CEM

Curriculum, Evaluation and Management Centre

DARWINIAN SCHOOLS:
SCHOOLING IN THE TWENTY-FIRST CENTURY

Carol Taylor FITZ-GIBBON

Darwinian Schools: Schooling in the Twenty-First Century

CAROL FITZ-GIBBON

How do we think about the future? We can dream of what we would *like it to be* but how do we guess at what it is *likely to be?* Perhaps the most important question is: how can we influence the present so as to produce outcomes in the future that will be consistent with the kind of society we wish to bequeath to our grandchildren. Or can't we?

Limits of extrapolation

A simple and important technique for looking into the future is extrapolation. From an existing time series of data, projections can be made as to the way the world will look if current trends continue. The problem here is that such projections are often wildly out, even in the short term, and are particularly problematic in the long term. There are strong underlying reasons for this situation which are explicable in terms of computer-based models. Whenever there is a feedback mechanism in action, prediction equations become highly unstable. Waldrop's book *Complexity, the emerging science on the edge of order and chaos*, provides a highly entertaining and accessible description of this fundamental concept. The dynamic inter-relationship between numerous variables makes the future extremely difficult to predict in any precise fashion as economists and business analysts constantly report. (Educators too will come to realise this as they are forced by legislation to set targets by politicians who haven't done their homework, i.e. have not made themselves well informed about data in the complex field of education.) In short, education is complex: as with the weather, so with economics, business and education: unpredictability.

A safe prediction? – indicators

However, to risk a short term projection I would certainly argue that indicator systems will continue to proliferate. Due to the increasing availability and accessibility of powerful computers, numerical data can be collected, stored, and analysed in vast quantties. Indicator systems will grow, as they have already since the ALIS project started in 1983 with a dozen schools. ALIS was then called the 'Confidential Measurement Based Self Evaluation' project. The first post in ALIS was paid for by northern LEAs and it was demands for the data from schools and LEAs around the country (Staffordshire being the first LEA outside the north) that led to the widespread use of value added. Uniquely among countries of the world, when government agencies in England realised how powerful and important 'value added' data was, the teaching profession was ready to welcome such data, having already had experience of its usefulness. In many other countries there is still considerable resistance to such monitoring and there are legal battles in some states in North America.

   In England, in contrast, we are now facing a national system of value added indicators for schools following a two year project summarised in the final report 'Feasibility Studies for a national system of value added indicators' (Fitz-Gibbon,

1997). For colleges, there has been encouragement from the Further Education Funding Council to collect quantitative indicators. Headteachers' associations are calling for 'validated self-review' which will almost certainly rest on indicator systems.

In short, throughout those parts of the world where computers are part of education, indicator systems are proliferating (Fitz-Gibbon and Kochan, 2000) and will almost certainly continue to do so. A professor of economics (Smith, 1995) noted numerous problems that will accompany indictor systems, and typified them as: tunnel vision, sub-optimisation, myopia, measure fixation, misinterpretation, misrepresentation, gaming and ossification and it has been noted that Heads had already perceived most of these perils in connection with 'League tables' and value added systems (Fitz-Gibbon, 1997, chapter 6). Nevertheless, the growth of indicator systems is a fundamentally important and irreversible change that will influence the evolution of society. Indicators represent additional intelligence about the reality of what is happening. They represent a chance to know what is happening in greater detail and more reliably than by use of other methods, such as methods from the last century such as the outdated 'look and say' amateurish approaches that were adopted by the Office for Standards in Education. Not that data will prevent bad management. The disastrous launch of the Challenger shuttle, leading to the deaths of its four astronauts, was made by managers in the face of the data and advice provided by engineers. This kind of tragedy, and disasters like the drowning of nearly 200 people on the *Herald of Free Enterprise* and the gruesome spread of Bovine Spongiform Encephalopathy as new variant Creutzfeld Jakob disease, may eventually teach us all to listen to scientists, watch the indicators and behave responsibly ….. and also to recognise what good managers know already: that those doing a job generally know more about it than anyone else, and hence they should be listened to. If such a rule had been applied the lives lost on the Challenger and on the *Herald of Free Enterprise* might have been saved. We need less spin, vision and mission and more intelligent management, informed by evidence.

To predict the continuing development and use of indicator systems is no more than to predict the ever-increasing application of science to all areas of life. It is the application of science that has led to mankind's evolutionary success. This success arose once the development of language enabled scientific behaviour to develop: the keeping of systematic records and the passing on of accumulated knowledge. On meticulous data collection and crucial experiments rested the incredible successes of physics, chemistry and engineering followed by biology and molecular biology, the latter unravelling the very stuff of life. There is no reason why the same methods will not guide us in social science.

Evolution goes on and on

The Darwinian concept of evolution is probably the most satisfactory framework to adopt in considering the future and it is that framework that I wish to apply to the curriculum for the remainder of this paper.

Exactly why the application of evolutionary biology to medicine and other aspects of human life has advanced so slowly after its magnificent inception in 1859 is a question that ought to be getting major attention from historians of science (Nesse and Williams, 1994, p. 48).

A conversation from the year 2013

Before pursuing this theme any further let us look at a school of the future: perhaps 2013 (or perhaps 2059 or later). We listen in on a visitor asking for explanations as he finds a school unlike the ones he knew in the 1990s.

Visitor to Curriculum Head: Good morning, it's very good of you to show me round your school. I'm completely unaware of changes in British education which I understand have been substantial in the last two decades. Now the first thing I notice is that there seem to be tall, medium and short pupils in this school, quite dramatically different sizes. Am I imagining this?

Curriculum Head: No, you're not imagining this. You're quite right. At the moment we have four year olds, seven year olds and ten year olds in the school. Last year the twelve year olds left and we started a new group of four year olds this year. You see the idea is that we have a school population which is more like a natural family with a two year gap in ages. This isn't just a precious idea based on an analogy. A farsighted Chief Education Officer some years ago tossed a coin and had some schools implement the every-third-year-intake model. The indicator systems shows that bullying, which had become a serious problem even though it was often hidden, was vastly reduced, cross-age helping relationships were strengthened, student satisfaction level increased but the most important finding of all was a dramatic rise in achievement. Not only that but our long-term indicators showed decreased arrest rates and vastly reduced maladjustment in adult life.

Visitor: Hey! Goodness! You've thrown a lot at me there. Where can I start? Why the increase in cognitive achievement?

Curriculum Head: Well, you see, once the Local Education Authorities were told they were accountable for finding ways to improve their schools and that they would also be accountable along with social services, for costs to the community such as the cost of imprisonment, which is huge, and ill health which is another major burden, they began to look at the research literature to find out where there was evidence that something really works.

Visitor: Well, how did this lead to the creation of a school with gaps in the age groups?

Curriculum Head: This is the year 2013. More than forty years ago Herbert Thelen said 'I know of no other intervention that has been so consistently perceived as successful' and he was referring to the use of cross-age tutoring, older children tutoring younger children. Not only was this an activity which children enjoyed – and that's important, more on that later – research evidence piled up that the tutors made substantial gains when asked to teach a topic that they were learning. The tutees also made gains. Here for example (Figure 2.1) is a very old paper comparing four interventions. These weren't tremendously well controlled studies but the findings have replicated fairly well.

[Insert Figure 2.1]

Visitor: So your school population with gaps in it facilitates the arrangement of cross-age tutoring and that led to an increase in cognitive achievement?

Curriculum Head: Oh yes, it made the timetabling very much simpler and that had been identified as the single greatest problem in organising cross-age tutoring projects. But although we were driven by the literature on cognitive gains from cross-age tutoring, many of us also saw the social outcomes from this way of working as very important. And I have to say that those results have been breath-taking. You see with the growth of video conferencing and the possibility of learning from delightful programmes on computers with full multi media support, the learning of content and the development of intellectual skills have been greatly facilitated. I mean we are quite determined that our pupils are not ignorant of scientific knowledge about their health, historical facts about the world, and geographical facts, etc. We have a high regard for reality and expect our pupils to have full contact with reality by the time they leave us at the age of twelve. But all of that is not the problem it might have been when we simply had teachers and textbooks.

However, parents were telling us that they didn't want pupils – who often watched television for entertainment in the evenings – to come to school and watch yet more 'television'. Again we were looking to introduce a social aspect into the curriculum by the use, intermittently, of cross-age tutoring. Putting pupils in the role of tutors – exercising responsibility, exerting authority, giving coherent explanations, listening to younger pupils, checking that they had learned – gave them insight into the learning process, the assessment process and practice in communication and it enabled us to take in and meet the needs of more pupils with fewer very expensive teachers. You may not realise that teachers these days are very well paid professionals.

Visitor: How well paid?

Curriculum Head: Close to doctors – and very much better than accountants.

Visitor: Well I never!

Curriculum Head: One reason teachers became very highly paid was the work of Fuchs in the United States. Using cross-age tutors, their team found an effect size of 0.84 – really massive – for tutees' learning when taught by an able rather than a less able older pupil. And indeed, in the value added system that became widespread in the UK in the late 1990s, studies found that more able teachers were more effective teachers. Lots of people said they'd known that all along but, as was usual then, they hadn't *quantified* the effect. Also, they had looked at degree classifications rather than general aptitude, and that was misleading for many reasons. The Coleman Study way back in the 1966 had found just one teacher variable that correlated with pupil progress: verbal ability. When tests of developed aptitudes became widespread ….. again in the late 90s ….. such measures eventually became available for teachers and the Fuchs team's findings were confirmed. That's when teachers began to become a highly remunerated group of professionals. It was recognised that good teachers had to be very able if the nation was to have cost-effective schools.

This change to highly paid teachers was also influenced by the need we see to change curricula constantly. Once it was realised that *what* students study was far more important than whether or not they got a B or a C, and as it was realised that the knowledge explosions could not be coped with by old centralised curriculum planning methods, on-going curriculum development started and has never stopped. Teachers have to be at the forefront of their subject-areas these days; they have to develop curricula that meet with the approval of leading scientists.

For example, the course I teach actually started, generically, as people became aware of the work of Jared Diamond. History became a scientifically-based subject. His wonderful work on the development and spread of knowledge and power, based on his work as an evolutionary biologist, was seen as an essential and intelligent challenge to all kinds of in-group prejudices of the kind that were ripping parts of the world apart – such as in the tragedy of Algeria.

Of course, since we manage our own budget, and that budget is tied to the number of pupils we educate, we face some very important questions as to how to balance class sizes with the need to buy in excellent teachers. We also want to have a wide range of recreational facilities and all the latest software and internet and video connections as well as good workshops.

Visitor: Workshops?

Curriculum Head: Oh yes, workshops are very important here. Again there's an evolutionary perspective. Much of man's survival in the 90 per cent of time when he was essentially a rare wild animal depended on practical skills. The exercise of practical skills is therefore something that gives many people an important sense of achievement. They can see their practical skills increasing with practice. Sport teaches the same lessons – practice makes perfect. This reinforcement cycle, this feedback loop, is a source of considerable pleasure and we believe that pupils are better citizens in the long term. And in any case quality of life is one of our indicators, valued in and of itself. School is not simply a preparation for the future, it is the child's life at this time and it must be a high quality life. Practical skills are an extremely important component in the quality of life. Again there were experiments on the impact of having pupils 'make things' (Siraj-Blatchford, 1996) and guided by these findings we recognised, particularly with long term follow-ups, that the richness of mental models which often underlie scientific discoveries and underpin the design of engineering projects, was much facilitated by early experiences in constructing two or three dimensional models with gear systems, levers, pulleys, etc.

You see, for some reason, politicians and others started to listen to people who had *done* something successful – like the vac-without-a-sac man (James Dyson). It became apparent, once there were indicator systems, that no progress resulted from listening to evangelists or garrulous sociologists quoting each other and constructing verbose theories, floating free of any underpinning data.

Visitor: Are these workshops for kinds of *vocational* courses?

Curriculum Head: All our work is vocational in the sense that all the work in a school aims to develop the productive citizen. A citizen will have a *vocation* and also *avocations* and broad interests. We see 'academic work' – as it used to be known – as a subset of the generally broad concerns for building on the strengths

of every pupil. And that brings me back to another themes which is, as Aristotle pointed out, that there is tremendous pleasure to be obtained from the exercise of a skill which you are good at.

Here, I have the quotation from Aristotle on the wall of my room:

> If happiness consists in virtuous energies, the greatest human happiness must consist in the exercise of the greatest virtue in man; which must be the virtue or perfection of his best part, whether this be intellect or whatever principle it be, that is destined to commend and bear away.

Similarly, in the design of our schools we have paid a lot of attention to Csikszentmihalyi's (1990) work on 'the flow experience'. So we try to find, by close observation of pupils, experiences that challenge them to the right degree so that they become involved, willing to spend time, absorbed and thus find all the pleasure associated with this state of learning.

Visitor: You seem awfully keen on pleasure. Is this an entirely hedonistic school?

Curriculum Head: Well, we take an evolutionary perspective on this. In fact you could call our curriculum a Darwinian curriculum. It's informed by concepts of evolution. Fundamental in these concepts is that our evolution has provided us with mechanisms to assist in our survival. Pain is there to warn us of what not to do. The muscles ache, the heart pumps uncomfortably, or something is too hot, or we throw up after eating. These pains warn us that we are mistreating the body and lessening our chances of survival. Conversely there are pleasure centres and when we feel pleasure (from endorphins and all the other complex interactions that lead to sensations of well being and pleasure and comfort), we are probably behaving in a way that promotes survival and decreases stress. Studies suggested those pupils who became difficult in our society, costing enormous amounts in prison sentences and ill health, were often stressed and insecure and alienated. They did not feel part of the tribe in the school. Moreover they had often experienced punitive environments and punishment had little impact on them. It might have made the punisher feel better but it had little impact on the pupils. Those particular pupils did respond by seeking pleasure, and we realised that school must provide pleasure if we were to keep difficult youngsters on board. Our long-term indicator systems are also coming to maturity and the school will be charged a certain amount if pupils subsequently become a burden on the community. So we've had to find ways to decrease disruption, to avoid expulsion and to produce healthy, happy adults. As I think we've done …..

Visitor: That all sounds like a far-fetched argument for tender-minded rather than tough-minded approaches – if you'll forgive my saying so. But look, it's late afternoon now, and here you've got your three year olds working on reading with eight year old tutors. Is it not a bad time of day for youngsters to be learning to read – shouldn't that be done in the morning?

Curriculum Head: If pupils are falling behind in their progress – which of course we track very carefully on the database – then we assign them afternoon lessons. The evidence-base for this policy was suggested by articles by Folkard in 1997 and 1980. Folkard *et al*. showed that, quite contrary to what used to be popular

opinion, learning in the afternoon was more effective, better retained than learning in the morning. The explanation is quite simple and again is a physiological, Darwinian, biological explanation. Metabolism – we learn better when we have a reasonably high level of arousal (and reference) and we have a better level of arousal in the afternoon when our metabolic rate is high than in the morning when metabolic rates are generally lower. There are of course individual differences but on average the experiments show that pupils retain the information they have learned in the morning. Folkard *et al.* conducted very simple experiments of randomly assigning pupils to hear a story in the morning or an afternoon. Three weeks later they were tested in a morning or an afternoon, and the analysis showed that the difference in the amount of information retained was of an effect size equivalent to the difference in competence of driving before or after alcohol! It was an effect size of 0.40.

Visitor: You certainly are keen on research findings!

Curriculum Head: I am keen on getting things right, that's why!

Visitor: ….. and what's an 'Effect Size'?

Curriculum Head: Oh, you have been away a long time ….. you were probably hung up on testing for 'significance' at the 0.05 level. It was amazing how popular that cookery-book rule-of-thumb was. Most peculiar. You can find a description of an Effect Size on a website maintained for schools to share information on 'what works': *www.rmplc.co.uk/sites/e-beuk/index.html*. Basically an Effect Size enables us to say how much difference something made, i.e. to answer the question 'What was the size of the effect?' Using Effect Sizes we can compare the effects of various kinds of policies on achievements, attitudes, etc. Once we can compare outcomes on a common scale we can develop measures of the cost-effectiveness of various policies.

What happened, in the time you've been away from the UK, is that people grew tired of ill-founded sound bites as a means of policy formulation. There were calls for the down-sizing of government and mechanisms were put in place to hold government responsible.

There was a nice irony actually. In education, governments thought value added measures would enable them to control schools by setting them targets but they soon discovered that value added data meant that the government's own pet policies – grant maintained schools, more homework, business take-overs, more time on basics – were shown quite consistently to be ineffective. This wasn't surprising since they had conducted no pilot studies, no independent evaluations or actual trials. There was no research basis. What else could they expect? Simply thinking up solutions and adopting them is pre-scientific behaviour: you have to *test* ideas and design systems based on adequate experimentation.

The nice irony was the way indicator systems actually empowered schools and led to far more accountability *on the part of government, national and local*. Indicators enhanced the possibility of *genuine accountability*. You didn't have to be accountable for pleasing inspectors or meeting pulled-from-the-air targets, but, rather, for getting education to work effectively. There developed, then, considerable competition between LEAs to get the best set of indicators. But

sometimes that meant a concentration on short term outcomes, like high achievement, even if that meant promoting a purely aggressive and selfish culture.

Meanwhile other service industries, like health, welfare, prisons, were arguing that they couldn't get their costs down unless schools and LEAs took some responsibility for long term outcomes as well as short term. The only way to implement this long term accountability was to feed back financial penalties. At gradually increasing rates, local government had to pay for the cost of ill-health and anti-social behaviour manifested by the products of its social services and schools, and the penalties had to be implemented as percentage decreases in salaries. Chief Education Officers had a lot to lose if their schools produced criminals by expelling students or shunting them into 'units'. Consequently schools and social services – and the health service – had to get together very rapidly and ask themselves: how do we avoid fines for producing criminals and people who are ill?

Visitor: But surely you can never prevent criminals and ill health. Isn't that a matter of personal responsibility?

Curriculum Head: Interesting you should say that because it fits in with another peculiar way of arguing that, I learned in history, was typical of the twentieth century: the false dichotomy. It isn't an either-or question. Also, it isn't important to ask who is to blame. What is important is how to improve the indicator. We think of the issue in terms of how to *reduce* the incidence of crime and ill-health. You see, if we take money off people in the form of taxes and use that money to implement policies, we simply have to try our best to make sure the policies don't make things worse rather than better. And we have to accept responsibility for that expenditure of public funds. Thus, although no Multi Agency Strategic Research Group has been able to reduce the prison population to zero, nor ill-health to nothing more than ageing, there are nevertheless policies that make things worse and policies that make things better. I am quite prepared, as a curriculum designer, to accept that I must know the research, assist with research and implement policies that are more likely to make things better than worse. It's as simple as that. Is there any other way to run society? Now, would you like a game of squash or would you like to join in the afternoon ceilidh, or go to the debating club?

Discussion

The conversation is more a hope than a prediction: the future is unpredictable.

One of the viewpoints for which I am trying to argue is that our consideration of how schools should function must pay due attention to our biological inheritance, from which we cannot escape. Our education must be consistent with that inheritance as well as being concerned with the needs of modern industry. We are animals, not basically different from our stone-age ancestors:

While natural selection has been changing us in many small ways in the last ten thousand years, this is but a moment on the scale of evolutionary time. Our ancestors of ten thousand or perhaps even fifty thousand years ago looked and acted fully human. If we could magically transport babies from that time and rear

them in modern families, we could expect them to grow up into perfectly modern lawyers, farmers or athletes or cocaine addicts.

(Nesse and Williams, 1994, p. 134)

The point ….. is that we are specifically adapted to stone age conditions. These conditions ended a few thousand years ago, but evolution has not had time since then to adapt us to a world of dense populations, modern socio-economic conditions, low levels of physical activity, and the many other novel aspects of modern environments ….. even more specific, we seem to be adapted to the ecological and socio-economic conditions experienced by tribal societies living in the semi arid habitat characteristic of sub Saharan Africa. This is most likely where our species originated and lived for tens of thousands of years and where we spent perhaps 90 per cent of our history after becoming fully human and recognisable as the species we are today ….. most of our ancestors of a few thousand years ago still lived in bands of hunter-gatherers. We are, in the words of some distinguished American anthropologists, 'Stone agers in the fast lane'.

(Nesse and Williams, 1994, pp. 134-135)

Perhaps we should recognise that sitting in groups listening to an adult is not the way in which humans have learned for most of their evolution. Perhaps that explains the success of cross-age tutoring – it is a design consistent with our evolution.

A second important viewpoint is that in trying to design a curriculum (what is taught and how it is taught) that produces the best outcomes for society, we need to have a profound respect for interpretable data. Here I will take a strong empirical position: interpretable data is that which arises from randomised controlled trials. I fully sympathise with David Sackett's view:

If you are reading an article about therapy and it is not a randomised controlled trial, why on earth are you wasting your time?

David Sackett
Director of the Centre for Evidence-Based Medicine
University of Oxford

The suggestion that the curriculum or policies should be based on evidence is often met with an immediate and glib rejection of experiments in education. It is argued that they are impossible and unethical. The counter-argument is that they have been done without a great deal of trouble and it is surely unethical to require people to implement policies and curriculum practices without evidence that, at the very least, they do no harm. There is nothing particularly moral about ignorance.

Doubters might wish to read a recent outstanding book on experimentation *Randomised Experiments or Planning and Evaluation: a practical guide* (Boruch, 1997).

But could it be that a particular way of teaching is actually harmful? One of the few randomised controlled trials that involved 'direct instruction' was conducted in the US and reported in a 1997 update of the World Organisation for Early Childhood Education. This reported results of a study of 68 three and four year old children who were living in poverty and at risk of school failure. Children were randomly assigned to either a direct instruction curriculum or a traditional nursery school curriculum or the hi/scope model. Long term outcomes were assessed and differences indicated more than twice the average number of arrests among those who had been in the

direct instruction curriculum than either of the other two. Did direct instruction in which 'teachers initiated activities and children responded, adhering to a script with academic objectives for the children' produce less well socialised or more aggressive and disruptive youngsters? Another clue came from asking respondents twenty-three years later how many people 'gave them a hard time'? Again the direct instruction group showed the worst outcomes with more than twice the rate reported than in the other groups.

Considering these results, along with many others arising from the longitudinal study of early childhood interventions (Schweinhart and Weikart, 1997; Lazar and Darlington, 1982), we are beginning to realise that the first experience of schooling can have a strongly formative influence on subsequent development, and pre school years may have an even greater influence. In pre school or early schooling the child's experience of school is their first induction to the wider tribe of their community. Their view of themselves as able to participate and belong to that tribe may have prolonged and profound long term effects. Then again, we do not have many experiments but perhaps we suffer from a reporting of those with dramatic effects and a non reporting of those that show no effects. This under-reporting of non significant results has led the Cochrane collaboration in medicine (see for example http://hiru.mcmaster.ca/cochrane/overview.htm) a problem that was recognised in Glass, McGaw and Smith (1982) in their important book *Meta Analysis in Social Research*. Also we may reasonably doubt the generalisability from the poverty stricken cities of the eastern seaboard of the United States to other parts of the world but we must have a profound respect for this high quality data built up over long periods of time. The findings cannot simply be forgotten.

Whilst *early childhood* interventions have suggested a large number of positive outcomes, an intervention with at risk *teenagers* (McCord, 1978) yielded quite different results. Whilst all the feel-good factors were positive ('I probably would have been in jail without the help', etc) the objective evidence was that those provided with five years' of help from social workers were subsequently more likely to be arrested and re-arrested than those not helped. Since this was also a randomised trial the results are profoundly worrying. Apparently we must learn to accept that good intentions are no guarantee of good outcomes and hence there is a need for experimental trials of policies before they are widely implemented. Does any other approach make sense?

References

Boruch, R. (1977) *Randomised Experimentation or Planning and Evaluation: a practical guide*, London: Sage.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D. & York, R.L. (1966) *Equality of Educational Opportunity* Washington: US Government Printing Office.

Csikszentmihalyi, M. (1990) *Flow: The Psychology of Optimal Experience*, New York: Harper and Row.

Diamond, J. (1997) *Guns, Germs, and Steel*, New York, London: W.W. Norton & Company.

Fitz-Gibbon, C.T. (1997) The Value Added National Project Final Report, SCAA Ref: COM/97/844.

Fitz-Gibbon, C.T. & Kochan, S. (2000) School Effectiveness and Education Indicators. In Teddlie, C. & Reynolds, D. *The International Handbook of School Effectiveness Research*, Lewes: Falmer Press.

Folkard, S. (1980) A note on time of day effects in school children's immediate and delayed recall of meaningful material – The influence of the importance of the information tested. *British Journal of Psychology* 71, 95-97.

Folkard, S., Monk, T.H., *et al.* (1977) Time of day effects in school children's immediate and delayed recall of meaningful material. *British Journal of Psychology* 68, 45-50.

Fuchs, L.S, Fuchs, D., *et al.* (1997) Effects of Task-Focused Goals on Low-Achieving Students With and Without Learning Difficulties, *American Educational Research Journal* 34, 3, 513-543.

Glass, G.V., McGaw, B., & Smith, M.L. (1981) *Meta-analysis in social research*, Beverly Hills, CA: Sage Publications.

Lazar, I. & Darlington, R. (1982) *Monographs of the Society for Research in Child Development: Lasting effects of early education*, Chicago: University of Chicago Press.

Lazar, I., Hubbell, V.R., *et al.* (1977) *The Persistence of Preschool Effects: A Long Term Follow up of Fourteen Infants and Preschool Experiments*, US Government Printing Office.

McCord, J. (1978) A thirty year follow up of treatment effects, *American Psychology* 33, 284-289.

Nesse, R.M. & Williams, G.C. (1994) *Why we got sick* (published in US).

Nesse, R.M. & Williams, G.C. (1995) *Evolution and healing: the new science of Darwinian medicine*, London: Weidenfeld and Nicholson.

Schweinhart, L.J., Barnes, H.V., *et al.* (1993) *Significant Benefits: The High/Scope Perry Preschool Study Through Age 27*, Ypsilanti, Michigan: The High/Scope Press.

Schweinhart, L.J. & Weikart, D.P. (1993) *A Summary of Significant Benefits: The High/Scope Perry Pre-school Study Through Age 27*, London: Hodder & Stoughton.

Schweinhart, L.J. & Weikart, D.P. (1997) The High/Scope Pre-school Curriculum Comparison Study Through Age 23: Executive Summary, *OMEP Updates* (Update 87): 1-2.

Siraj-Blatchford, J. (1996) *Learning Technology, Science and Social Justice: an integrated approach for 3-13 year olds*, Nottingham: Education Now.

Smith, P. (1995) On the unintended consequences of publishing performance data in the public sectors, *International Journal of Public Administration* 18, 2/3, 277-310.

Waldrop, M.M. (1993) *Complexity: the emerging science at the edge of order and chaos*, London: Viking.