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Adolescence; a critical evolutionary adaptation

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The 21st Century Learning Initiative's essential purpose is to facilitate the emergence of new approaches to learning that draw upon a range of insights into the human brain, the functioning of human societies, and learning as a self-organizing activity. We believe this will release human potential in ways that nurture and form local democratic communities worldwide, and will help reclaim and sustain a world supportive of human endeavor.

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Adolescence; a critical evolutionary adaptation

This Paper, by drawing on a range of recent research in several disciplines on how the brain functions, and how humans learn (and how children are taught), can be seen as a challenge to an over-dependence on outcome-based strategies to raise levels of educational attainment. Such an outcome-based system of education drives up standards of numeracy and literacy for some at the expense of the development of the whole child (adaptability, flexibility and creativity), trivialising human potential.

The author has wide experience of education systems in other parts of the world, as well as first-hand knowledge of how nearly twenty years of such outcome-based education strategies have impacted on teachers, pupils and communities in England. The paper urges all participants at the Budapest Conference to consider whether reforms in their own lands are not in danger of creating "overschooled but undereducated" young people. Better appreciation of the biological changes occurring in the adolescent brain should inform any reform concerned with secondary education, and a full appreciation of the biological changes involved in both the youngest children as well as in adolescents, should raise fundamental questions about the traditional resource allocations that have normally favoured secondary education.

Any system of schooling has inevitably to be based on a perception of how children learn. From the irate, gutsy parent exclaiming "I somehow survived school and it did me no harm, so just get on and do as you are told", to the belief of the ancient Greeks that only those youngsters who had been born with gold in their constitutions (as opposed to silver or iron) were worth educating, formal systems of schooling reflect the dominant perception of how people learn. Systems of education that still reflect the influence of the English grammar school tradition need to remember that this was originally defined in 1570 by Roger Ascham who claimed that more could be learned from one hour of academic study than from twenty hours of practical experience. This assumption, still alive and thriving in many places, continues to drive a

dangerous wedge between every effort to link practical experience with theoretical knowledge.

Despite Charles Darwin's assertion in 1859 that the human brain, both in its structures and in its processes for learning, was as likely to have been shaped by evolution as the rest of the body, psychology took a hundred years longer than medical science to appreciate that the brain was infinitely more than "a blank slate." Consequently, learning theory for much of the twentieth century was dominated by Behaviourist psychology, which ignored all explanations of human behaviour which could not be observed, tested and confirmed within a controlled laboratory environment.

Learning, Behaviourists asserted, was all about being taught. With the appropriate teaching, they argued, it was possible to condition people in any way specified. Inadequate learning could then be explained by ineffective teaching methods rather than any possibility that the very methods employed by schoolteachers might run totally counter to the "grain of the brain" – the way people learn naturally.

Despite the insights of many perceptive educators from the mid nineteenth century onwards (Froebel, Montessori and Rudolf Steiner to name but three), national policy makers have found it extremely difficult to refute the Behaviourist approach to formal schooling. The technologies which now enable scientists to study the details of how the brain functions did not become available until the invention of PET and CAT scans in the late 1970's, and of functional MRI in the mid 1980's. Consequently the reforms proposed by the Hadow Report in England as long ago as 1926, the Plowden Report of 1965, and in Canada the Hull/Dennys Report of 1967 – persuasive as they were of informed opinion - eventually failed to convince the mass of the population who found such concepts too insubstantial to believe without the scientific findings to support them.

The past twenty or so years have seen a plethora of studies on the brain emerging from three "new" scientific disciplines which now provide much of this scientific corroboration.. **Cognitive science**, which has grown out of the study of the possible similarities between the way in which computers operate and the structures to be found in the human brain, has caused scientists to refute the idea of the brain as a

"blank slate" as earlier argued by eighteenth and nineteenth century philosophers. **Neurobiology**, using the new brain scan technologies, was able in the 1980's to study the amazing interconnectivity between disparate parts of the brain involved in even the simplest intellectual processes. **Evolutionary psychology** dating only from the late 1980's, is a hybrid of evolutionary sciences and psychology together with genetics, archaeology, anthropology and biology. Evolutionary psychology seems set to explain more and more of our every-day behaviours in terms of mankind's evolutionary origins.

Fascinating as these three disciplines are, they use different research methodologies and seem not even to talk the same language, so that it is often difficult for the layperson to understand their significance. The analogy of the Hindu proverb of the three blind men trying to describe an elephant is appropriate – one man feels its trunk and says it's a snake; another feels a leg and concludes that it is a tree, while a third, feeling its ears, believes it to be a gigantic leaf.

At a time when there is increasing concern amongst many developed countries that formal education, especially at secondary level, is failing to meet the needs and expectations of young people for an appropriate induction into adult life and responsibilities, there is an urgent need for a Synthesis of all this research; something which shows what the research means when taken in its entirety. **Such a Synthesis should then inform policy makers as to the political, strategic and resource implications of what ought to become a new model of learning which goes far beyond that which can be readily measured and targeted.**

Central to the findings contained within the Synthesis as set out by The 21st Century Learning Initiative are two key concepts. Firstly, in comparison to other mammals, human babies are born with premature brains which are only forty percent fully formed. Other mammals give birth to their young with almost fully-formed brains. The reason for this, it is now generally accepted, is that for several million years of human evolution the more our ancestors used their brains, the larger their brains became, and so the bigger their skulls had to be to contain them. The human skull grew so large that it could no longer pass down the woman's birth canal, and so a unique evolutionary compromise emerged. Human babies are born with brains that

contain, within their incomplete structure, a mass of evolutionarily constructed predispositions that enable the baby to mastermind its own subsequent brain growth through responding to its immediate environment during the first thirty months of life. It is this phenomenal natural talent for learning that accounts for our species growing from being almost helplessly vulnerable at birth to eventually becoming the dominant species on the planet. It is our brains that give us this dominance, not our muscles – and our brains do not grow through instruction, but have evolved to learn from direct experience.

Secondly, contrary to what was assumed until extremely recently, brain development is not completed by about the age of twelve, with only the sexual hormones of adolescence being responsible for what often seems the bizarre, irresponsible and irrational behaviour of teenagers. Neurobiology is just starting to show that, far from such behaviour being simply the result of tempestuous hormones, the physiological changes taking place in the adolescent brain are so profound that they rival the growth spur of early childhood. These structural changes, only apparent to scientists in the last five or so years, suggest that the adolescent brain is passing through a period of structural reorganisation that is every bit as critical as are the first few months of life.

> "The teenage brain, far from being ready-made, undergoes a period of surprisingly complex and crucial development. The adolescent brain is crazy by design." writes the most recent commentator on the primal brain,

The Initiative's Synthesis, by drawing on both the theories from evolutionary psychology as well as noting what cognitive science shows are the cognitive strategies humans have evolved over time to be extremely effective learners, has concluded **that by being "crazy by design", adolescence is actually a critical evolutionary adaptation that is essential to our species' survival.**

Those structures that had earlier enabled the young to learn easily as toddlers, through intense emotional connection with older people, had to be balanced later by an internal mechanism that prevented children from becoming mere clones of their parents. In other words, unless those close bonds which had characterised the earliest years were ruptured (forcibly if necessary) the young would never grow to be adaptable to new situations. Adolescence, it is now becoming recognised, is that

deep-seated biological adaptation that makes it essential for the young to go off, either to war, to hunt, to explore, to colonise, or to make love – in other words to prove themselves – so as to start a life of their own. **As such it is adolescence that drives human development –it is adolescence which forces individuals in every generation to think beyond their own self-imposed limitations, and to exceed their parents' aspirations.**

The implications of such an understanding about brain and intellectual development are immense. Immediately it would suggest that, by contemporary schooling continuing to emphasise the assumptions of the classical curriculum and the belief that education is pre-eminently an institutional activity, it is actually the process of schooling which is exacerbating the difficulties which contemporary societies experience with their young people, rather than alleviating the problem. From the findings of cognitive apprenticeship it would seem that a model of learning is needed that gives every support possible to the youngest learners (both to the children themselves, as well as the range of adults who support them) so that, as the child grows older, it takes more control of its own learning. **Such a Model of Learning would match exactly the neurological progression of the brain of the young child as it transforms itself into the adolescent brain. Adolescents, it seems, have evolved to be apprentice-like learners, not pupils sitting at desks awaiting instruction.**

In considering how best society in general could respond to this changed view of learning it is worth pondering the dogma of **Subsidiarity**. Defined in 1931 as a doctrine to strengthen the resolve of Catholics in central Europe that it was entirely right for them to hold on to their beliefs, despite all the pressure from the new communist governments for everyone to conform to the new political ideology, Subsidiarity has more recently become the organising principle for the European Community (not always honoured in the observance) to ensure that decisions are always made at the lowest appropriate level possible. Subsidiarity states: **"it is wrong for a superior body to hold for itself the right to make decisions which an inferior is already qualified to make for itself."**

The doctrine of Subsidiarity simply restates what every self-respecting craftsman of years gone by knew had to be the evolving relationship between himself and each of

his apprentices. It needs to define a similar evolving relationship between teachers and maturing youngsters.

People have always learnt through constantly facing challenges somewhat beyond what they think is within their own reach. The strategies we apply to learn reflect, quite literally, what millions of years of fine adaptations have bequeathed to us, namely, that our learning is most effective when it is done collaboratively, on-the-job, and when it is directed to the solution of real problems. Secondary schools have existed for only about two hundred years. They are not about apprenticeship forms of learning; they were designed to respond to a Behaviourist concept of human learning. We now know that Behaviourism is a significantly flawed concept. If today's secondary schools are the wrong place for the descendants of brilliant stone age thinkers to thrive in, then society as a whole (and certainly not simply the schools on their own) has to rethink how to direct the creative energy of adolescence to the overall good of the community. **Youngsters who are empowered as adolescents to take charge of their own futures will make better citizens for the future than did so many of their parents and their grandparents who suffered from being over schooled but undereducated in their own generations.**

Note: The research on which this Paper is based suggests that an increase in resources in the earliest years of schooling (linked to an appropriate pedagogy that prepares youngsters to take responsibility for their own life-long learning from an early age), should lead to very different forms of secondary education. In such systems the emphasis would be on using resources to enable young people to take ever more responsibility for their own (apprentice style) learning, with ever decreasing dependence on teachers for instruction. Such a redistribution of resources would give the youngest pupils many years to prepare to use their adolescent predispositions ever more constructively which is what – this paper has argued – the adolescent brain has evolved to do most successfully over aeons of time. Educationalists have to reverse many of their assumptions about Adolescence, and see it as an Opportunity not a Problem. Education which "goes with the grain of the brain" will deliver results far superior to those gained without the full emotional and intellectual involvement of the student.

Educationalists have one further assumption to reverse; it is not only teachers who can teach, and it's not only in classrooms that students learn. The new technologies of information and communication have been demonstrating this for years. Motivated pupils, confident of their own skills and aware of their growing maturity, and accepting ever more responsibility for monitoring their own performance would be enormous assets to communities which have, over recent years, tended to see adolescents at worst as threats, and at best as a cost.

Policy makers have to ponder these issues most carefully, reappraising the effect an outcome-based system of education has upon schools and the unbalanced curriculum they offer. It is paramount that policy makers consider the impact this has on teachers, all too often killing their ability to think for themselves, to innovate or to be creative, to respond to the needs of the children they know and to "lead them out" (Latin; educare – to lead out) to become independent radical thinkers. This is the new world whose birth we have to assist.