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ABSTRACT

This paper contends that classrooms should be safe places for students and their teachers to be wrong, suggesting that this concept should provide the mainspring for educational reform in Hong Kong and in other places in the world. It notes that education in Hong Kong is harsh and has a tendency to label students; for the majority of students, this labeling is very negative. The paper explains how error correction can be beneficial to a student's education. It begins by examining three reasons why classrooms should be safe places to be wrong. The first, Karl Popper's falsificationism, is philosophical and draws on the philosophy of science. The second, Gerald Edelman's theory on neuronal group selection, is psychological or neurophysiological and concerns the physical workings of the human mind. The third, a vision of education, is educational. The paper concludes that whatever methods teachers may use, they should always ensure that their classrooms are safe places for themselves and their students to be wrong and to learn from their errors. (SM)

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Title: *Classrooms as safe places to be wrong*

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The basic argument of this paper, that classrooms should always be safe places for students and their teachers to be wrong, is not particularly profound. Instead, it might better be viewed as a cry from the heart. If implemented in practice, however, it would profoundly affect the way that teachers teach and students learn. This is particularly true in Hong Kong, which provides one of several backdrops for this paper, for it is where I am presently employed. Indeed, I suggest that this concept should provide a mainspring for the reform of education currently being considered there. But the underlying concern of this paper applies beyond the city of Hong Kong, to all other parts of our global village, the community of peoples on planet Earth. Like most issues in education, ultimately it comes down to practice, but as practice in education is always theory-impregnated, I want to begin by offering three good reasons why classrooms ought to be safe places to be wrong. The first is philosophical, drawing particularly on the philosophy of science. The second concerns the physical workings of the human mind, so might be called psychological or neurophysiological. The third is educational. We will take them in that order, with education returning us to the issue of implementation in practice.

First good reason - Karl Popper's Falsificationism

A very common saying in English, I am sure in other languages too, is that we learn by our mistakes, by trial and error. Karl Popper, one of the most distinguished philosophers of science in the twentieth century, elevated this basic idea into a very influential view of science. Popper argued for 'falsifiability' as the essential characteristic of science and thus the dividing line between genuine science and what he called 'pseudo-science'. His principle of falsification bears some similarities with the 'verification principle' of twentieth century Logical Positivism, in that it uses methodology as the criterion for demarcating science from non-science – a strategy that can be traced back to Aristotle. Popper was well aquatinted with the founding members of Logical Positivism, the Vienna Circle, including Rudolf Carnap, but these similarities and relationships are deceptive, for Popper's notion of falsificationism quite literally stands the verification principle on its head.

According to the positivist the only statements about the world that are meaningful are those that can, at least in principle, be verified by an appeal to sense evidence. Only these 'sense-statements' belong to science. All other statements related to the

world are strictly 'non-sense' – including those that express metaphysical and religious beliefs, and value statements of various kinds. If I assert that $E=mc^2$, I can carry out certain experiments that either will or will not verify the statement. But if I assert 'thou shalt not kill' what kind of empirical evidence can support that? It is simply a statement of wish or emotion, they claimed. Popper believed, however, that no scientific statement is ever verifiable in the way demanded by the positivist, and that the 'repeated attempts of Rudolf Carnap to show that the demarcation between science and metaphysics coincides with that between sense and nonsense have failed' (Popper, 1972, p.253). Moreover their formulation allows into the arena of science other areas of inquiry claiming empirical evidence, including Marxism and Adlerian psychology, that he believed were not science at all.

What distinguishes a scientific statement or theory, he argued, is its potential falsifiability, not its verifiability. The best scientific theories are those that are most highly falsifiable and yet have not been falsified. Poor scientific theories are only weakly falsifiable and non-falsifiable theories are non-scientific. $E=mc^2$ is highly falsifiable, in that it makes a number of predictions that might turn out to be wrong. Popper strongly admired Albert Einstein, not only for his genius in synthesising his thoughts to produce relativity theory, but also for the boldness of his conjectures - taking the risk to be wrong. By contrast he was highly critical of Marxism and of Adler for producing theories that could always be safeguarded from being falsified. Every conceivable situation relevant to the theory could be accommodated in it. The theory was always right – always verifiable. Popper recalls:

> As for Adler, I was much impressed by a personal experience. Once in 1919, I reported to him a case which to me did not seem particularly Adlerian, but which he found no difficulty in analysing in terms of his theory of inferiority feelings, although he had not even seen the child. Slightly shocked, I asked him how he could be so sure. "Because of my thousand-fold experience", he replied; whereon I could not help saying: "And with this case, I suppose, your experience has become one thousand and one-fold" (Popper, 1972. P.35).

Actually there are severe problems with Popper's notion of falsificationism, as a criterion of demarcating science from non-science, that need not bother us here. Its main value, I suggest, is as a strategy for learning, whether in school or in undertaking research. Popper argues that we should always make bold, highly falsifiable statements if we want to grow in understanding, both individually and as a community of inquirers. In other words, our statements should take risks, and should be stated with transparency and clarity such that it is evident what circumstances or events would falsify the statement. And if it is falsified, then this is a moment for *celebration* for we have actually learnt something. Nothing is learnt, he believes, from the repeated verifications of our favourite theories.

Here, then, is a view of learning and inquiry that places high value on *risk* and *error*. It is therefore one that, if implemented in education, would require the learning environments of classrooms to be safe places to be wrong. Places where teachers

and students alike can take risks, be bold in their imaginations and recognise the value of error. *'Well done, you have given it a try and got it wrong, you have learnt something important'*. How many times do you hear teachers say that? Not many in Hong Kong, and not many elsewhere from my observations of classrooms over the years. But, then again, how many researchers in education are trying to produce theoretical constructs that are high in falsifiable content? How many, like Adler, are simply verifying their favourite theories, for the umpteenth time?

Second good reason - Gerald Edelman's theory of neuronal group selection

Popper's idea of learning provides one good reason why classrooms need to be places where it is safe to make mistakes. *Without mistakes there is no growth of learning,* he believes. His idea of learning by mistakes is corroborated by Gerald Edelman's theory of how the brain functions to produce our thoughts – although neither author seems to have been aware of the other. Edelman's theory of mind and brain provides a second reason why classrooms need to be safe places to be wrong. In 1972 Edelman received the Nobel Prize for his pioneering work on the immune system in which he challenged conventional wisdom, particularly Linus Pauling's instructionist theory of antibodies. Edelman's basic idea was that antibodies are produced in the body by a process of selection and not instruction –mirroring the nineteenth century battle between Darwin's concept of evolution by natural selection and Lamarck's notion of evolution by natural instruction. In the1980's, Edelman came to believe that his ideas on the immune system might also apply to processes within the brain. The brain works he believes by a process that he calls *neuronal group selection*, a principle similar to natural selection. The theory as a whole is very detailed, but the basic idea is relatively simple, although it takes just a bit of explaining. Edelman is strongly opposed to the conventional view of the mind as essentially a biological computer. In addition, he directs our attention to issues of perception and categorisation and the relationship between the two. Also, to the idea that the world does not come ready-labelled. Finally, as we noted, he points to the biological theory of evolution and development by natural selection. These are the main starting points of the theory.

Edelman challenges the idea that the brain works by a system of instruction. That requires the world to be ready-labelled –with objects and processes in the world, ready made, for us to perceive and categorise. In short, the 'instructionist view' is dependent on a *realist account of the world* and a *correspondence theory of truth*. In addition to the world being ready labelled, the brain is said to be pre-programmed to receive information from this already structured world. Edelman sees problems with both aspect of this image of the mind. First, the world is not ready labelled. Instead, the world comes to us as a kind of chaos that we have to sort out, we have to do the labelling and categorise our perceptions. Second, the mind is not pre-programmed to simply receive information. The problem here is that our bodies are constantly growing and changing, so to operate them one would need not one but very many programmes located in our brains or genes, to be called on as we develop. Furthermore, for computer programmes to work they have to process information that is carefully and accurately loaded in by an operator. But there is no operator, no 'little man' (homunculus) within the brain, so the information can only come from

the world, but then the world does not present itself as pre-packaged and orderly in that way. We seem to be trapped in a circle.

Edelman's alternative theory posits that our image of the world is not *imposed on* the brain by a process of instruction, but instead is *composed by* the brain through a process of selection. How might that occur? He draws our attention to the notion of population, which, of course, was also crucial for Darwin. In this case, however, it is not the population of a species, in which some features are favoured over others and survive, but the immense, overabundant population of neurons and neuronal maps composed of synaptic connections in the brain. These physically connect with maps of sensory receptor cells (of eyes, ears, etc.) and also between themselves (maps to maps) within the anatomy of the brain, a process he calls *global mapping*. The signals between maps go back and forth, constantly, in exceedingly large numbers, a process that he calls recursive *reentrant signalling* (Edelman, 1989, p.64). In this dynamic process some of the many connective patterns thus formed become strengthened, because they possess salience or meaning for the individual – they work – whereas those not of value are weakened or die. It is this process, he believes, that in particular accounts for perceptual categorisation and memory.

Consider a young baby and its exploration of the world in which it finds itself. According to much conventional theory, the baby's ability to come to terms and make sense of its environment is pre-programmed, 'telling' the baby how to grasp objects, for example. Edelman's alternative view is that no such programme exists, in the sense of having sets of 'rules' hard-wired into the brain at birth. Instead the baby learns to perform these actions by trail and error, employing many and various reaching movements that are caused by random firing patterns in the cerebral cortex, until some register as successful. Over many repeated trials those that work are strengthened, while those that are unsuccessful are weakened. The firing patterns remain the same, what changes is their selection. The patterns that are strengthened are more likely than others to fire again. Here, then, we have a selectionist or Darwinian view of learning. Independently, Popper also argues for selection over instruction and on similar grounds, related to the nature of perception, although he does allow instruction 'from within the structure itself' (Popper, 1994, p.8).

For Edelman, selection is guided by *value* imposed in the brain by the brain. What the brain possess is not a set of genetically acquired 'rules', but rather a *value system*, physically located in the 'old' evolutionary brain stem, which works by sending chemical signals throughout the brain, reinforcing those connections that have meaning and salience for the individual. In the case of memory, the 'computer view' suggests a process of essentially recalling or retrieving an original input, whether short-term or long-term. For Edelman, memory is value-dominated (Edelman, 1989, p.99) and results 'from a process of continual recategorization' (ibid., p.56), on the basis of previous categorisation, each time modifying previously selected neuronal groups. Thus we have a notion of memory, and indeed of the mind, as always reinventing itself.

I am not competent to judge the neurophysiological status of this theory, that is something for those more deeply immersed in that area of inquiry to decide.

Edelman, himself is thoroughly aware of the tentative nature of his proposal. Suffice it to say that John Searle, the distinguished philosopher of mind, has called it 'the most impressively worked out and most profound' (Searle, 1997, p.37) neurobiological theory of consciousness he has seen. Oliver Sacks, the no less distinguished neurologist, points out that this is the first radically global evolutionary theory of mind, and he believes it will open the way to what 'will be the delightful science of the next century' (Sacks, 1994, p.14). What I can say, however, is that if it is generally on the right lines, and I believe it is, it provides another reason why classrooms should to be safe places to be wrong. Edelman not only stresses the learning value of mistakes but also the value of successes. It is the successes that are accorded value by the brain, thus strengthening the synaptic connections. A classroom safe to be wrong is also a classroom that progresses towards success. *'Well done, you have given it a try and got it wrong, you have learnt something important, you now have the opportunity to build on the mistake and get it right.'*

(iii) Third good reason – a vision of education

Finally to our third good reason, to education, but this time it is not so much a grand theory of learning or mind as a vision of what education should be. That vision is captured in the concept of a Liberal Education. One trouble with this concept is that it means different things to different people. Another is that it has been largely overtaken in many industrialised (and industrialising) parts of the world in the drive towards vocational competence, equipping students to meet the ever-changing needs of the workplace, particularly with the onset on new technologies. I do not intend to discuss these differences of view, or engage in the debate between liberalism and vocationalism. A very helpful introductory survey is provided in Bailey (1990). Instead, I just want to pick up one central theme; that *education is intrinsically worthwhile* – it is an end in itself, and not simply a means to other ends. That is why liberal educators oppose vocationalism, because it makes education a means to that alternative end. Closely tied to the idea of education's intrinsic worth is the notion that learning is good in itself, and that we should therefore encourage a *love of learning* in our children, but these are actually two very different ideas.

There is an educational institution in Hong Kong that has as its motto: 'The sheer joy of learning'. That is a good motto, but it hardly captures what I suspect is the experience of learning of most pupils in Hong Kong schools, or even their teachers. For many, I suggest, far from being a 'sheer joy' it is instead a 'sheer burden' – a burden of seemingly endless work, made worse by a constant threat of failure. It is only partly eased, one suspects, by the hope of better things to come, when the fruits of education might be garnered for other ends, related to employment and salary. For a very large number of students in Hong Kong schools (and for many in Britain, too) education is best characterised as an experience primarily marked by varying degrees of failure, and it is very difficult to love something that always seems to turn out that way.

The present banding and examination systems provide outward and visible signs of failure in Hong Kong. Every child has a label, and for the majority that label is very

negative. Does that also mean that those students whose overriding experience of education is failing to make the grade also lose a love of learning? I suggest not. For some thirteen years I taught students in Britain who knew, often from a very early age, that their prospects for success were non existent. Some were simply resigned to their fate, some were angry and some let the school know it by exhibiting behaviour that teachers construed as unacceptable. But what always impressed me, was that they retained a love of learning those things that they enjoyed and in which they gained a measure of success. Education and learning are not the same, but this simple fact is frequently overlooked by those working in education and policy makers too. Moreover, to have a love of learning is not necessarily to have a love of education, or to see the processes of education as worthwhile. And that is my point. What I am suggesting is that these two can be brought closer together when classrooms are made safe environments to be wrong. Failure then loses its sting. It takes on a new complexion. It is seen as the springboard to success and not as the mark of defeat.

Currently in Hong Kong there is a drive towards what the policy makers there are calling the 'student centred principle' of learning. For example, the Education Commission in its discussion document, advocating a set of new aims, argues that:

> The "student-centred" principle should be adhered to in the course of implementing the aims of education. Students should play the main role in the learning process.... If students cannot build up their confidence and play an active instead of a passive role in the learning process, the aims of education proposed in this document can never be achieved (Education Commission, 1999, p.23).

The sentiments underpinning this statement may appear to be precisely those I am referring to, but there may also be a very real difference. It depends on what is meant by the 'student centred' principle. To come straight to the point, I am not advocating one teaching method over another – child-centred over teacher-directed, for example. These distinctions of methodology have frequently influenced debate about classroom practice and the content and implementation of the school curriculum. Neil Postman has suggested that problems in education are basically of two kinds: *engineering*, technical problems related to the means by which we educate, and *metaphysical* problems related to the reasons why. Although the former are given an inordinate amount of attention within the study of education, he believes, 'the engineering of learning is often puffed up, and assigned an importance it does not deserve' (Postman, 1996, p.3).

In similar vein, I believe that method is much less important than it has often been supposed to be. Teachers should use whatever methods seem most appropriate for the particular task they have in mind. A well taught teacher-directed lesson can be the most appropriate technical means of reaching the desired educational aim. In higher education, one mass lecture can sometimes achieve what five seminars would not. Issues of method should not be determined ideologically and they are not the most important. We need to keep a focus on the metaphysical problems that Postman was referring to above - the 'reasons why' we educate. Primarily, I

suggest, we educate to help develop the minds of our pupils. If Popper and Edelman are right that requires, quite literally, providing learning experiences that will encourage risk, reward error when genuinely made, and so provide the brain with the opportunity to select for success. What does that mean in practice?

First and foremost it means that teachers adopt the attitudes and values that go with making classrooms safe places to be wrong. For many that will entail a substantial change of mind-set. It means a change in the style of language used about error and success, as I tried to indicate earlier. Those attitudes and the language style that goes with them can guide a teacher-directed lesson as much as one that is child-centred. It also means celebrating a love of learning and sharing that love with our students. The slogan 'Education for all' is one that we all espouse, especially as we live in a global village where that is by no means achieved. I want to suggest, however, that 'Love of education for all' would be an even better slogan. This is the cry from the heart that I referred to earlier - on behalf of the many children whose education experience is primarily one of failure, from which they have somehow to recover when they leave school.

But perhaps this is ivory tower stuff – the kind of thing one expects from people like me who have been in teacher education for too long. What about the real classroom? And anyway, perhaps this distinction between right and wrong is over-done. Most subjects in schools are not like that – we frequently deal in shades of opinion, not absolutes. That is partly true, but being wrong in class is not simply getting a wrong answer to a question that clearly has a right answer. It is more subtle than that. Much more, I suggest, it is a matter of being wrong footed, not knowing the answer or not understanding the question, or providing an answer that is viewed by the teacher or classmates as simplistic or silly. The wrong-answer syndrome is just a very stark expression of that more general sense of being wrong.

So to the classroom. One very important contribution that many teachers can make to their own thinking is to stop seeing themselves as a kind of human encyclopaedia. If you ask student teachers at the Hong Kong Institute of Education what they most fear about teaching practice their replies are consistently the same: student behaviour, and whether they will know their subject well enough. In other words, they primarily define their expertise as a teacher in terms of subject expertise, rather than in terms of being an expert organiser of the learning environment - despite being worried that school students can misbehave. They are frightened about being wrong-footed in their subject, so I ask them what they would do if a student asked them a question to which they did not know the answer? The idea that their role as a teacher is not to be a subject encyclopaedia hardly occurs to them, and the image of a classroom where it is safe for them *not* to know the answer seems almost beyond imagination. This scenario is not restricted to Hong Kong. I have witnessed it many times in Britain and elsewhere on the continent of Europe. Something has to be done about the image of the teacher, and the image teachers have of their role, if classrooms are to be places that allow for mistakes.

With some very real reservations I will end by telling you about an aspect of my own practice. I have reservations because it concerns the teaching of mathematics

and I was not trained as a maths teacher, although I came to teaching from a career in which mathematics was one of the main tools. From 1989-1991 I was involved in helping to establish a new school, and for those two years I found myself having to teach maths. This was in England, where maths is one of the most deeply disliked subjects – for all sorts of reasons. One main reason is that it so often leads to failure, getting the answers wrong. I wanted to try to encourage success, and hence a different attitude to the subject.

As we moved from topic to topic through the syllabus I would typically introduce the subject by placing it very much within context, including historical, social and personal contexts. Pythagoras' theorem, for example, would be introduced via the person of Pythagoras, something of his lifestyle, and the problem he set himself to solve. The theorem's use as a way of solving practical problems would take us outdoors to measure sides and right-angles, later to be used to estimate the height of the school building. We would then, but only then, start with the maths, proper. Setting the various contexts was considered very important, to give the learning relevance and anchor the problem that were to be solved in the real world. When students did examples or tests to show they had learnt the technique of handling the particular questions at issue, they would mark their own work. Their mistakes were private at that point. I would then ask to see any students who were really lost –I would then be very teacher-directed. The others, who felt they could manage to solve their errors, would get to work on their own. They had to find out why they had got the wrong answers, which allowed for collaborative work with others in the class. That was the aim – not to contrive a right answer. They had to write a brief description in their workbooks of what they had done wrong. It was that description that I marked, not the worked examples, and these also provided the content for the follow-up discussion as we brought the particular topic to a close – revising our mistakes and what we had learnt when putting them right.

I do not claim this is the correct way to teach maths, it is one of many possible methods. All I will say is that it helped to take the fear out of the subject for many of those students. I sense that this is also possible in most areas of the curriculum. So, have I not brought it back down to a matter of teaching method, after all? Not really, for underpinning the method was a set of values and attitudes and they guided how I implemented the teaching strategy at any one time, and how I spoke to the class about their work. They were the really important factor. Also, it is not method as such that I am questioning, but rather adopting one method or another as the presumed solution to all educational problems – be it so-called progressive child-centred methodology or whatever. My argument has been that whatever methods teachers employ, they should always be such that their classrooms are made safe places for themselves and their students to be wrong.

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