

# Chapter 11: Teaching Ethics to Science Students: Challenges and a Strategy

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To be an effective scientist in the twenty-first century requires not only a specialised scientific knowledge but an appreciation of the ethical dimension of science. Scientists need to be able to recognise ethical dilemmas and formulate coherent responses to them. But scientists are not philosophers or ethicists, and their ethics education, therefore, needs to be different from that frequently offered as part of mainstream ethics courses, particularly those on moral theory. This chapter will argue that dual-use dilemmas and role-play involving real scientific case studies are an ideal vehicle for effectively engaging future scientists in ethics education, and helping furnish the necessary skills for their professional development.

## The Role of Ethics Education for Scientists

Two questions which ought to precede any properly informed discussion of how to teach ethics to scientists are 'Why should we teach this group ethics?' and 'What do we hope to achieve from their ethical education?' Ethics teachers who are novices in the area might well be driven to ask these questions in despair as they confront resistance to their efforts on the part of both students and their colleagues in the science faculty. Nonetheless, how we respond to these questions is a serious matter and crucial to determining the shape of ethics courses.

A recent workshop on ethics education in science and engineering began by asking participants why they thought ethics education was important. Respondents talked about famous cases of research misconduct (presumably hoping they could be prevented in the future by ethics education) and how public trust in the integrity of science and research may be undermined by problematic practices. It was also noted that some students only appreciated

the value of their ethics education in retrospect, after practising their discipline and being forced to confront real-life ethical issues. Interestingly, there was also a suggestion that talented students with high ideals might be lost if ethics education were ignored.<sup>1</sup> Whilst all these factors can play a role in motivating ethics education for scientists, the central problem which surely underpins them all is that ethical issues constantly arise in science, and scientists need to learn how to deal with them. As researchers investigating ethics education in the life sciences have noted, the 'more influential science becomes, the more ethical issues become associated with scientific practice directly, and scientists are increasingly required to participate in the value questions born from new knowledge and new technologies'.<sup>2</sup>

There are a number of ways in which the practice of science generates ethical issues. Regarding the methods adopted in research (for instance, we can ask 'Should we run placebo-controlled drug trials, or use animals in experimentation?') these include how knowledge is applied (for example, how do we respond to knowledge of aerosolisation being used to make more effective bioweapons?), as well as the very questions which drive scientific research in the first place (for example, should we do research into human reproductive cloning, or weapons of mass destruction?). In fact, the ethically charged nature of science is well exposed by the dual-use dilemma, since dual-use scenarios demonstrate that even the well-intentioned pursuit of scientific research can generate difficulties. Although a scientist may be pursuing admirable goals such as understanding how a particular disease spreads with a view to containing future outbreaks, this does not preclude this same research being used for harmful ends such as deploying the disease as a biological weapon.

Since WWII at least there has been a growing awareness that the ethical challenges generated by science need to be addressed. To this end various strategies have been tried, including codes of conduct and ethics such as the World Medical Association's Declaration of Helsinki and the International Ethical Guidelines for Biomedical Research Involving Human Subjects; regulations and laws like those prohibiting research on human reproductive cloning in Australia; and boards or committees in universities, hospitals and other institutions charged with assessing whether proposed scientific research is ethical.

Though motivated by laudable goals, these measures are limited and for a variety of reasons fall short of what is required to address the ethical challenges generated by science. For instance, one issue with respect to some codes of conduct and ethics is that although they may supply aspirations and even

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1 Hollander, R. (ed.) and Arenberg, R. A. (co-ed.) 2009, *Ethics education and scientific and engineering research: What's been learned? What should be done?*, Washington, DC: The National Academies Press, p. 6.

2 Clarkeburn, H., Downie, J. R. and Matthew, B. 2002, 'Impact of an ethics programme in a life sciences curriculum', *Teaching in Higher Education*, vol. 7(1), pp. 65–79.

appropriate rules for behaviour, individuals may not possess the practical know-how or skills to apply them.<sup>3</sup> Thus, even the most well-conceived, well-written and comprehensive codes may not foster ethical conduct if the individuals to whom they are meant to apply do not understand how to follow them, or have not been involved in the process of developing them.<sup>4</sup> When it comes to laws and regulations, these are frequently backward-looking and thereby may be ill-equipped to cope adequately with new situations being generated by science. In the case of ethics committees, their purview is limited. They are generally constrained to monitoring human and nonhuman animal experimentation rather than research in fields like physics, chemistry and engineering, and are charged with determining whether experiments that have already been conceived and developed comply with an institution's policies. Finally, none of these measures genuinely address the institutional and cultural factors that may impede ethical conduct in science.<sup>5</sup> Therefore, it seems that if we as a society take ethics in science seriously, we do our future scientists a disservice if we do not adequately prepare them for the ethical challenges they will face, since we cannot depend solely on outside parties and existing mechanisms to ensure 'good' science.<sup>6</sup>

In accepting that scientists need ethics education, a further question arises: What form should this ethics education take?<sup>7</sup> I suggest below that based on the particular needs of science students and the learning outcomes that should be set for them, teaching activities should include role-play involving real cases or plausible hypothetical ones, with an emphasis on those situations with dual-use implications. In isolation these activities cannot meet all the needs of this cohort of students. However, as will become apparent through this chapter, they can make a significant contribution to this end, particularly if deployed in conjunction with other strategies, such as those aimed at improving student literacy.

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3 In the *Critique of Pure Reason* Immanuel Kant famously drew attention to an important distinction between knowing a rule and knowing how to apply it. A134/B174. For instance a judge might have a good knowledge of the law but yet not know what law a particular case falls under, or a physician might be familiar with the descriptions of a disease but be unsure of the correct diagnosis when presented with a diseased patient.

4 For a good discussion of codes of conduct with respect to biological weapons, see Rappert, B. 2007, 'Codes of conduct and biological weapons: An in-process assessment' *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, vol. 5(2), pp. 145–54.

5 For a discussion of these factors, see Martin, B. 1992, 'Scientific fraud and the power structure of science', *Prometheus*, vol. 10(1), pp. 83–98; Hollander and Arenberg 2009, *op. cit.*

6 Good is being used here in the ethical sense, though it also has connotations related to validity, and there is frequently a connection between ethically and epistemologically good science, though not the space here to expand on this link.

7 The discussion here focuses especially on ethics education for undergraduate students, though some of the points made might be incorporated into training for practising scientists.

## The Needs of Science Students

Many undergraduate science students experience particular difficulties when they undertake study in philosophical courses, even when these courses cater to their presumed interest in science (for instance, in classes on science and ethics or the philosophy of science). These difficulties are of concern not only because they limit student enjoyment of the subject studied, but also because evidence suggests students who have a negative orientation toward a subject will experience poor learning outcomes;<sup>8</sup> that is, they do not achieve what they ought to from their studies. Therefore, if the attainment of the generic and course-specific learning outcomes set for an ethics class is valued, these difficulties represent genuine concerns that need to be addressed.

Analysing the relatively limited literature regarding teaching philosophy to science students reveals that at the broadest level student difficulties stem from a difference in the culture and norms of the humanities and sciences. This manifests itself in science students frequently not having the requisite skills in writing, reading, and so on, to perform well in philosophy subjects generally (of which ethics forms a part); in their not knowing, understanding or being comfortable with the culture and expectations of philosophy; and in their possibly having a hostile orientation towards a discipline which they may perceive as either challenging or inferior to their chosen career path in science. These three specific issues demand special attention when teaching ethics to science students.

In expanding on the skills deficit experienced by science students, I want to begin by joining Geoffrey Cantor in observing that it is not simply the case that the difficulties encountered by many science students studying philosophy align with what he describes as the 'crude stereotype' that construes them as 'illiterate and culturally inept'.<sup>9</sup> Nor does the skills deficit result from a failure of intelligence or moral fibre; rather, it is frequently a product of the inexperience of students in certain types of activity, or occasionally a failure to value these activities. Sometimes it may also be the case that students have chosen a degree in science because they feel they lack natural competency in the skill set demanded by the humanities.<sup>10</sup>

The most widely discussed skills deficit canvassed in the higher-education teaching and learning literature in this area centres on essay writing. Essays are effectively an alien genre for many science students since they are generally

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8 Murtonen, M. 2005, 'University students' research orientations: Do negative attitudes exist toward quantitative methods?', *Scandinavian Journal of Educational Research*, vol. 49(3), pp. 263–80.

9 Cantor, G. 2001, 'Teaching philosophy and HPS to science students', *PRS-LTSN Journal*, vol. 1(1), pp. 14–24, p. 15.

10 Cantor, for instance, makes this suggestion. *Ibid.*, p. 20.

not required within the natural sciences and mathematics, though they may form part of the assessment in biology classes and in the so-called soft sciences such as psychology. According to Cantor, given that essay writing is not emphasised in science education, the ‘prospect of essay writing may evoke fear and uncertainty since many science students will have no conception of what is involved or how to begin the process of essay writing’.<sup>11</sup> Problems divide into two main categories — those to do with an inability to engage in the analysis and thinking demanded by an essay, and those related to written expression. Into the first group fall the difficulties encountered by students with the very notion of developing and defending their own original point of view; with appreciating how to engage critically with the literature (including knowing how to analyse key concepts in written form); and with knowing what would constitute an appropriate answer to the question asked. The latter can manifest in students being unsure whether or not their essay even represents a legitimate response to the question.<sup>12</sup> Frequently such students submit papers that simply and unreflectively restate course content and border on plagiarism, since sources for the various arguments and concepts are not cited.<sup>13</sup> The second category involves the more general struggle of science students to write clearly and fluently. Such students also have problems knowing how to use the first person and active voice in essay writing, most likely as a result of being discouraged from doing so in scientific writing.<sup>14</sup>

If science students do not already possess or develop essay-writing skills they are unlikely to flourish in philosophy subjects which require them as part of their assessment. This means that not only will they achieve a poor grade in such subjects but they will fall down in their studies at a deeper level too. Sellars, for instance, makes the argument that essays are not merely arbitrarily associated with philosophy, ‘they reflect the very nature of philosophy itself’.<sup>15</sup> If students cannot write an essay, they cannot ‘do philosophy’, they are not properly engaged in critical thinking, analysis and evaluation, and may be unable to construct an argument. On this view, philosophy teaching must incorporate the writing skills crucial to achieving critical analysis — the very stuff of philosophy. Lecturers and tutors should not regard their students as incompetent if they do not already possess writing skills, and the teaching and learning of writing should not be considered a merely remedial and distracting

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11 Ibid.

12 Gooday, G. ‘The Challenges of teaching history and philosophy of science, technology & medicine to “science” students’, available: <http://prs.heacademy.ac.uk/view.html/prsdocuments/66>

13 Ibid. As Gooday notes, to many science students it would seem irrelevant or arrogant to attribute authorship to facts and theories in science.

14 Ibid.

15 This is Crome and Garfield’s way of expressing Sellars’ point in Crome, K. and Garfield, M. 2004, ‘Text-based teaching and learning in philosophy’, *Discourse: Learning and Teaching in Philosophical and Religious Studies*, vol. 3(2), pp. 114–30, p. 124.

activity the teacher is forced to engage in by virtue of student inadequacy.<sup>16</sup> As Sellars notes, it should be regarded 'an essential part of any training designed to teach students how to argue clearly and effectively. If our aim is to teach students how to think then we must accept that it will also be our task to teach them how to write'.<sup>17</sup>

Another feature of literacy increasingly acknowledged as deficient amongst the broader student population in universities is that of critical reading.<sup>18</sup> In the case of science students, problems may be compounded since many do not enjoy reading, are slow readers and they struggle to know how to evaluate a text.<sup>19</sup> In spite of this deficit, it appears little research has been undertaken into how to remedy this situation.<sup>20</sup> Yet, as with essay writing, an inability to read effectively is a significant impediment to studying philosophy, not just because it means students are unlikely to score well in their subjects, but also because critical reading is just part of what it is to do philosophy — to reflect on and analyse arguments and ideas. Thus, Kelton describes it as a 'gateway intellectual activity';<sup>21</sup> that is, an essential tool to getting started in one's philosophical studies. Crome and Garfield go further when they claim 'there is an intimate and unique bond between an appropriately engaged or active reading of a philosophical text and the act of doing philosophy itself'.<sup>22</sup> As with essay writing, these authors maintain that developing a student's reading skills should not be seen as a remedial activity, but part of the broader 'aim of all philosophy teaching, getting students to do philosophy'.<sup>23</sup>

There are two further skills that are important but often appear lacking amongst science students (again due mainly to lack of exposure and experience); namely, verbal ability and note-taking proficiency. Science students may not be comfortable expressing themselves in a public oral forum, and in lectures and tutorials they may struggle to know what is important and worth taking down, since they are accustomed to being provided with handouts or having key formulae clearly identified for them.<sup>24</sup>

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16 There is a strange belief that teachers (including myself) sometimes have that students ought to already possess at least some of the skills and knowledge that we are charged with teaching them in a course. It is salutary to remind ourselves that our role as teachers is to teach, not complain when our students lack such knowledge.

17 Sellars, J. 2002, 'Some reflections on recent philosophy teaching scholarship', *PRS-LTSN Journal*, vol. 2(1), pp. 110–27, pp. 126–7.

18 Crome and Garfield 2004, op. cit. p. 115.

19 Ibid., pp. 119–20.

20 Ibid., p. 117.

21 Kelton, S. 1997, *On assessing philosophical literacy*, available: [http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content\\_storage\\_01/0000019b/80/16/c7/0d.pdf](http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/16/c7/0d.pdf) [viewed December 2009] p. 4.

22 Crome and Garfield 2004, op. cit. p. 122.

23 Ibid., p. 123.

24 Gooday, op. cit.

An inability to appreciate and embody in practice the different norms that govern the pedagogy of the humanities, as opposed to the sciences, contributes to the struggle with skills competency experienced by science students, particularly in essay writing. Gooday describes the problem well when he comments that '[w]hen learners enter into an unfamiliar field of knowledge, their entry is never *just* a simply unidirectional process of picking up knowledge...novices need to secure the appropriate practices, strategies and expectations to be able to articulate and use such knowledge in accordance with the values of their specialist field'.<sup>25</sup> In the case of the sciences and humanities, the differences present a 'clash of cultures' in Gooday's view, which leaves science students unclear and confused over what is expected of them when studying philosophy. They may feel unsure of the rules of the game, do not necessarily understand what their teachers are seeking, and may find the tactics they have deployed to effect in their science subjects do not translate to success in philosophy. Again, as Gooday comments, '[f]rom the point of view of science students, the scholarly values of HPS [History and Philosophy of Science] teaching can seem bafflingly vague, gratuitously subjective and self-indulgent, whilst the pedagogical practices employed seem to lack a proper emphasis on "getting the right answer"'.<sup>26</sup>

This last point is significant and reflects a strong difference between the humanities and sciences cultures. From their mainstream courses, science students are reinforced in the belief (prevalent in broader society too) that there is just one truth of matter and it is the business of science to discover it. In this context the teacher and text are often regarded as authorities, and it is expected that there are definitive right and wrong answers to questions.<sup>27</sup> Therefore, to a science student the operation of an ethics class is highly puzzling. There is no one correct answer to ethical dilemmas so that neither textbooks nor lecturers are authoritative. Discussions are open-ended and can seemingly be mired in subjectivity and opinion. To succeed in the sciences students need to demonstrate they know and understand the dominant prevailing theory in a field, while in the humanities interpretative work is required and the ability to understand and critically evaluate a diversity of views including one's own. The ability to construct an original line of argument is also rewarded.

Related to the differences in culture and norms of the sciences and humanities (and again with the potential to hamper student learning) is the inadequate conception some science students hold of what the discipline of ethics is about.

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25 Gooday, G. 2002, 'How do different student constituencies (not) learn the history and philosophy of their subject?' *PRS-LTSN Journal*, vol. 1(2), pp. 141–55, p. 147.

26 Gooday, op. cit.

27 Most philosophy of science since the influential work of Thomas Kuhn challenges the idea that science itself is actually like this. Nonetheless, these kinds of assumptions still appear prevalent in the teaching of science in higher education.

For instance, they may regard ethics as constituted by externally imposed rules and regulations; they may conflate ethics and law; or believe the discipline of research ethics exhausts the ethical issues raised by science, so that effective ethics committees may be all that is required to ensure ethical practice in science.

The final impediment to the learning of science students considered here is related to the hostility toward the entire discipline of philosophy (including ethics) found amongst many such students, their teachers<sup>28</sup> and scientific practitioners more broadly. Unfortunately, within this group, C. P. Snow's famous 'Two Cultures' thesis still appears widely accepted, namely that science and the humanities represent two quite separate cultures that lack even a common language to mediate between them. According to this division of the intellectual landscape, the sciences are superior to the humanities, with the latter often construed as irrelevant or just common sense. As former science 'insiders' who have gone on to work in philosophy, both Cantor and Gooday acknowledge the veracity of this perception. As Cantor describes it: 'When at school I shared with many of my peers the (utterly depressing) view that science students are innately superior to those taking humanities subjects, and that the sciences hold the key to the future.'<sup>29</sup> He goes on to discuss the self-selecting and mutually reinforcing nature of the community of science students who 'often perceive themselves as having chosen science and thereby positively rejected humanities subjects'.<sup>30</sup> They may regard the humanities in general as 'a doddle'<sup>31</sup> and philosophy, more specifically, as comprising waffle and navel gazing.<sup>32</sup>

If science students assume intellectual superiority over humanities students, any difficulties they experience with a philosophy class due, for instance, to the skills deficit described earlier will surely be particularly disturbing. They may well wonder how it is that armed with their natural academic ability they do not automatically prosper in their philosophical studies. Therefore, it seems probable that they will ascribe these difficulties to some fault with the teacher or the subject itself, further fuelling their frustration and antipathy toward the humanities.

Even if they do not have an overtly hostile orientation to philosophy, the study of applied ethics can be confronting for any student. As Joan Callahan comments, '[p]ractical ethics courses press students to become clear about their own biases

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28 Part of the issue for this group may also be that they do not believe time in the curriculum should be devoted to a subject which is not strictly speaking science, or that such an ethical education is not needed because it is irrelevant or just common sense.

29 Cantor 2001, *op. cit.* pp. 15–6.

30 *Ibid.*, p. 17.

31 *Ibid.*, p. 18.

32 These observations are drawn from my own experience. I find such perceptions of philosophy particularly intriguing as they seem to me to be the antithesis of what philosophy is actually about; namely, rigorous argument well supported by evidence.



and to examine the reliability of their own ways of making moral decisions, and this, unavoidably, makes students feel vulnerable'.<sup>33</sup> Ethical positions are often deeply held, dependent on cultural and religious background, and may go unchallenged in daily life, so that formulating coherent reasons and justifications for beliefs may be difficult and intimidating for students. Many science students may also perceive philosophy of science and ethics as a direct threat to the discipline they have committed themselves to as students and potential future professionals. Unaccustomed by their scientific studies to engage in reflection on the philosophical basis for science and how it can be justified, or the ways in which it might legitimately be curtailed by the ethical concerns of society more broadly, they can interpret any such debate as a challenge to their personal integrity. The perception that the very existence of some philosophical disciplines represents an attack on the scientific enterprise and on individuals as participants in this enterprise is surprisingly widespread and continues into professional life. Frequently, scientists and those in medicine view discussion of ethics in these contexts as an unwarranted attack on their good intentions, calling into question their motives in a discipline they perceive to be dedicated to the public good. A philosopher's call to justify an ethical stance can be construed as unjust slander against one's person, partly because philosophers and ethicists are sometimes seen as outsiders who have no legitimate status or expertise with which to criticise the authority and status of science and scientists.

Whilst I think scientists, doctors and others may well be overreacting when they feel personally threatened and intimidated by philosophers, at the same time there is a sense in which education is and should be transformative — a catalyst to change. To reflect seriously and critically on one's world view may well be disconcerting and unsettling. A further unfortunate side-effect of such a transformation may be underperformance in science subjects, where the kind of scepticism and critical reflection encouraged in ethics and philosophy of science classes may undermine achievement in straight science subjects.<sup>34</sup>

Thus it seems from this critical examination of the literature that the challenge for teaching (and learning) ethics to science students is to investigate approaches which could build their skills, minimise experiences which may be threatening, while supporting the learning outcomes of philosophical ethics.

Although the difficulties experienced by science students are acknowledged in the literature and by teachers in the area, few systematic and well-researched solutions to such difficulties are proffered. Nigel Taylor makes this point when posing questions about possible principles to guide the teaching of philosophy

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33 Callahan, J. 1998, 'From the "applied" to the practical: teaching ethics for use', in Kasachkoff, T. (ed.), *In the Socratic tradition essays on teaching philosophy*, Lanham: Rowman and Littlefield Publishers, Inc. pp. 57–69, p. 65.

34 Gooday, op. cit.

to non-philosophy students and the means of assessing good practice in this area: 'I shall not be drawing on any substantial body of literature about this topic, still less on an established body of "theory", for there isn't any.'<sup>35</sup> Therefore, he resorts to the same strategy as other authors confronting this problem; namely, he relies on critical reflection into his own experience, or self-reflection in tandem with the reflective experience of colleagues. The paucity of research in this area is not unique to the teaching and learning of non-philosophy students, but is part of a more general deficit in the philosophical literature. Sellars bemoans the proliferation of narrative, personal, experiential accounts of teaching philosophy, and hopes for more theoretical reflection in the future.<sup>36</sup> Part of the rationale behind this paper is to move beyond these kind of attempts, to systematically reflect on and re-conceptualise the problems, and address them by appealing to the broader literature in higher-education teaching and learning.

## Setting the Ethical Agenda

Having established that science students need ethics education (bearing in mind they are also a group with special needs when studying humanities), what goals should be set for their ethical education? In other words, what learning outcomes — skills, knowledge, and so on, should students take away from ethics classes?

The 'virtue/skill dichotomy' represents a fundamental divide in approaches to ethics education of medical students that is also relevant in this context.<sup>37</sup> Those who emphasise the virtue approach claim that ethical instruction should teach virtue, students should exit classes as better people, and courses should transform them into citizens of good character. In a tradition originating with the ancient Greeks, the underpinning rationale is simple — that good people make good decisions.<sup>38</sup> Conversely, those who lobby for a skills focus argue that the emphasis in ethics education should be on fostering skills and resources required to engage in solving ethical problems. Whilst the virtue position embodies a noble and laudable goal that may follow from ethics education, I agree with Eckles *et al.* that it must surely lie beyond the primary business

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35 Taylor, N. 2003, 'Teaching philosophy to non-philosophy students: The example of architecture and town planning', *Discourse: Learning and Teaching in Philosophical and Religious Studies*, vol. 3(1), pp. 41–52, p. 41.

36 Sellars 2002, *op. cit.*

37 The literature on teaching medical students ethics is more developed than that for science students.

38 Justin Oakley has argued for the virtue approach to be adopted in teaching science students, citing the experience with medical students to support his case. Oakley, J. 2009, 'Teaching scientists the value of virtue', *Australasian Science*, vol. 30(2), p. 39.

of ethics teachers.<sup>39</sup> Such a learning outcome would also present significant challenges for assessment. How could a teacher determine whether or not students had attained this learning outcome? What possible measure could be used to decide if they were of good character? Therefore, given the problems inherent in the virtue approach it seems more plausible to accept the slightly less lofty, skill-based goal for ethics education of science students. Thus, at the broadest level, the aim should be to teach students the skills that will equip them to practise science ethically. To achieve this aspiration I would argue that there are two groups of learning outcomes that should be set — those to do with understanding the nature and terrain of ethics, and others related to how to do ethics or applied philosophy more generally.

Students need to develop an appreciation of some of the key features of ethics in order to operate ethically in science. In the first instance, they need to acquire what I call their ‘ethical radar’; that is, a sensitivity that allows them to recognise moral issues, as well as situations where values are in conflict. Such an understanding may appear common sense and such conflicts might seem obvious, but this, in my experience, is not necessarily the case. For instance, some students in medical sciences consistently conflate ethical and clinical choices, and assume they are making purely medical decisions based on scientific factors when their conclusions are being driven by their own personal values (for example, what constitutes a good quality of life). Similarly, it may be difficult for a student in the life sciences to see that there is any ethical issue generated by research into a deadly virus because they may implicitly value scientific knowledge, research and progress over issues such as threats to public health and security. Thus, they might be unconcerned by research into transmission of the Ebola virus, for instance, seeing the science as neutral or focusing on the good ends such research might produce, rather than its potential to lead to a disease outbreak or biological attack.

Related to developing sensitivity to the presence of ethical issues is the goal of learning to appreciate the complex and contested nature of the ethical landscape. Students need to understand that there are genuine and well-grounded points of difference between people on such issues, but that although complete consensus on the nature and resolution of a concern may be rare, this does not undermine the value of discussion and argument, nor does it mean that ethical relativism must follow.

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39 Eckles, R. E., Meslin, E. M., Gaffney, M. and Helft, P. R. 2005, ‘Medical ethics education: Where are we? Where should we be going? A Review’, *Academic Medicine*, vol. 80(12), pp. 1143–52.

To complement this appreciation of the nature of ethics, students should acquire a particular set of skills regarding criticism, analysis and argument. Although discussing philosophical pedagogy more broadly, the aims Sellars sets down apply equally well in practical ethics. He writes:

If one defines philosophy as a critical analysis of one's existing opinions and the attempt to replace those opinions with rationally ground beliefs, then teaching philosophy should involve teaching the skills necessary to accomplish this. A successful philosophical education, then, will be one at the end of which one's students are able to call into question their own unexamined presuppositions and to think rationally for themselves.<sup>40</sup>

Students need to be able to interrogate and critique ethical views expressed in the literature, in the media and by their colleagues, as well as systematically reflect on their own views. Students should be able to argue and formulate coherent, reflective and well-justified responses to ethical situations, both verbally and in written form. Therefore, it is insufficient to accept the UK Quality Assurance Agency for Higher Education's claim that in the biosciences we should expect all students to develop 'some understanding of ethical issues and the impact on society of advances in the biosciences', but that only good students should 'be able to construct reasoned arguments to support their position on the ethical and social impact of advances in the biosciences'.<sup>41</sup> Good students will presumably produce better arguments than poorer students, but to have no expectation that poorer students will develop any skills in argument is to set the bar too low. If students do not obtain competency in such a fundamental learning outcome, they should not pass the course in which they are enrolled.

Further learning outcomes have been suggested in the literature, including that ethics education should canvass the 'development of competencies in analysing how social and technical factors interact'.<sup>42</sup> I would argue, however, that this is beyond the purview of philosophical ethics and that traditional teachers of ethics would likely lack the relevant expertise to do justice to such a goal, though if such outcomes are regarded desirable by some institutions, then teachers should be sourced and course goals amended.

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40 Sellars 2002, op. cit., p. 126.

41 As reported in Willmott, C. J. R., Bond, A. N., Bryant, J. A., Maw, S. J., Sears, H. J. and Wilson, J. M. 2004, 'Teaching ethics to bioscience students — A Survey of undergraduate provision', *BEE-j*, vol. 3.

42 Hollander and Arenberg 2009, op. cit. p. 11.

## Meeting the Challenges

Pedagogy is important. There are better and worse ways to teach particular subjects and disciplines. One factor demonstrated to benefit student learning in all areas of higher education is the constructive alignment of learning activities (that is, the activities in which students engage during their studies) with outcomes and assessment.<sup>43</sup> In essence, constructive alignment ensures that what is done in the classroom supports what students ought to learn. It involves determining appropriate learning outcomes, having students perform tasks and activities that develop these outcomes (often particular skills or abilities), and rewarding successful achievement of goals by awarding marks. For instance, if the goal is to teach medical professionals how to give injections, rather than delivering lectures on how to do this and assessing their skills by a written paper, students should practise this skill (initially in some form of simulated environment) and teachers should assess by valuing it relative to other learning outcomes by assigning a particular grade. Such a strategy might sound self-evident; however, for various reasons including historical and pragmatic ones, such an obvious strategy may not always be adopted. For instance, Kelton discusses how he used multiple-choice exams with computer grading, partly as a way of coping with the enormous volume of marking generated by large class sizes. However, eventually he came to regard such tests as ineffective in assessing whether students had achieved learning outcomes.<sup>44</sup> Courses and entire disciplines might also have certain assessment strategies historically linked to them that may not align with or be the best way of ensuring the attainment of learning outcomes.

Now I want to put the case for why role-play (focusing especially on dual-use dilemmas) can help meet some of the important learning outcomes identified for science students in ethics. First a couple of the key terms need to be defined. By 'role-play' I mean a structured exercise in which participants are assigned roles and some form of scenario in which to play out these roles.<sup>45</sup> For the purposes here, a dual-use dilemma is a situation that arises when one and the same technology, scientific research project or outcome of a scientific research project is such that it can be used as a basis to provide means to significantly

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43 Biggs, J. 1996, 'Enhancing teaching through constructive alignment', *Higher Education*, vol. 32, pp. 1–18; Biggs, J. 1999, *Teaching for Quality Learning at University*, Buckingham, UK: SRHE & Open University Press; Prosser, M. and Trigwell, K. 1999, *Understanding learning and teaching: the experience in higher education*, Buckingham, UK: SRHE & Open University Press; Ramsden, P. 2003, *Learning to Teach in Higher Education*, 2nd edition, London: Routledge.

44 Kelton 1997, op. cit.

45 For a good example of a dual-use role-play, see Rappert, B. 'The Life sciences, biosecurity and dual use research', available: <http://projects.exeter.ac.uk/codesofconduct/BiosecuritySeminar/Education/index.htm> [viewed December 2008].

harm others as well as perform another purpose that is not harmful. A dilemma arises in such a case, as there are reasons both for and against developing the technology or conducting the research.<sup>46</sup>

Evidence suggests that role-play with dual-use cases is a highly effective teaching activity to support the learning outcomes outlined earlier. In the first instance, role-play can help students develop their ethical radar, enabling them to become aware of the issues generated in scenarios.<sup>47</sup> Such scenarios can also foster an appreciation of the complex and contested nature of practical ethics generally. In applied ethics, opinions can differ over what values are at stake, and what the morally correct response should be. Since role-play can force students to adopt and defend positions they may not actually hold, and engage with other similarly positioned individuals, they learn to appreciate that there can be multiple legitimate positions to any ethical debate.<sup>48</sup> Students have reported that role-play may be superior to other teaching and learning strategies when it comes to developing a sense of the ethical terrain. They noted that in role-play they could '[c]reate a discussion...[which] makes you transport yourself to the role and situation...[and] [s]ee it from "different shoes"' and 'It makes people think, adopt different points of view, and therefore, get a broader understanding of an issue.'<sup>49</sup>

To assist psychology students in learning about the complexity of research ethics and demonstrate that there are multiple perspectives that should be considered in the evaluation of studies, Rosnow developed a role-play exercise.<sup>50</sup> Strohmets and Skleder later evaluated the effectiveness of this role-play in achieving the stated learning outcomes, validating Rosnow's work.<sup>51</sup> Other authors have also supported the value of role-play. Chesler and Fox, for instance, 'suggest that students can achieve insights into themselves, others, and motivations for actions which "can aid students in clarifying their own values and in effectively

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46 Definition adapted from unpublished research by Dr. John Forge, University of Sydney.

47 For instance, Illingworth argues role-play can 'enrich students' perceptions of morally significant situations', Illingworth, S. 2004, *Approaches to ethics in higher education: Teaching ethics across the curriculum* University of Leeds: Philosophical and Religious Studies Subject Centre, p. 52; Brummel, B. J., Gunsalus, C. K., Kristich, K. L. and Loui, M. C. 2008, 'Development of role-play scenarios for teaching responsible conduct of research', available: <http://netfiles.uiuc.edu/loui/www/RCRRolePlays.pdf> [viewed December 2009], p. 1.

48 Brummel *et al.*, *Ibid.*

49 *Ibid.*, p. 6.

50 Rosnow, R. L. 1990, 'Teaching research ethics through role-play and discussion', *Teaching of Psychology*, vol. 17(3), pp. 179–81, p. 179.

51 Strohmets, D. B. and Skleder, A. A. 1992, 'The Use of role-play in teaching research ethics: A validation study' *Teaching of Psychology*, vol. 19(2), pp. 106–8, p. 108.

directing or changing their own behaviour'''.<sup>52</sup> Similarly, Doron comments that role-play 'exposes the students to attitudes or viewpoints that they might otherwise not have been conscious of'.<sup>53</sup>

In addition to helping develop their ethical radar, role-play can assist students to pick up analytic, critical and argumentative skills. Primarily through their deployment in simulated settings, students learn the skills required to navigate real ethical situations. The task they embark on in role-play is not abstract and theoretical but highly immediate and practical. By being forced to understand, interrogate and attack one's opponents and defend a position in the cut and thrust of debate, a whole raft of skills may be developed.

Significantly, the use of role-play can also be an effective means of dealing with some of the special needs of science students in the ethics classroom. Engagement in role-play can break down the hostility toward ethics sometimes encountered, by providing an enjoyable and stimulating environment for learning. Brummel, for instance, reports on the high level of student satisfaction associated with this form of learning activity,<sup>54</sup> and Doron comments that role-play 'facilitates deeper individual involvement with, and interest in, the case' being examined.<sup>55</sup> As the higher-education literature has shown, this is significant, because positive learning experiences can translate into better learning outcomes.

The potentially threatening nature of ethical discourse for science students can also be ameliorated by role-play since, as Brown notes, such scenarios 'have the advantages of creating low-risk conditions for expression of extreme opinions by students'.<sup>56</sup> He goes on: 'The freedom afforded by playing a stranger, and attributing extreme positions to that individual, allows the players tremendous scope of exploration into the nuances and conflicts inherent in any complex situation, without exposing the players' own beliefs.'<sup>57</sup> However, Brummel notes there can also be unfavourable responses to role-play, with students potentially feeling awkward or not seriously engaging with the exercise.<sup>58</sup> In his research, such shortcomings did not outweigh perceived advantages on the part of students generally and, in my view, could potentially be handled by sensitivity on the part of the teacher to the needs of students who are not as socially competent or skilled as their colleagues.<sup>59</sup>

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52 Quoted in Brown, K. M. 1994, 'Using role play to integrate ethics into the business curriculum a financial management example', *Journal of Business Ethics*, vol. 13(2), pp. 105–10, p. 105.

53 Doron, I. 2007, 'Court of ethics: Teaching ethics and ageing by means of role-playing', *Educational Gerontology*, vol. 33(9), pp. 737–58, p. 742.

54 Brummel *et al.* 2008, *op. cit.*, pp. 2 and 4.

55 Doron 2007, *op. cit.*, p. 742.

56 Brown 1994, *op. cit.*, p. 105.

57 *Ibid.*, p. 106.

58 Brummel *et al.* 2008, *op. cit.*, p.6.

59 Illingworth gives some excellent and practical suggestions for teaching ethics generally which are particularly relevant in this context. She focuses specifically on creating a safe environment, ensuring mutual

Role-play also enables students to be immersed in an environment where the potentially alien norms of the humanities operate and can be implicitly fostered. A very different notion of the teacher prevails in such scenarios. For instance, the manner in which role-plays function mean they 'avoid...preaching by the authority figure'.<sup>60</sup> Doron supports such a view, claiming that in role-play the teacher 'is not the omniscient expert who possess the correct answer and whose place in the classroom is laid down by a hierarchy of superiority that is based on the disparity between the teachers' and their students' knowledge and experience'.<sup>61</sup> According to Brown, another advantage of such exercises is that '[b]y its nature, a role-play has no ultimate solution contained within it, and so emphasises the indeterminate elements of decisions'.<sup>62</sup> There is no single correct answer that is possessed by authorities, either teachers or texts.

Dual-use cases add to the effectiveness of role-play by helping provide the realistic and practical context science students crave. As recent research with ethics teachers in science has shown, '[w]hen it comes to the aspects of ethics respondents believe students find most interesting or engaging, the most prominent theme is that of real world cases, or ethics in social contexts'.<sup>63</sup> Not only do real dual-use scenarios provide a realistic setting for ethical discussion, they also have at their heart a significant conflict, which as Brown has argued, is essential for the success of role-plays.<sup>64</sup> Dual-use situations have an inherent tension between values — the desire for scientific knowledge and progress, and the potential for such knowledge to generate harm. Finally, dual-use scenarios demonstrate vividly to science students that even if they are well-intentioned scientists and moral people more generally, their research can still create significant ethical concerns. In the heat of role-play they learn that they need to deal with these ethical concerns if they are to be effective scientists in the twenty-first century.

## Conclusion

Though it may represent a challenging exercise, science students need to be taught ethics. They need to be empowered with the skills to conduct their professional lives in the face of the moral challenges they will confront. Role-plays based on dual-use dilemmas can motivate engagement with ethics, be a

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respect and protecting confidentiality. Illingworth 2004, op. cit., pp. 82–90.

60 Brown 1994, op. cit., p. 105.

61 Doron 2007, op. cit., p. 743.

62 Brown 1994, op. cit., p. 106.

63 van Leeuwen, B., Lamberts, R., Newitt, P. and Errington, S. 2007, 'Ethics, issues and consequences: conceptual challenges in science education', in UniServe Science Teaching and Learning Research Proceedings, available: <http://science.uniserve.edu.au/pubs/procs/2007/23.pdf> [viewed December 2009] pp. 112–9, p. 117.

64 Brown 1994, op. cit., p. 106.



catalyst to developing critical, analytic, argumentative and verbal skills, and do so in an enjoyable and non-threatening way, conducive to getting the best from current students and future scientists.