have done a thing before. This may be part of a sort of metamemory – the ability to ‘know what you know’ and to recognize when a particular activity has been ‘done to death’ – both of which are skills that often seem to be missing in people with frontal lobe damage. (p195)

Our capacity to learn is the result of an incredibly complex equation of which neural processing is only a part. It would be difficult to produce a list of all the factors influencing learning without listing everything informing who we are as people. However, as our knowledge of neurological functioning improves it might be increasingly possible to help individuals understand the optimal circumstances that inform their potential to learn. Any summary of these issues is bound to be a parody but it is possible to identify a range of implications for educators about research into the brain:

- There is a need for a much greater understanding of the development of the brain, and leaning potential, in the early years.
- Effective learning is an individual phenomenon – every brain is unique – and there needs to be much more explicit recognition of individual disposition to learn.
- Teaching needs to pay more attention to the variable influencing engagement with learning, e.g. choice of learning activities, time-on-task, appropriate levels of challenge, development of cognitive skills and strategies, especially memory.

- The psychological aspects of learning need greater recognition – even though the effects may be long term. Health is a vital component of effective brain functioning.
- Human relationships, especially in the family, have a profound impact on learning capacity. Effective neurological functioning is significantly determined by the emotional state of the learner.

### Learning is a social relationship

The increasing recognition of the importance of emotional intelligence in all aspects of human collaboration is firmly rooted in neurological science. The core proposition is very simple - our emotional responses to the world are so powerful that they can overwhelm most cognitive processes. For Greenfield (2000)

The question of emotions is one of the most important that a brain scientist, or indeed anyone, can explore. We are guided and controlled by our emotions. They shape our lives as we attempt to maximise some, such as happiness, and obliterate others such as fear. (p107)

Simplistic thinking in this area sees the brain as a battleground between the emotions and reason, between EQ and IQ.

This may be the very heart of learning in the future and learning for the future – developing strategies to enhance the potential and capacity of every person: replacing knowing ‘what’ to knowing ‘how’. The work of Gardner and others on multiple intelligences and Goleman and others on emotional intelligence demonstrate the potential for building the capacity to learn on the basis of focused interventions.

Gardner (1999 p81) identifies seven implications for educators growing out of brain and mind research:

1. The tremendous importance of early experience.
2. The imperative “use it or lose it”.
3. The flexibility of the early nervous system.
4. The importance of action and activity.
5. The specificity of human abilities and talents.
6. The possible organizing role played in early childhood by music.
7. The crucial role played by emotional coding.

Each of these is an intervention – the result of learning and teaching strategies, which have the potential to develop (nature via nurture!) all aspects of human potential. The development of appropriate learning strategies will create richer, stronger and more resilient networks of neurons, which, with repetition, will become the brain’s default option – our automatic and spontaneous response. Our emotions inform our learning at the neural, personal and interpersonal levels. Developing our interpersonal relationships and our capacity to understand our emotional selves has a direct impact on our neural functioning. The health of the neural network is a product of the health of the social network and vice versa.

Perhaps the most important component of the social network is the family. In Gardner’s list above most of the factors can be directly associated with the quality of family life. In his major review of the impact of family life on a child’s educational achievement Desforges (2003) concludes:

Research also establishes that parental involvement has a significant effect on children’s achievement and adjustment even after all other factors (such as social class, maternal education and poverty) have been taken out of the equation between children’s aptitudes and their achievement. Differences in parental involvement have a much bigger impact on achievement than differences associated with the effects of school in the primary age range. Parental involvement continues to have a significant effect through the age range although the impact for older children becomes more evident in staying on rates and educational aspirations than as measured achievement. (p86)

and

What parents do with their children at home through the age range, is much more significant than any other factor open to educational influence. (p91)

High quality social relationships in the family have a direct impact upon the development of an individual as a learner. It would therefore seem appropriate to



argue that personalisation should start with the child in the family rather than the pupil in the classroom.

Effective family life is made up of a complex network of relationships which, depending on the size of the family, will usually involve sophisticated interactions between two, three or four people. There is powerful research evidence to suggest that this provides the model for the most powerful learning. Bloom (1984) demonstrated that tutoring (one-to-one teaching/mentoring/coaching) is the single most powerful learning relationship. Examining the differences between a class of 30 and the impact of tutoring he found that in terms of both learning and cognitive development in higher mental processes tutoring improved performance by two standard deviations (2\_) beyond the level of achievement in conventional classrooms.

This provides powerful empirical confirmation of Vygotsky's notion of the Zone of Proximal Development and Bruner's theory of scaffolding which according to Mercer (2004)

...represents both teacher and learner as active participants in the construction of knowledge.

The essence of the concept of scaffolding as used by Bruner is the sensitive, supportive intervention by a teacher in the progress of a learner who is actively involved in some specific task, but who is not quite able to manage the task alone. (p74)

Most parents will recognise this relationship; virtually all of us will have experienced a learning relationship with another person which has moved us beyond what we might have achieved on our own – learning to drive, to swim, to tell the time, to ride a bicycle, to play a musical instrument, to talk. The most powerful learning relationship in our lives is the one-to-one with a person whom we trust, who has the skills to take us forward and with whom the emotional relationship develops as the learning relationship grows and matures. Edgar (2001) provides a powerful vindication of the role of the family:

...the family, in whatever form, is the foundation for every human child's human capital; it is the crucible of competence. It is also the starting point for every child's networks, its connections with the wider world, its sense of trust

of and reciprocal obligations towards ‘strangers’ in the society as a whole. Married or not, single parent or two, first family or step, based on blood ties, adoption or simply deep friendship, families are the key mediation point between individual and society, the private self and the public self as employee, voter or community group member. (p31)

Any model of personalisation has to be based on the individual child in the family setting.

However, it is important to recognise that personalising learning is not about individualization. Much of human life is rooted in social interaction, largely in groups of varying sizes. The ability to work and learn in groups and teams is as much a part of personalisation as the ability to work alone or with a mentor. In Appendix 1 Hazel Pulley, Headteacher of Coldecote Primary School, Leicester describes her school’s strategy to build effective relationships to support learning. Her account identifies a number of significant factors in creating a climate and culture for learning:

- The development of shared values;
- Working through agreed protocols;
- Developing meta-cognitive understanding through the use of relationships;
- Providing ongoing support, development and training;
- Celebrating success.

#### Intelligence and learning

The debate around the nature of intelligence is central to any view of learning in the future. Most education systems are still dominated by four fundamental assumptions about intelligence:

- intelligence is expressed through logical and reasoning abilities;
- those abilities can be measured quantitatively;
- such measures are predictive;
- intelligence is fixed for life.

These assumptions have led to patterns of schooling, assessment, the nature of the curriculum, models of accountability and dominant modes of teaching. A key influence in Britain was Cyril Burt who argued that intelligence was 80 per cent genetic in origin – which might explain the confidence in predestination implicit to

many education systems. However, according to Ridley (2003) reviewing studies of twins:

IQ is approximately 50 per cent 'additively genetic', 25 per cent influenced by the shared environment and 25 per cent influenced by factors unique to the individual. (p90)

Ridley points to two other crucial findings; firstly living in poverty has a profound impact on IQ – environment outweighs genetics. Secondly, ageing reduces the effect of family environment on IQ and genetic factors become more significant. If these points are accepted then many of the fundamental assumptions underpinning schooling are called into question. Schooling fails to come to terms with environmental issues and what we are learning about the influence of genetics. The essential model of schooling is a reflection of theoretical assumptions change then the model of schooling has to change. To build an educational system around IQ, which is so culturally and chronologically specific is to deny the full human potential of an individual.

I view giftedness as being of multiple kinds, as would be retardation.

Componential, experimental and contextual strengths and weaknesses can all lead to different patterns of giftedness or retardation, and hence, for me, giftedness and retardation are in no way unitary phenomena. (Sternberg 1990 p299)

Sternberg's view has, of course, much in common with Gardner's view of multiple intelligences; both offer a response to the potentially inhibiting model based around IQ. If our understanding of intelligence moves from a unitary to a federal model then a range of assumptions about the nature of the curriculum, the role of the teacher, the patterns of assessment and accreditation are all called into question. Gardner shows just how fundamental the challenge is:

For those who believe that human beings have a desire to explore and to understand the most fundamental questions of existence, and that curricula ought to be organized around the teaching of these epistemological concerns – familiarity, the true, the beautiful and the good. (1999 p226)

The response to this challenge lies in what Gardner characterises as ‘literacy skills, disciplinary skills and the possibility of multidisciplinary or interdisciplinary approaches’ (ibid). A further challenge to the historical model of intelligence is the recognition that intelligence is, partly, a social construct based on interactions.

.....I want to capture the important fact that intelligence, which comes to life during human activities, may be crafted. There are both social and material dimensions of this distribution. (Pea, 1997, p50)

Intelligence is constructed socially through relationships and interactions; the material dimension is in response to the environment and artefacts. Intelligence can thus be said to be constructed, in fact, intelligence can be learned and can be taught, if we change the definition of intelligence. We have changed our definitions of democracy, family, and culture; so it may now be time to develop a new understanding and shared usage around the concept of intelligence.

Csikszentmihalyi (1997) offers a powerful model to help us place the debate about intelligence in context.

Generally, when the issue of thinking comes up, most people assume it must have to do with intelligence. They are interested in individual differences in thinking, such as: “What’s my IQ?” or: “He is a genius in math.” Intelligence refers to a variety of mental processes; for instance, how easily one can represent and manipulate quantities in the mind, or how sensitive one is to information indexed in words. But as Howard Gardner has shown, it is possible to extend the concept of intelligence to include the ability to differentiate and to use all kinds of information, including muscle sensations, sounds, feelings, and visual shapes. (p27)

For Csikszentmihalyi the central feature of effective learning is flow:

These exceptional moments are what I have called *flow experiences*. The metaphor of “flow” is one that many people have used to describe the sense of effortless action they feel in moments that stand out as the best in their lives. Athletes refer to it as “being in the zone,” religious mystics as being in “ecstasy,” artists and musicians as aesthetic rapture. Athletes, mystics, and

artists do very different things when they reach flow, yet their descriptions of the experience are remarkably similar. (p29)

Csikszentmihalyi goes on to identify the factors that are most likely to lead to flow:

- A clear set of outcomes that require a proactive response;
- Immediate feedback that provides a clear indication of progress;
- A challenge that is attainable but stretching;
- Skills that are appropriate to the challenge.

When all of these elements are in place then we are most likely to experience meaningful success which reinforces our desire to learn.

Thus the flow experience acts as a magnet for learning – that is, for developing new levels of challenges and skills. In an ideal situation, a person would be constantly growing while enjoying whatever he or she did. (p33)

### Learning for the future

Based on what has been discussed in this chapter it is possible to begin to draw some tentative conclusions about what actions might be taken now in order to create a model of learning in the future and learning for the future. The fundamental issue is to create an effective dialogue between professional educators and those carrying out research into all branches of neuroscience and cognitive development. At present educationalists are working by inference and innuendo, feeding off the crumbs when they need to be sitting at the table as equal participants. There is an obvious need for a radical change in the perception as to what constitutes professional knowledge and the creation of new communities of practice centred on the application of scientific research to professional practice in schools. The implications of such a partnership might include:

1. A focus on the need to design learning programmes around the individual as a unique learner rather than as a member of a class. This implies much more than the diagnosis of learning styles, rather a detailed profile of all the variables that are likely to have an impact on the individual's ability to learn. In medical terms moving from an X-Ray to a full body scan.
2. A recognition of the impact of the social environment as a crucial determinant of educational success. The significant improvements in public

health in the nineteenth century were partly the result of improvements in medical practice but were substantially the result of improvements in the basic infrastructure i.e. clean water and sewers. Real improvement in the learning of all will only come when the issues of social equity are addressed.

3. The introduction of programmes to enhance cognitive ability; what might be called the ‘cognitive curriculum’ that might take the form of a range of interventions to enhance the skills that Gardner outlines above. The content-based curriculum would become the vehicle for the cognitive curriculum rather than, as at present, an end in itself.

4. As part of the cognitive curriculum, far greater emphasis needs to be placed on the cultivation of personal and social skills, the concept of emotional intelligence. This has implications for effective learning, the development of social skills, employability and, crucially, the social expression of moral principles.

5. A review of our understanding of assessment, both what is assessed and how it is assessed, in essence moving from summative to formative, from assessment of learning to assessment for learning.

6. A radical rethinking of the role of the teacher, moving from the manager of information to the facilitator of the learning of the individual. Central to this change is the development of the role of the educator as coach as the pivotal relationship in the facilitation of learning.

7. A focus on the development of ICT to support the learning process, especially the development of cognitive skills such as memorisation, problem solving, analysis and information management.

Fundamental to all of these points is an emphasis on the early years of learning; neurologically, socially and morally investment in the early years seems to be the one thing that is most likely to create a learning society through the development of personalised approaches.