

Value-added futures: education, the environment and the economy

Jacqueline S. Rowarth

Institute of Natural Resources, Massey University, Private Bag 11-222, Palmerston North, New Zealand
j.s.rowarth@massey.ac.nz

Abstract

The proportion of students choosing to study the quantitative sciences has been decreasing for over 15 years, coinciding with the advent of the Y-generation and educational reforms. The aim of the reforms, which occurred in many developed countries, was to prepare students to be successful in a global world – to have confidence, analyse and interpret based on sensibilities rather than memorised facts, to challenge ideas, and to express opinion. At the same time, the value of time and money was impressed upon them, and working ‘smarter not harder’ became the rule. The unintended consequence is that those disciplines where memory and accuracy are important have become less popular than the creative disciplines associated with talent. Of equal importance is that laboratory-based subjects are more time-consuming than non-laboratory based subjects. Where the intended career is in a profession perceived to have high kudos and financial reward (e.g. medicine and veterinary studies), students are still attracted into the sciences, prepared to put up with strictures and effort on the basis of future gain. For careers based on soil science, however, the rewards are not at present apparent to the young. This paper discusses the origin of the problem and suggests a path for change.

Key Words

Discipline, science subjects, students, Y-generation

Introduction

Soils feed us, clothe us and filter our drinking water.

Soils, plants, lakes and rivers form the landscape in which we live.

Soil Science helps us to understand the landscape and to balance the needs of production and conservation.

Professor I.S. Cornforth, *Why Soil Science?* 1993

Given the importance of soils to human existence, and therefore the underpinning disciplines of biology, physics, chemistry and mathematics, the decline in popularity of these subjects is something of a conundrum. It is, however, a global phenomenon – at the very time when pressures on the globe are escalating, and the need for scientists, technologists, engineers and mathematicians (STEM) has never been greater. In addition to environmental and food production concerns is the drive for economic development and improved productivity, which is linked to tertiary education in science and technology (Wolff and Gittleman 1993). Of equal importance is the ability to create wealth from innovation, which is closely and significantly related to the relative number of scientists and engineers in the workforce (Porter and Stern 2001).

Investment is being and has been made made in various countries (e.g. Canada, UK and USA) in an attempt to ensure a strong supply of skilled STEM workers. Analysis has suggested (Westgate 2007) that factors behind the decrease in STEM students include shortage of specialised STEM teachers, (2) image of science and scientists (not trendy), (3) perception of science as a harder subject and (4) lack of knowledge about what STEM careers entail. All of these factors are true, but school children still take the sciences if they want to be doctors or veterinarians (Hipkins *et al.* 2006). The challenge, then, is to make STEM careers as attractive as the medical professions by showing the students that the rewards are high. At present, however, a considerable portion of the value that soil scientists experience is intrinsic (discovery) rather than extrinsic (money and kudos). Career decisions are made at school before many of the children have the maturity to understand the difference between intrinsic and extrinsic rewards. Well-meaning suggestions that specialisation can be avoided by doing ‘general subjects’ actually limit future options.

This paper considers the changes that have resulted in the current trends and discusses the potential for a different future to ensure that soils are not treated like dirt.

The generational change

People are affected by the world in which they grow up. While having individual experiences as part of a family, they have collective experiences as part of a school, region, and country. War, depression and affluence are experienced collectively, and buffered individually. Baby Boomers, born between approximately 1946 and 1964, were brought up post-war by conservative parents influenced by the depression as well as the war itself. Education was a privilege (only approximately 3% of school leavers

actually went to university), discipline was expected, and science and technology were regarded as the way of the future. To be accepted into a science career spoke well of intelligence, and the future of the world was associated with having good people making discoveries. Salaries were not startling, but the kudos and security were innate.

By 1965, the contraceptive pill meant that babies were (increasingly) the product of choice about family size, and the birth rate dropped. By the mid-60s, electrical convenience was becoming commonplace and the world was 'globalising'. In order to cope with the coming trends, including education for a greater disparity of people, educational reforms were ongoing.

In the late 70s, the birth rate began increasing, reflecting the fact that Baby Boomers had started families. The group born between approximately 1978 and 1994 (but sometimes considered to be 1982-2000) is the first in history to have been born during a period of affluence (plus two income families), with no direct experience of war. The minor depression of the late 80s did not factor into their experience. The Y-generation is being followed by the Zappers, or Z-generation, currently still at school. It is expected that the Z-generation will be similar to the Y-generation in terms of attitude because the factors in positive parenting and schooling have not changed. Their world view, however, and consequently their attitudes towards environmentalism and employment security, is being influenced by climate change and the current economic downturn.

Members of these new generations have been brought up as the focus of the family. Parents have tried to give better parenting than they received from their own parents, and have typically brought their children up with more affection and involvement than previous generations. These parents have articulated the 'I don't mind what they do, I just want them to be happy' mantra (Cooper and Keitel 2008). In a deliberate move to give them the confidence to be able to compete successfully in the global workplace, and in marked contrast to the 'children should be seen and not heard' attitude of previous generations, they have frequently treated the children as equals. The benefit to the parent is that their children regard their parents as friends, but in adopting the role of friend and equal, parents are finding it difficult to provide guidelines and assume the role of authority (Poulter 2008). Positive parenting in an era of high tolerance has resulted in huge confidence and an awareness of self-value: in 2006 two thirds of the 16,475 American college students evaluated nationwide in the Narcissistic Personality Inventory recorded above-average scores – a 30% increase since 1982 (Twenge 2006). At the same time, however, underperformance has increased and 'anxiety' has reached record levels (Twenge 2001). The sad irony is that in encouraging children to be happy and 'all that they can be', the result has been the opposite.

Education

Reforms in the education system towards the end of last century were focussed on ensuring that every child completed a qualification with a sense of achievement. Subject liberalisation was intended to make education more relevant for a greater proportion of the population, and choice increased. At the same time, the need for a scientifically-literate society able to understand the benefits and risks of new developments was recognised and the approach to teaching traditional subjects was changed. This involved a move away from the 'old' system where knowledge and abstract facts were considered to be important and exams were final, to a child-centred approach with greater emphasis on course work, open-ended tasks, context dependent knowledge, analytical skills and verbal reasoning (Warrington and Younger 1999).

The unintended consequence has been that as the Y-generation members have a high awareness of work-life balance and expect rewards without having to 'bust a gut to achieve them' (Sheahan 2005), children have tended to opt for the subjects which they perceive to be enjoyable and where acceptable achievement can be obtained for minimum effort. Research from the Centre of Evaluation and Monitoring, Durham University (Coe *et al.* 2008), has revealed that it is more difficult to achieve high grades for subjects where accuracy and memory are required (physics, chemistry, biology, maths, French, German) than in the creative subjects (drama, design, photography).

The future

Students are interested in science and do see it as having value for the future (National Education Monitoring Project 2007). Furthermore, they are concerned about the environment. The links to employment choices then depend on making the science careers attractive. Having a variety of assignments in work, and contributing to society, were important career goals for approximately one third of the 7,500 students from Durham University participating in the Universum Graduate Survey in the UK (Van Mosselvelde 2007). The

proportion for contributing to society was similar in the US, but somewhat smaller in Europe and China. Work life balance rated more highly in all countries – it was the most important career goal for over 50% of respondents. At the same time, salary expectations are high. Research by Robert Half International (2008) indicates that members of the Y-generation want salary, benefits, career growth, location, good leadership, respected brand and job title. They believe that having gained a degree, their job should reflect the effort and years spent at university.

Knowing the background and goals, it should be possible to create an attractive proposition for employment.

Dollars and status

Salary should never be discounted: it is ranked (Robert Half International 2008) as the top reason for changing jobs. In New Zealand salary packages currently offered to final year degree students with science, particularly soil science, in their degrees are so attractive that postgraduate education is being eschewed – the opportunity cost of further study is too great and the graduates are ‘sick of study and want to have some fun’ – for which they need money.

Beyond money, part of the attraction in becoming a doctor or veterinarian reflects the fact that there is status and kudos in being accepted into these professions – there is a respected brand and job title. Substantial education and training are required, the nature of which is determined by members of the profession, who also influence entry to the profession. This implies accreditation of, for example, university courses that are judged to meet these standards to facilitate entry, a code of conduct to regulate how members behave in their professional lives, and mechanisms for disseminating knowledge of good practice to members.

Attempts at establishing accreditation schemes such as CPAg and CPSS have not received universal acclaim, because there is no regulatory body operating in the same manner for agriculture and soil science as there is for the medical, veterinary and engineering professions. Regulation also implies litigation, however, hence reluctance to embrace the model.

Satisfaction

Job satisfaction is difficult to explain to the young who tend to concentrate more on the lifestyle that the salary can afford (hence the work-life balance) than the satisfaction innate in the work. However, with a third of students indicating ‘society’ as important, emphasis in recruitment into the sciences can be placed on this aspect, but might take some adjustment in the employer to achieve, in this era of accountability.

Autonomy (the ability to take responsibility and to be treated as if those responsibilities will be exercised) is associated with job satisfaction and engagement (Deci *et al.* 1989), as are usefulness and social interaction (Borooah 2009). An engaged workforce is productive and creative – making progress is the single biggest motivator for employees (Amabile and Kramer 2009); workers are most creative the day following a happy day (Amabile *et al.* 2005).

Job opportunities

The economic recession has brought job security back into the concerns of undergraduates and senior school children. Although unemployment has increased globally, increases in job opportunities in science-based careers are apparent. Statistics New Zealand has reported (Laugesen 2009) an almost 11% increase in the year to June in the ‘life science and health professionals’ category (which includes doctors, dentists, veterinarians, pharmacists, nurses, midwives, biologists, agricultural scientists and botanists). Physical, mathematical and engineering sciences experienced a 9% increase.

Job variety

Perhaps of most importance given the desire for variety in work, plus the prediction that they will have 22 different ‘careers’ (Sheahan 2005) is the fact that from the sciences most things are possible – that the reward for ‘sticking with the hard stuff’ is flexibility. In addition to the obvious science-based careers, a study by Cornell University in 1995 reported that 90% of 500 Chief Executive Officers thought people with higher degrees in physics, chemistry, maths and computer science would be the next generation of managers, and over 66% agreed that the competitiveness of the company would be increased if more senior managers had a technical background (Motluk 1996). Education also requires science people – the need for great science teachers to inspire students to excel in mathematics and science has been highlighted by President Obama since before his election. Similarly, the media employers are increasingly interested in reporters with knowledge – particularly in the science and technology areas which form an important part of news.

Actions

Peter Sheehan and other Y-generation gurus have said repeatedly that the Y-generation place culture and

leadership at the top of their consideration (once money has been addressed). They also want their jobs to have purpose and meaning, entail responsibility, give promotional opportunities, challenges and experiences, fair remuneration, increased employability, and allow creativity and individuality (Sheahan 2005). Science should allow all these things. Of note in some minds might be 'creativity' – but science is a creative activity as it creates new knowledge. Florida (2003) lists (in order) creative types as: scientists and engineers, university professors, poets and novelists, artists, entertainers and actors, designers and architects.

Conclusion

Members of the younger generations are still focussed on salary and lifestyle, but are increasingly concerned about the environment and food production. The economic recession has refocussed thinking on to what matters in the world, and the auguries are right for a resurgence in science as food security becomes paramount for the global population. The world needs more scientists to manage the environment and produce food sustainably as well as to create economic development, and they will become the gold-collar workers of the future. Everything that the younger generations need, want and desire can be managed from a science-based education... as long as it is clear that society values their efforts and the soil appropriately.

References

- Amabile T, Kramer S (2009) What really motivates workers. The HBR Breakthrough Ideas for 2010. Harvard Business Review. <http://hbr.org/2010/01/the-hbr-list-breakthrough-ideas-for-2010/ar/pr> (accessed 23rd December 2009)
- Amabile TM, Barsade SG, Mueller JS, Staw BM (2005) Affect and creativity at work. *Administrative Science Quarterly* **50**, 367-403.
- Borooah VK (2009) Comparing levels of job satisfaction in the countries of Western and Eastern Europe. *International Journal of Manpower* **30**, 304-325.
- Coe R, Searle J, Barmby P, Jones K, Higgins S (2008) Relative difficulty of examinations in different subjects. (CEM Centre, Durham University). 142 p.
- Cooper A, Keitel E (2008) I just want my kids to be happy! Late August Press 176 p.
- Cornforth I (1993) Why soil science? Lincoln College and Lincoln University Inaugural Addresses 1980-1993, pp. 214-234. (Lincoln University Press, Canterbury, New Zealand).
- Deci EL, Connell JP, Ryan RM (1989) Self-determination in a work organization. *Journal of Applied Psychology* **74**, 580-590.
- Florida R (2003) The rise of the Creative Class. Hazard Press 404 p.
- Hipkins R, Roberts J, Bolstad R, Ferral H (2006) Staying in science 2: transitions to tertiary study form the perspectives of New Zealand year 13 science students. 92 p.
- Laugesen R (2009) No. No. No. Yes. Nice work. *NZ Listener* **220**, 16-23.
- Motluk A (1996) If you want to get ahead, get a science degree. *New Scientist* 2023, 43.
- NEMP (2008) Science surveys 2007 p. 61-63.
- Porter M, Stern C (2001) National innovation capacity. Pp 102-115. In: Global Competitiveness Report 2001. World Economic Forum and Harvard Business School.
- Poulter S (2008) The mother factor: how your mother's emotional legacy impacts your life. Prometheus, 352 p.
- Robert Half International (2008) What millennial workers want: how to attract and retain Gen Y employees. 19 p.
- Sheahan P (2005) Generation Y: Thriving and surviving with generation Y at work. Hardie Grant Books. 274 p.
- Twenge JM (2001) College Students and the Web of Anxiety. <http://chronicle.com/weekly/v47/i44/44b01401.htm> (accessed 22 October 2008). Chronicle of Higher Education, Washington DC, USA, 13 July 2001.
- Twenge JM (2006) The age of anxiety (and depression and loneliness): Generation stressed. Generation Me: Why Today's Young Americans are More Confident, Assertive, Entitled – and More Miserable than Ever Before. Pp 104–136. The Free Press, New York, USA.
- Van Mosselvelde C (2007) The Universum Graduate Survey 2007 UK edition. 41 p.
- Warrington M, Younger M (1999) Perspectives on the gender gap in English secondary schools. *Research Papers in Education* **14**, 51-77.
- Westgate T (2007) Strategic science. Parliamentary Office of Science and Technology, Postnote 277, 4p.
- Wolff E, Gittleman M (1993) The role of education in productivity convergence: Does higher education matter? In 'Explaining Economic Growth'. (Eds A Szirmai, B van Ark, D Pilat). Amsterdam: North-Holland.