

The teaching of social and ethical issues in the
school curriculum, arising from developments in
biomedical research: a research study of teachers

Final Report to The Wellcome Trust

by

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Tribute

Dr Sheila Turner, co-project director and Reader in Education at the Institute of Education, died on 4th November 2000 at the Princess Alice Hospice, Esher, Surrey. Sheila initiated this project at the Institute and was responsible for its early development. Although Sheila was diagnosed with cancer shortly after the project began, she remained energetic and committed throughout, taking meticulous notes, reading thoroughly and constantly feeding back important insights. Her courage and openness about her illness were truly inspiring. The team will always remember Sheila's kindness, her endless supplies of buns and coffee, and her humour, support and friendship. We miss her, as do all those who knew her.

An obituary to Sheila is posted at www.ioe.ac.uk/media/r001115.htm

Ralph Levinson

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1. Executive summary

In April 1999 the Wellcome Trust commissioned a study of **the teaching of social and ethical issues in the school curriculum, arising from developments in biomedical research** with particular reference to the 14+ age group. The research was undertaken by an interdisciplinary team led by Ralph Levinson and Dr Sheila Turner at the Institute of Education, University of London between May 1st and December 1st 1999.

The project had five main objectives:

1. to identify the perceived importance amongst teachers (especially science teachers) of social and ethical issues in the curriculum arising from developments in biomedical research;
2. to identify strategies currently employed in teaching issues with a social, moral or ethical dimension across the curriculum;
3. to indicate the successes and impediments to success in delivering issues based education;
4. to highlight the experience of teachers in approaching the social, moral, ethical and legal impacts of genetic research;
5. to identify the types of resources and training required by teachers to support issues based learning associated with scientific developments.

The main findings and recommendations are set out below.

2. Recommendations for the Wellcome Trust

- The Wellcome Trust could explore with teachers, higher education institutions and professional subject bodies how teaching topical and controversial issues in science to all students at post-16 level can best be achieved. There are clear limitations to the General Studies course and a course such as the AQA board's *Science for Public Understanding* could address these issues in greater depth.
- The Wellcome Trust should liaise with the DfES, QCA, ASE, NATE, SACRE and examination boards in exploring changes in the national curriculum and GCE AS/A2 to encompass emphases on teaching the social and ethical aspects of developments arising from biomedical research.
- The Wellcome Trust could play an instrumental role in devising assessment criteria in co-operation with science teachers, English teachers, religious education teachers and examination boards. Analysis of syllabuses in Critical Thinking, Philosophy, GNVQ Health and Social Care and General Studies, and students' responses to questions on socio-scientific issues, might provide a useful starting point. Teachers following the GNVQ Health and Social Care syllabus report that assessment of ethical issues is built into the teaching programme. Evaluation of assessment and teaching approaches in this course may yield some valuable indicators for the broader curriculum.
- The Wellcome Trust could work in association with bodies such as the Citizenship Foundation through conferences and in-service training, and could include more advice and examples about the handling of socio-scientific issues and the presentation of moral and ethical dilemmas through the science curriculum.
- A future research project could be aimed at establishing criteria, developing strategies and appropriate materials for teaching ethical issues in a science context. Findings should be disseminated and the opportunity should be left open for follow up studies.
- Educational resources should highlight the main ethical arguments of socio-scientific issues. Resources should focus on supporting the teaching of making risk assessments and rights and responsibilities.
- Educational materials could be provided through web-sites. Materials should contain a science background for non-specialists, updated lists of expert speakers, information for assemblies, exemplars on controversial issues and support for students with low literacy levels.
- An evaluation of the collapsed day model of cross-curricular co-ordination for teaching social and

ethical issues in science could be researched and disseminated. Evaluation would: identify appropriate schools, scientific issues addressed, assessment criteria and the role of science knowledge; establish criteria of effectiveness; and take on board views of participant teachers and students.

- Some schools run philosophy courses for children at the latter stages of Key Stage 2 and at Key Stage 3. These philosophy/natural philosophy courses are worth evaluating particularly if children have had the opportunity to think reflectively about moral and ethical issues - and their links to science - before secondary school.
- Careful thought needs to be given to an appropriate training programme. This might be based on case studies incorporating the underpinning science, the moral and religious values, and different ethical positions.
- Teachers need access to religious views on biomedical issues, particularly from the minority faiths.
- Schools are wary of teaching about mental health. The reasons for this caution need to be understood and awareness training should be developed at both regional and national levels. (Schools indicate there are local issues). One possibility is to increase the scope for teaching about brain science at Key Stage 4 and post-16 levels. We would not wish to speculate how this could best be done; it may be a matter of working with non-governmental bodies such as the Mental Health Foundation as well as Health Action Zones, Department of Health and DfES.

3. Findings and Recommendations

3.1. Main Findings

3.1.1. *Perceived importance*

Most teachers believe it is important to teach about developments in biomedical research and to explore the social and ethical issues that relate to them. Given time constraints in an overcrowded curriculum some teachers believe that sex education and drugs education have a greater immediacy in PSHE and should take priority over teaching other contemporary socio-scientific issues.

Nearly two-thirds of questionnaire respondents did not think there was sufficient coverage of biomedical and mental health issues in schools. To address these issues effectively, teachers thought that other topics on the curriculum will have to be dropped. (Sections 6.2, 8.16)

HIV/AIDS is the topic covered most commonly by teachers followed by the science and social and ethical issues underpinning the new genetic technologies. Much less attention is given to mental health and neuroscience with the exception of eating disorders. Only a quarter of respondents had covered the Human Genome Project in their teaching, and these are almost exclusively scientists¹. (Section 6.2)

The development of decision-making and critical thinking are the two skills most commonly cited in questionnaires by teachers for teaching the social and ethical issues arising from biomedical research. In interviews teachers stressed the need for sensitivity to others although this justification was rarely mentioned in questionnaires. Very few teachers included a) an understanding of risk assessment and b) any emphasis on individual rights and responsibilities. These omissions are surprising given the prevalence in contemporary public debate about the nature of risk, in for example the consumption of GM foods, environmental risks from the introduction of transgenic species and the importance of civil rights in genetic testing and DNA fingerprinting. (Section 6.3.1)

3.1.2. *Strategies*

Teachers use a wealth of methods and approaches, and employ a range of strategies, when teaching socio-scientific issues. Discussion, debates and videos are the most frequently used strategies, though science teachers tend to use both formal and informal debates less than humanities practitioners.² While science teachers acknowledge that students enjoy debating issues, curriculum constraints and lack of teacher confidence have been advocated as reasons for not having formal debates and discussions in science lessons. English teachers, in particular, frequently run debates or discussions covering diverse viewpoints and are practiced at managing them. (Sections 7.1 and 7.2)

¹ These findings preceded the media attention given to the publication of the first draft of the Human Genome.

² The term 'humanities' is used broadly to include teachers of Arts and Social Science subjects.

The devil's advocate position is often used by teachers to stimulate debate and to highlight arguments that may not otherwise be heard. While this is a perfectly creditable strategy teachers should make clear to students that the arguments put forward are not necessarily theirs. (Section 7.2.8) Teachers also relate that teaching issues from a personal perspective makes the topic more approachable to students and lends credibility to the dilemmas involved. Teaching biomedical issues from a personal perspective is advocated most enthusiastically by some science teachers, possibly because the personal element is underpinned by secure knowledge of the related science. However, topics such as genetic screening, IVF treatment and mental health may have very personal implications for teachers and the influence of personal experiences on teacher confidence should not be underestimated. (Section 7.2.9)

3.1.3. Balance

School managers and teachers overwhelmingly emphasize the importance of taking a balanced or unbiased approach in discussing controversial issues. This may be because of fear of parental complaints or complaints from other sections of the local community. Balance is perceived to be a good thing so that students have access to all sides of the argument and can have an informed opinion. Most teachers acknowledge the complexity of both giving and developing balanced viewpoints but students are given little guidance on how to weigh arguments. Few teachers use the concepts and procedures of ethical enquiry in their teaching. One of the few syllabuses that fuse teaching of science with explicit teaching of ethical concepts is GNVQ Health and Social Care.

Teachers are keen to have access to comprehensible resources that show different sides of the argument about an issue, to invite in expert visiting speakers and to have guidance as to choice of balanced resources. (Section 8.1)

3.1.4. Assessment

Assessment is crucial to the seriousness and depth of teaching of a topic, a point also made in the Nuffield 2000 report³. There do not appear to be effective criteria in science syllabuses for assessing the skills and knowledge required to address the social and ethical aspects arising from developments in biomedical research.

3.1.5. Where should biomedical and mental health issues be covered in the curriculum?

There is no obvious curriculum site for issues-based education within a science context. Teachers and students perceive PSHE as having low status, little time is allocated to it on the curriculum and it is not examined. While socio-scientific issues are taught in the popular General Studies courses at post-16, they are often covered only superficially by non-scientists; co-ordination between science teachers and non-science teachers is not always in place and teachers report that the quality of examination responses on scientific issues is often poor with low levels of analysis. Arts students find it difficult to

³ R. Millar and J. Osborne (eds), *Beyond 2000: Science education for the future*, 1998

address socio-scientific issues and often lack, or cannot use, the relevant science knowledge base. GNVQ Health and Social Care is a promising option as a model of how these issues could be taught, because it brings science together with its social and ethical implications. However the assessment criteria do not invite in-depth exploration of these issues and GNVQs are taken by relatively few students. At Key Stage 4 the science curriculum is perceived as content-laden and overcrowded, militating against critical thinking on these issues, and teaching strategies are transmissive rather than student-centred. Ethical issues are not necessarily addressed and tend to be hand-waving rather than discursive and analytical. Where there are questions in science examinations on social and ethical issues some teachers report that students find it difficult answering questions that invite opinions. Humanities curricula tend to stimulate critical thinking more than science but teachers' grasp of the technical information is often inadequate to invite critical exploration of rapidly changing technologies. In some cases, humanities teachers may unwittingly enhance misconceptions rather than allay them. The new modular AS biology courses offer interesting possibilities post-16 but are likely to reach only a minority of students.

3.1.6. Citizenship

Citizenship is another area where these issues could be tackled. There are very few references to citizenship in the questionnaire responses but it is discussed more extensively in interviews. Science teachers see citizenship as an opportunity to develop thinking about socio-scientific issues but humanities teachers are more sceptical, suggesting that citizenship may be about describing civic duties rather than stimulating critical debate. For citizenship to be effective teachers think lessons have to be participatory, critical and involve opinions and discussion. Teachers believe that citizenship may lose out against core subjects in an overcrowded curriculum and that science teachers may be less involved in teaching citizenship because their curriculum offers less opportunities for incorporation.⁴ (Section 8.2)

3.1.7. Cross-curricular collaboration

Although different curriculum areas have complementary strengths there is little cross-curriculum co-ordination in schools and colleges between science and humanities departments.

One model of cross-curricular collaboration is the collapsed day. This involves taking a year group off curriculum, cross-subject planning on an integrated theme and assessment through one subject area. The last point could be problematic in that teachers in the assessed subject may have curricular hegemony and some disciplines may receive greater emphasis than others. (Section 8.13)

3.1.8. Perceptions of science

A majority of interviewees and a substantial proportion of questionnaire respondents perceive science as value-free. Science teachers see themselves as teaching the 'facts' whereas the social, moral and

ethical implications of some of these facts are broached by humanities teachers. Where ethical issues are addressed in science they are treated as a bolt-on and are summarised briefly with little analysis or critical discussion. Few humanities teachers used science knowledge in addressing these issues, and many do not see the need to. (Section 8.10)

3.1.9. Students' conceptions of developments in biomedical research

Teachers report the 'Frankenstein effect' in students' views on developments in biomedical science. According to teachers, students' information on these issues come from skimming of tendentious headlines and leaflets from pressure groups. There are popular misconceptions on cloning and test-tube babies. Students, particularly girls and younger students, are reported to have passionately held views on animal rights. (Section 8.7)

3.1.10. Use of the media

Science and humanities teachers have markedly different approaches to the use of the media. The tabloid press is seen as a source of misinformation, bias and propaganda on biomedical issues for science teachers but an opportunity for analysis of interest positions for humanities teachers. All teachers interviewed who mentioned broadsheets see them as balanced on socio-scientific issues. Serious science programmes, such as Horizon, are perceived as good resources for teaching socio-scientific issues in sixth form science lessons. However teachers did not refer to the skills needed by students in interpreting newspaper reports of science. (Section 8.8)

3.1.11. School policies

School policies on controversial issues relate mainly to sex education and drugs education and there is very little, if any, formal consideration of mental health issues. Teachers want guidelines rather than formal documents and prefer to rely on their own professional judgement.

3.1.12. Training

Questionnaire responses about training needs concentrated on in-service training rather than pre-service training. Time is frequently quoted as a constraint. Teachers wonder whether it is their job to be teaching about these issues. The main needs are perceived to be training in methods and approaches to areas of controversy. Teachers feel they lack the required expertise to teach ethical aspects of controversial issues, particularly in scientific areas (Section 10).

3.1.13. Resources

A large majority of teachers feel there is a need to develop educational resources that address the social and ethical issues arising from developments in biomedical research. Videos, outside speakers as experts and up-to-date information accessible to non-specialists are seen as priority needs. Many

⁴ Curriculum 2000 was published after responses to questionnaires and after most of the interviews were carried out.

teachers want high quality worksheets. Assemblies are often used as a forum to address contemporary scientific and technological developments, this indicates an opportunity to develop materials that can be used in assemblies. Teachers express concerns about bias in materials and a list of criteria for use of materials would help. There are specific requests for materials for students with low levels of literacy (Section 10).

3.1.14. Mental health

Teachers are broadly aware of issues that may be sensitive to students. While teachers are generally confident of handling issues connected with genetic conditions, schools are very wary of teaching about mental health issues even when there is unequivocal acknowledgement by headteachers and subject teachers that students may either suffer from, or be exposed to, mental illness. Few schools incorporate the teaching of mental health issues in the curriculum or devise policies on mental health in their equal opportunity statements. A substantial proportion of headteachers and heads of department interviewed, cautioned against teachers dealing with aspects of mental health. Some schools use outside speakers to address topics such as eating disorders. (Section 8.4)

These findings suggest that teachers do feel it is important to teach the social and ethical issues arising from developments in biomedical research but the rigidity of the science curriculum and associated syllabuses militate against this. While these issues are discussed in other areas of the curriculum, primarily English and religious education, there is little use of background science knowledge. Co-operation and co-ordination between science and humanities teachers, bringing together different areas of expertise, is rare. Ethics as an academic mode of enquiry is not often taught and there is a preoccupation with balance and lack of bias at the expense of judging the merits of different arguments. There are, however, examples of excellent practice and useful models to think about and develop.

Teachers recognise that many students encounter mental illness in one form or another but that little is either formally or informally incorporated in the school curriculum to support the teaching of mental health and the development of appropriate attitudes. Little is taught about the science of the brain and where it is links are not made to mental illness. Most teachers interviewed were nervous teaching about mental health and some school managers actually discourage teaching by non-experts.

3.2. Recommendations

- a. At present most students do not have the opportunity at school or college to engage with the social and ethical aspects of developments in biomedical research at any depth post-16. An ability to understand and critically engage with biomedical topics is vital to young people today in terms of the skills they will need to deal with dilemmas both at a public and individual level. With the new AS/A2 model, a course such as *Science for Public Understanding* could be taken by most post-16 students. Scientific issues could then be explored at a greater depth than they are in the very broad General Studies syllabus, emphases being given to risk assessment and rights and responsibilities. Similar courses of science for all are run in high school education and higher education in Thailand, Israel and Holland.⁵ The Wellcome Trust could explore with higher education institutions, professional subject bodies and teachers how this could best be achieved.
- b. Opportunities should be created in the science curriculum both at pre-16 and post-16 for the teaching of social and ethical issues arising from biotechnology and biomedicine. Social, moral and ethical issues should be explicated in syllabuses, more so than they are at present. Suggestions for appropriate approaches, background knowledge and materials could be incorporated into non-statutory statements. The Wellcome Trust should liaise with the DfES, QCA, ASE, NATE, SACRE and examination boards in identifying possible changes in the national curriculum and GCE AS/A2 to encompass these issues.
- c. Specifications of learning outcomes and assessment criteria should incorporate discussion of controversial issues. Formal assessment is crucial in determining the priorities given to teaching topics. Assessment criteria could be devised which emphasize both discursive argument and knowledge of science content⁶. Science-based curricula are the best site to discuss these issues but the consideration of moral, social, ethical and legal implications must be integrated into the curriculum. Requirements by institutions of higher education for a qualification at post-16 either in science or a science for public understanding course may be one way of raising the status of teaching these issues at school. The Wellcome Trust could play an instrumental role in devising assessment criteria in co-operation with science teachers, English teachers, religious education teachers and examination boards. Analysis of syllabuses in Critical Thinking, Philosophy, GNVQ Health and Social Care and General Studies, and students' responses to questions on socio-scientific issues, might provide a useful starting point.
- d. The teaching of moral and ethical principles underpinning controversial issues in science needs to be highlighted. Teachers in all subject areas need to be trained to teach ethical principles and to enable students to weigh arguments. Input by English teachers could be helpful. These principles should be incorporated into curriculum documentation, local authority INSET programmes and into teacher training syllabuses. The Science orders in Curriculum 2000 enjoin teachers to teach

⁵ Fensham, P. (1997) 'School science and its problems with scientific literacy' in Levinson, R and Thomas, J (eds) *Science Today*, Routledge London and New York.

⁶ Millar and Osborne, op cit

ethical issues in Sc1⁷. The new citizenship curriculum could include more advice and examples about the handling of socio-scientific issues and the presentation of moral and ethical dilemmas through the science curriculum. The Wellcome Trust could work in association with bodies such as the Citizenship Foundation through conferences and in-service training to achieve these aims.

- e. Little is known about what constitutes effective teaching of ethical issues in science. A future research project could be aimed at establishing criteria, developing strategies and appropriate resources. Findings should be disseminated and the opportunity should be left open for follow up studies.
- f. Educational resources should highlight the main ethical arguments of socio-scientific issues before explaining the scientific principles. Developing alternative ethical arguments should be encouraged to take ethical thinking further. There needs to be a focus on risk assessment, e.g. in relation to transgenics, rights and responsibilities in relation to issues such as genetic testing and the responsibilities we have to local and global communities, e.g. gene patenting, the variety of family relationships, which should take into account cultural and religious positions.
- g. Educational materials on bioethics, perhaps discussing case studies, and offering flexibility of use could be important resources. The main needs are:
 - up to date information, possibly on dedicated web-sites;
 - provision of basic science background for non-specialists;
 - lists of expert speakers willing to talk to school students;
 - information for assemblies;
 - materials for understanding the reasons for participants' viewpoints, for detecting and challenging bias;
 - information and exemplar materials on the Human Genome Project and other major scientific initiatives (particularly for non-specialists), risk assessment and individual rights and responsibilities in relation to biomedical research;
 - exemplars of materials and approaches to teaching controversial aspects of biomedical topics;
 - access to information, possibly through professional subject groups;
 - materials for students with low levels of literacy.
- h. Cross-curricular collaboration could build upon the expertise of subject specialists and could be encouraged through funding initiatives from the DfES, professional subject bodies, non-governmental bodies supporting citizenship education and foundations promoting educational research. At present the collapsed day model involving a year group going off curriculum is worth evaluating. This model appears to be gaining currency in schools instead of PSHE. An evaluation of this model of teaching socio-scientific issues could be researched and disseminated. Evaluation

⁷ Sc1, *Scientific Enquiry*, is Attainment Target 1 of the national curriculum in science. In Key Stage 4 Double Science it states 'Pupils should be taught . . . to consider the power and limitations of scienceand the ethical issues involved.'

would identify appropriate schools, staffing structures, socio-scientific issues addressed, assessment criteria and the role of science knowledge; establish criteria of effectiveness; and take on board views of participant teachers and students.

- i. Research indicates that there is a pattern in students' moral development⁸ and opportunities to discuss issues, such as animal rights, should be available to pupils at Key Stage 2. Some schools run philosophy courses for children at the latter stages of Key Stage 2 and at Key Stage 3. These philosophy/ natural philosophy courses are worth evaluating particularly if children have had the opportunity to think reflectively about these issues - and their links to science - before secondary school.
- j. A training programme for teachers might adopt a case by case approach of specific issues such as xenotransplantation or genetic screening. These cases would include consideration of the underpinning science, the moral and religious values and beliefs, and the different ethical positions.
- k. There needs to be resource development for teachers of religious views on developments in biomedicine, and controversial areas of science in general, particularly in faiths other than Christianity, Judaism and Islam.
- l. Schools are wary of teaching about mental health. The reasons for this caution need to be understood and awareness training should be developed at both regional and national levels. (Schools indicate there are local issues). One possibility is to increase the scope for teaching about brain science at Key Stage 4 and post-16 levels. We would not wish to speculate how this could best be done; it may be a matter of working with non-governmental bodies such as the Mental Health Foundation as well as Health Action Zones, Department of Health and DfES.
- m. Schools have to recognise the need to address mental health issues because of the prevalence of mental health problems among students. At present, mental health issues are approached in an ad hoc way in both the formal and informal curriculum. There are resource and training implications for teaching about mental health but it is much more than this. Schools are wary of teaching about mental health. The reasons for this caution need to be understood and awareness training to be developed at both regional and national levels. (Schools indicate there are local issues). One possibility is to increase the scope for teaching about brain science at Key Stage 4 and post-16 levels. We would not wish to speculate how this could best be done; it may be a matter of working with non-governmental bodies such as the Mental Health Foundation as well as Health Action Zones, Department of Health and DfES.

⁸ Eg Colby, A and Kohlberg, L. (1987), 'The measurement of moral judgement'. Cambridge: Cambridge University Press.

4. Abbreviations used in the report

AQA	Assessment and Qualifications Alliance
ASE	Association for Science Education
BBSRC	Biotechnology and Biological Sciences Research Council
CFC	Chlorofluorocarbons
DfES	Department for Education and Skills
ECT	Electroconvulsive therapy
FE	Further Education
GCE	General Certificate of Education
GM	Genetically Modified
GNVQ	General National Vocational Qualifications
HOB	Head of Biology
INSET	In-Service Training
IVF	In-vitro Fertilisation
LEA	Local Education Authority
NATE	National Association for the Teaching of English
OCR	Oxford Cambridge and RSA Examinations
PSHE	Personal, Social and Health Education
QCA	Qualifications and Curriculum Authority
RE	Religious Education
SACRE	Standing Advisory Council on Religious Education

5. Introduction

In April 1999 the Wellcome Trust commissioned an interdisciplinary team from the University of London Institute of Education, to carry out an investigation into **The teaching of social and ethical issues in the school curriculum, arising from developments in biomedical research** with particular reference to the 14+ age group, i.e. those students studying at Key Stage 4 and above. The views of teachers working in schools and colleges throughout England and Wales were to be sought with particular reference to Headteachers/Principals, Heads of Biology and Humanities Departments and Co-ordinators for Personal, Social and Health Education (PSHE).

Use of the term 'ethical' in the context of the study has been taken to mean consideration of the ways groups of people ought to act in relation to scientific knowledge of biomedical issues. Interviewers used examples as prompts if responses from interviewees did not address these issues. The term 'moral' was associated in interviews with the rightness or wrongness of an action.⁹

This study is opportune and timely in view of the debates surrounding recent advances in biomedicine and biotechnology and the implications of the Human Genome Project. Furthermore, the study has taken place at a time of curriculum review in England and Wales, including publication of the new orders of the national curriculum, recommendations of the Nuffield *Beyond 2000* report, preparations for *Citizenship* in the national curriculum and changes in provision for 16 to 19 year olds. It should be noted that the *Citizenship* curriculum was published just after the interviews for this report had been carried out. As we have indicated in the report and recommendations citizenship could be an important arena for the teaching of issues connected with developments in biomedicine.

During the period in which this research was being carried out the following topics were widely discussed in the media:

- the debate over GM foods;
- cloning of embryo tissue;
- pre-implantation diagnosis;
- the artificial creation of life;
- xenotransplantation;
- gene patents.

Young people studying in schools or further education will encounter the new biomedical technologies in some form. They will need to be equipped with the necessary skills to contribute to the emerging dialogue between policy-makers and citizens' as well as the skills and knowledge to make personal choices that become available to them. These are major challenges for the school curriculum.

⁹ As an example, Muslim pupils considered it wrong to use pigs hearts for transplanting to Muslims but were prepared to consider the issues involved in terms of the ethics of transplantation more generally.

The teaching of mental health issues is an integral part of this report and teachers were asked how related topics were addressed in school policies and in the curriculum more broadly.

5.1. Project aims and objectives

The study had five main objectives:

1. to identify the perceived importance amongst teachers (especially science teachers) of social and ethical issues in the curriculum arising from developments in biomedical research;
2. to identify strategies currently employed in teaching issues with a social, moral or ethical dimension across the curriculum;
3. to indicate the successes and impediments to success in delivering issues based education;
4. to highlight the experience of teachers in approaching the social, moral, ethical and legal impacts of genetic research;
5. to identify the types of resources and training required by teachers to support issues based learning associated with scientific developments.

5.2. Structure of the report

The rest of section 5 discusses the methods used in gathering and analysing the data. Sections 6 to 9 are a discursive analysis of the project objectives, including data from both questionnaires and interviews which are complementary but have been described separately. Section 8 is the longest section and is the only one where we felt it was appropriate to place recommendations in the various sub-sections. Shorter versions of these recommendations have been incorporated into the main recommendations in Sections 2 and 3. There is a short conclusion.

5.3. Methods

Two main methods were used in gathering data: questionnaires to schools and follow-up interviews. A seminar for teachers was held at the Wellcome Trust to consider the findings of the interim report.

This survey consists of three parts. The first part – responses to questionnaires sent out to 1000 schools in England and Wales - was completed by the end of the summer term 1999. The second part – interviewing teachers in selected schools - commenced in July 1999 and was completed in mid-December 1999. Analysis of the questionnaires began in July 1999. Interview transcripts were analysed

from September 1999 through to February 2000. The draft version of the final report was completed in March 2000.

5.3.1. The survey - questionnaires

In the first part, questionnaires were sent to one thousand educational establishments, which constituted a randomised but representative sample of secondary schools and further education institutions in England and Wales. More precisely, the sample contained about every fifth school or college out of the lists of *The Education Authorities Directory and Annual for 1999*, published by the *School Government Publishing Company Limited*. The selection was actualised in two phases, each one consisting in the selection of every tenth school in the directory lists, with a different starting point each time. All types of schools or colleges catering for the ages 14-19 were counted in the sampling process. The sampler went through the relevant lists in the order they appear in the directory assuring balanced representation of the following types of educational institutions:

LEA secondary schools (county and voluntary)
 Grant Maintained schools
 Independent secondary schools
 City Technology Colleges
 Sixth Form Colleges
 Further Education colleges

Institutions were selected from all regions of England and Wales including urban, suburban and rural areas. The questionnaires were trialed with a principal, a headteacher and teachers from an LEA secondary school and a college of further education. Modifications to the questionnaires were made as a result of the trials.

A set of four colour-marked questionnaires was sent to the Head/Principal of each school/college, together with a cover letter explaining the aims and objectives of the project and asking for their assistance. The copy of the questionnaire to the Head/Principal (white) was to be completed by the Head or an appropriate Deputy Head (Appendix A). The remaining three questionnaires were different to that sent to Headteachers identical to each other. The three copies were to be completed by the Heads of Biology/Science, Humanities/Social Science, and PSHE/Student Services, or their equivalents (Appendix B). Four stamped, self-addressed envelopes were included in the post for returning the completed questionnaires.

The following topics were addressed in the questionnaires:

- information about the school
- teacher confidence in addressing issues based topics
- topics covered in teaching
- resources used for teaching
- teaching strategies

- departmental and whole school/college policies

The questionnaire to teachers included a list of topics as examples of issues-based topics that might be taught within the context of developments in biomedical research

The questionnaire to the headteachers was completed and returned by 214 respondents (21.4% of the headteachers approached), while the questionnaire to the heads of department was completed and returned by 408 teachers. The numbers by specialism are:

- 156 science specialists (38.2% of the teacher respondents);
- 111 humanities specialists (27.2% of the teacher respondents);
- 141 PSHE co-ordinators (34.5% of the teacher respondents)¹⁰.

This makes a total of 622 responses from teachers and headteachers. 305 schools participated in the survey, a response rate of 30.5% with respect to schools and 15.5% with respect to teachers, with one mailing and without any follow-ups. In addition, another sixty schools responded in writing letting us know that they were not able to contribute to the research at that point. If this response is counted towards the general response rate, then 36.5% with respect to schools of the initial sample can be considered as respondents.

Table 1 shows the percentage, by type of educational institution, who responded.

Table 1: *Percentage by type of responses from educational institutions*

	Schools contacted	Responses	Rate
LEA funded	573	168	29.32%
Grant maintained	162	60	37.03%
Independent	151	46	30.46%
FE	114	31	27.19%

Percentage responses from single sex schools were much better than from mixed sex schools (Table 2). We have no evidence to account for these differences but it suggests single sex schools may have a keen interest in promoting issues-based teaching.

Table 2: *Percentage responses according to student gender of schools*

	Schools contacted	Responses	Rate
Boys	64	30	46.8%
Girls	96	57	59.4%
Mixed	840	217	25.8%

Most questionnaires were completed and were rich in detail; however a smaller proportion of the

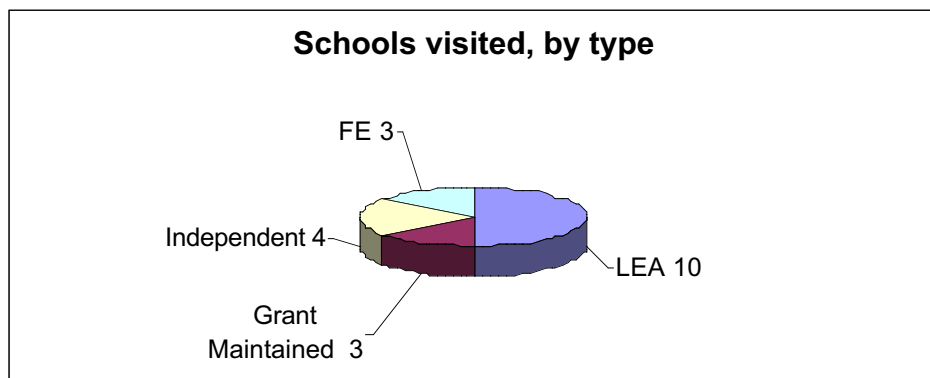
¹⁰ 80% of PSHE co-ordinators were non-scientists; 20% were scientists.

humanities teachers had completed the questionnaires fully compared with heads of science and PSHE co-ordinators. (In interviews humanities teachers occasionally expressed surprise that we wanted to interview them about 'biomedical research' although the purpose of talking about social and ethical issues clarified the position once it had been explained to them. The headings of the questionnaires may have appeared irrelevant to humanities teachers on first sight.)

5.3.2. *The interviews*

Twenty institutions were selected for the second part of the survey based on a balanced representation of those institutions who had responded to the questionnaire, and who had indicated agreement to be approached for further interviews (Figure 1).

Figure 1



The purposes of the interviews were to clarify individual responses from the questionnaires, to probe thinking on conclusions drawn from the questionnaires and to gain detailed insights into the teaching through the objectives of the study. An interview format was devised to address the objectives, consisting of a sequence of agreed questions with scope for prompting. There were four sets of questions for:

- individual subject teachers;
- PSHE co-ordinators;
- headteachers, deputy headteachers and other senior curriculum managers; and
- groups of teachers.

Groups of teachers came either from different subject areas or from the same subject area and were usually selected by the headteacher or deputy headteacher according to teacher availability and willingness to be interviewed. The smallest groups consisted of two teachers, the largest six.

The questions were first trialed on a small group of science teachers who volunteered to attend a recorded session at the Institute of Education. These interviews were transcribed and modifications were made to the questions. The revised sequence of questions was then trialed with teachers at a large

comprehensive school, including the head teacher, heads of subject areas, the PSHE co-ordinator and a group of teachers. As a result of this trial, minor changes were made to the questions. At the start of each interview, teachers were always told of the purpose of the interview, informed by the interviewer that they could withdraw at any time and asked if they were prepared to have the interview recorded on tape. Of 111 teachers interviewed overall, a small minority preferred not to be taped, in which case extensive written notes were taken of the interview. No teacher withdrew from an interview, although on a small number of occasions teachers requested the tape to be turned off when answering a particular question or responding to a prompt.

These semi-structured interviews were used for the first eight schools, A-H. At the time of the writing of the interim report the project team decided that some questions needed re-wording. Minor adjustments were agreed amongst the team and passed on to the project manager at The Wellcome Trust who responded to the changes. The revised interview formats are in Appendix C.

A brief description of the twenty schools at which interviews were carried out is in Appendix D. A breakdown by subject specialism of teachers interviewed is given in Appendix E.

5.3.3. Data Analysis

Open responses from the questionnaires were categorised independently by members of the team and verified by the research officer. Categories that emerged from the open responses were used to inform questions and prompts in the interviews. Other data has been incorporated into the relevant sections of this report.

Interview data was analysed in detail once the twenty schools had been visited, although some of the revised questions were designed to build on data from the questionnaires that formed part of the interim report. The interview transcripts were analysed and coded by four members of the team. Sample transcripts from four schools were distributed randomly such that each team member received transcripts from two schools. The transcripts were analysed, and sectioned into themes or headers according to a list agreed by the team after extensive reading of other transcripts. Team members knew only which schools they had coded and were unaware what transcripts other team members had analysed. The research officer then compared the codings and there were no significant discrepancies. Another two transcripts were analysed by a member outside the team and there was again significant agreement. The headers were then entered into a database and assimilated into the report. The qualitative data thus described was compared with the quantitative data from the questionnaires. The report indicates data interpreted from the questionnaires and data taken from interviews. Some aspects discussed in the report were only conveyed by interviews whereas others come entirely from questionnaires.

5.3.4 Other methods

In addition to the questionnaires and the in-depth interviews, two further methods were used to obtain extra data. These were:

- a seminar for teachers held on 2nd December 1999 at The Wellcome Trust designed in part to generate feedback to the interim report. Fifty teachers from across England and Wales attended the seminar. Appendix G contains the programme for the seminar.

There were eighteen respondents to the advertisement.

Discussion in the morning session of the seminar, when teachers were invited to respond to the findings of the interim report, helped to clarify initial conclusions or to raise alternative explanations for the data. These have been integrated into the final report. Evaluation of the seminar by the participants suggested it had been a very enjoyable and stimulating day but more information could have emerged with a sharper focus on the research findings.

6. To identify the perceived importance amongst teachers (especially science teachers) of social and ethical issues in the curriculum arising from developments in biomedical research

6.1. Overview

Nearly all teachers interviewed, including all subject teachers and PSHE co-ordinators, agreed that it was important to teach the topics underpinning the social and ethical aspects arising from biomedical research. There were different emphases in subject areas: broadly science teachers dealt with the conceptual technical content whereas humanities teachers concentrated on the moral and ethical aspects. The way in which learning objectives were perceived was largely dependent on the syllabus requirements and, where there was no statement in the syllabus about teaching social, moral, ethical and legal issues, these tended to be omitted.

6.2. Questionnaires

Table 3 refers to the numbers and percentage of respondents who felt there was sufficient or too little coverage in their school/college of social and ethical issues linked to biomedical research. No one felt there was too much coverage while two thirds of the respondents felt there was insufficient coverage. A higher proportion of science specialists than those from humanities and PSHE - just under half the number of science specialist respondents – thought there was sufficient coverage of these issues. Just over a third of humanities specialists thought coverage of these issues was sufficient and just under a third of PSHE co-ordinators thought there was sufficient coverage.

Table 3: *Teachers' questionnaire: Question F1*

'How well do you feel that the coverage of social and ethical issues linked to biomedical research is catered for in your school/college?'

	Frequency	Percent
Too little	189	59.6
Sufficiently	128	40.4

N=317

Eleven teachers directly alluded to the importance of teaching these issues. Of these, four respondents did not see these issues as being important for all students – 'not of vital importance for everyone to know about and understand.' Six of these respondents highlighted the importance of teaching these issues, including the need to discuss them with 'informed adults', the importance of keeping in touch with 'rapid developments', the value of these issues as subjects for debates and their central importance as 'the moral dilemmas of our age'. Two responses referred to the need to counteract media attention to these issues. One further respondent was equivocal about the importance of social and ethical issues, saying these issues 'probably' needed more attention. Other teachers referred to the impediments. Approximately 12% commented on the syllabus, 12% on opportunities or constraints of cross-

curricular co-ordination, approximately 10% on time restrictions, 10% related to subject opportunities, 6% to resources and the rest were linked to comments about PSHE, student interest and information. These aspects are discussed more fully in section 6.

Table 4 indicates the percentage of teachers covering each of the topics listed in question B.1.

Table 4: *Teachers' questionnaire: Question B1*

'Please indicate which of the following topics you usually cover in your subject teaching / tutoring / PSHE, or elsewhere.' (This covers those topics mentioned in passing.)

	Count	%
AIDS/HIV	286	73.3%
Genetic engineering	214	54.9%
Eating disorders	212	54.4%
In vitro fertilization	189	48.5%
Reproductive technologies	183	46.9%
Animal experiments	175	44.9%
Nature/nurture	169	43.3%
Dolly the sheep	162	41.5%
Genetic testing, e.g. for sickle cell	148	37.9%
Consumption of GM foods	141	36.2%
Prenatal screening	131	33.6%
Overprescription of antibiotics	129	33.1%
Genetic fingerprinting	125	32.1%
Animal to human transplantation	113	29.0%
Human genome project	99	25.4%
Depression	96	24.6%
Behavioural genetics	58	14.9%
Other topics dealing with soc. and eth. issues in science	47	12.1%
Dementia	44	11.3%
Brain tissue transplants	19	4.9%

N=390

Other than eating disorders topics related to mental health are covered less frequently than the rest of the topics. This particular distribution may be reflected in the higher proportion of science specialists responding to the survey. Only three of the topics are covered by over fifty percent of the teachers, AIDS/HIV being covered far more than the other topics. Given the topicality of the Human Genome Project it is rather surprising that only 25% of teachers had covered this topic in their teaching and the vast majority of these were science specialists. Only four humanities teachers had covered the Human Genome Project and a high proportion of humanities teachers interviewed had not heard of it. Teachers frequently mentioned abortion and euthanasia as issues that arose in class discussion.

Many headteachers gave reasons for the importance of teaching these topics. Where justifications were given the most common was making sure students have an informed opinion (thirty two comments) followed by developing critical thinking in students (thirteen comments).

6.3. Interviews

Humanities teachers covered those aspects that related to their own syllabus requirements, e.g. geography teachers discuss GM technology in terms of changes in farming methods, historians might look at genetic fingerprinting in the context of law and order, gene patents might be examined in a business studies course and religious education teachers would bring out the moral aspects of reproductive technologies in terms of the sanctity of life. Interestingly, English teachers covered these issues very broadly.

Social and ethical issues arising from genetic and reproductive technologies were barely touched upon in PSHE courses although a greater depth of treatment tended to be given to mental health issues. However, this coverage of mental health depended on the proclivities of the teachers and occupied a small part of the PSHE course, at the most two taught sessions, and frequently only one session.

No interviewee dismissed the teaching of these topics as unimportant but two head teachers and one deputy headteacher (from schools A, O and J) preferred to stress the priority of building up students' self-esteem and an 'achievement culture' in the school so that students feel empowered to give an opinion. Hence: 'A lot of our kids don't give an opinion because they don't value their own opinion.' (Headteacher, School O).

One deputy headteacher underplayed the importance of teaching about socio-scientific issues – students who were achieving would feel empowered to engage with any topic. Self-esteem was perceived as a crucial pre-requisite to addressing these issues.

'Our priority has got to be to ensure the students are wanting to achieve academically, socially ... if we get the achievement culture right and support that, it will provide them with many of the qualities that'll enable them to encounter these issues and deal with them in a mature way... to be able to make responsible decisions.' (Deputy Headteacher, School J)

These qualities were amplified, for students.

'...to be able to research issues and be able to find out information for themselves and make judgements on whatever the issue is they're discussing. It's these personal as well as academic skills that you want to engender within them. You can't prepare them for every situation.' (Deputy Headteacher, School J)

Teachers in schools located in socially deprived areas are clear that teaching issues-based material presupposes an achievement culture, although one headteacher preferred to stress students valuing their own opinion, and did not explicitly talk about achievement.

Alternatively, in one school, (School I), a girls grammar school, teachers interviewed, separately, all mentioned at some point that the students in their school were likely to attain positions of power and influence. It was therefore important to begin to reflect about these specific issues while they were still at school. Teachers in selective schools tended to refer to students' future careers as influential decision-makers though less emphatically so than in School I. The way in which these issues are treated may depend on the 'achievement culture', the school ethos and the socio-economic circumstances of the students in a particular school.

6.3.1. Justifications

Different justifications were given for teaching the social and ethical aspects of biomedical issues.

Although a number of teachers gave more than one justification and there are overlaps in meaning, the justifications are discussed separately because we feel there is a consistency of meaning within each category. Figures in brackets indicate numbers of teachers interviewed who mentioned each aspect. There was no significant difference in numbers between science teachers and non-science teachers. The justifications are

- Building confidence (11);
- Critical thinking (15);
- Decision-making (21);
- Detecting bias (13);
- Impact on lives (4);
- Need to be informed (8);
- Relevance (7);
- Risk assessment skills (5);
- Rounded humans (7);
- Sensitivity (36) and
- Topicality (12).

6.3.1.1. Building confidence

This is the justification closest to the importance of raising self-esteem where discussion of these issues further builds confidence in students. This was seen very much in the context of giving students enough information so they have the confidence to express their own opinions. Some teachers elaborated on the importance of being able to 'talk openly' (Head of PSHE, School C) or having a 'safe environment' in which to talk. (Head of English, School N; Head of 6th form PSHE, School H).

6.3.1.2. *Critical thinking*

Critical thinking focuses on teachers encouraging students to develop their own personal viewpoint so ‘they’re not tempted to follow the main line on it just because everyone else is doing it’ (RE Teacher, School D). This entails students coming to grips with the complexity of an issue and not reacting to surface events.

Another aspect of ‘critical thinking is that students might be able to transfer those skills of argumentation to other subject areas’. (Head of Politics and General Studies, School B). This is an interesting but speculative statement. Transfer is certainly a consideration in teaching Key Skills and in the Cognitive Acceleration in Science Education project but we are not clear what aspects of argumentation or thinking skills can be transferred or re-situated.

Frequently, the media, and more particularly the press, are used as a source for critical analysis: this occurs predominantly with humanities – mainly English – teachers. In these cases the emphasis is on discovering the ‘interest’ or ideological position behind an article or media report. Few science teachers use this approach although an exception is a science teacher who encourages students

‘to say why they thought it was interesting and getting them to discuss it and by teaching them to put over the factual side, they can begin to develop some sort of critical appraisal.’ (Science Teacher, School I).

This science teacher was very involved in issues arising from genetic research having helped to write materials for *Jeans for Genes*, been invited to the *Human Genetics Advisory Commission* and was very well informed about the various scientific bodies who could contribute resources.

6.3.1.3. *Decision-making*

There were different aspects to decision-making. Some teachers wanted to emphasise that decision-making was often not clear-cut. When dealing with dilemmas there is often ‘no straightforward answer’ (Head of English, School E) or that when making a decision students have to recognise that the science underpinning the new genetic and reproductive technologies is still developing and ‘not all answers are in place.’ (Head of Science, School E).

Other teachers referred to those students who were likely to grow up to become influential decision-makers. Grammar school students or other high attaining students were the focus of these kinds of comments.

‘They’re going to be making the decisions... you can actually have quite an input, if you’re powerful enough and you all get together and talk. And some of these girls are very vocal and very talented and are probably going to end up as MPs.’ (Science Teacher, School I).

While all students should be enabled to make decisions about these issues the ‘brighter ones ... realise there will always be more to look at, and the boundaries will always be pushed back’ (Head of Humanities, School J).

Decision-making, according to a Senior Teacher, was a central strand in the school’s perception of what constituted a well-educated student. Students needed to understand the various factors that go into making a decision and the consequences.

‘...we like them (the students) to make one form of decision as opposed to not really being bothered or not knowing at all ...I feel like it’s a golden thread going through the school as a whole ...a lot of areas that we’ve got here (from the questionnaires) are ones that they ought to be making some sort of decision about.’ (Senior Teacher, School T).

The ethos is a combination of building confidence so students have a sense of purpose, and relevance to the issues they will have to engage with as citizens.

Other teachers stressed the importance of individuals feeling they could make an impact by working with others. One teacher exemplified how a public-led revolt forced CFC products off the shelves, and ‘showed that it was individuals who were acting and making a moral decision and they changed the world they lived in.’ (Psychology teacher, School J). The emphasis is on decision-making for lobbying and communal action.

6.3.1.4. Detecting bias

Science teachers perceived the media as a source of bias leading to student misconceptions, genetically modified foods being quoted most often. English teachers in particular, and humanities teachers in general, were less sanguine and tended to use the media as a resource to identify the underlying messages. Topics in the media about the new technologies could be used to help students develop skills interpreting media information, although this was developed predominantly by humanities teachers.

6.3.1.5. Impact on lives

Some of the issues discussed by teachers will have a direct impact on young people’s personal lives, now and in the future. One teacher identified HIV/AIDS, over-prescription of antibiotics and eating disorders as likely to have the greatest impact on the lives of young people (Group of teachers, School C). Other teachers thought it was likely that these issues would have an increasing influence on contemporary students, as they grow older. Outcomes of biomedical research would also affect students’ professional lives (Physics teacher, School I) where they may hold positions of influence in the future. Students are likely to be increasingly affected by issues arising from biomedical research but it is important to maintain a balance between ‘making them (the students) aware and just trying to

protect them a little bit and let them have some childhood' (Assistant Head in charge of PSHE, School F).

6.3.1.6. Need to be informed

Being informed on these issues as part of an overall general knowledge about the world was mentioned. Teachers thought that a sound knowledge of the facts would also help to counterbalance media hysteria. (E.g. Head of Science, School L).

6.3.1.7. Risk Assessment Skills

Five of the interviewees referred to risk assessment as an important skill that students will need to acquire. Three of these mentioned risk assessment in the context of drugs education and sex education (Deputy Head, School E; Headteacher, School F; Biology teacher, School Q). Only one teacher expanded on the importance of improving skills at estimating risk.

'Even with genetic screening it doesn't give them a definite answer, but could give them an element of risk that they may develop a condition later on... Nowhere in teaching do we help them assess risk and what it means to them.' (Science Teacher, School I).

6.3.1.8. Rounded humans

Many teachers expressed the hope that through their education students would turn out to have a more expansive view of the world. Often discussion about these issues was used to help students realise that there was more to life than passing exams. They would be encouraged to respect themselves, respect others and the environment and to have a 'world-view'. (Head of English, School E)

6.3.1.9. Sensitivity

This brought out both the affective domain in learning about these issues and a moral responsibility towards others. Teaching citizenship through debates about the new genetic and reproductive technologies will make people realise that their actions affect others and that they have a moral responsibility toward each other. HIV/AIDS and IVF should not be treated in a clinical manner, they are issues that involve people's feelings and its 'important to put that across to young people.' (Group of Teachers, School C). Literature was seen as a way of bringing young people to experience vicariously 'depression or dementia'. (Head of English, School I).

6.3.1.10. Topicality

Teaching the social and ethical aspects of issues is perceived as a way of encouraging students to debate contemporary events and help students

‘deal with developments such as newspaper screaming headlines so that we can respond ... with a balanced approach rather than just leave them at the mercy of the mass media’.
(Headteacher, School C).

Some head teachers and teachers, however, expressed scepticism about ‘flavour of the month’ headlines almost unanimously identifying the debate about genetically modified foods. Teachers also saw topical events as ways of contextualising syllabus content and drawing on students’ interests. Two examples are consumption of genetically modified foods from work done on nutrients and healthy eating, and animal to human transplantation ‘kids always ask about because you’re teaching humans are mammals and these organs are in common.’ (Physics teacher, School D)

6.3.1.11. Other justifications

These included connections to the outside world so students can see the relevance of the curriculum, and empowering students to deal with issues, perhaps thinking about them in a different way.

The ethical dimension was highlighted in some cases when encouraging students to face the unknown: ‘equipping them with the tools to engage in the world that is not even yet ... the principles of the values of life’ (RE teachers, School I). Teaching students about the sanctity of life must include consideration of such issues of cloning, animal to human transplantation and animal experiments. The value of discussing these issues in class ‘makes the girls think, it develops their sense of values and their sense of what’s right and wrong or what they believe is right and wrong ... it helps build up a framework for them to rely on later on in life ... then they can rely on that sort of base later on when they have to make decisions about other things.’ (Head of English, School K).

Developing a balanced and informed opinion is another objective that can be achieved through discussion of issues like these. Having a balanced view was seen as a desirable means of considering these issues though relatively few teachers perceived it as an outcome. These issues were seen as a good way to generate tolerance and respect for others’ viewpoints ‘by looking at the issues and looking at the arguments... they can start to see why people hold views which are directly opposite to theirs.’ (Head of Philosophy and Critical Thinking, School B). Some teachers thought these issues were fascinating in themselves, that students were ‘really hot on socially sensitive issues... fascinated by them’. (Head of Psychology, School K).

Finally, answering questions on ethical issues in examinations was a reason for covering social and ethical issues (Principal, School B), and for discussing these issues with confidence when the students go for interviews at university.

7. To identify strategies currently employed in teaching issues with a social, moral or ethical dimension across the curriculum

7.1. Questionnaire

Teachers were asked to list the three most successful approaches/individual lessons they had used/taught when teaching social and ethical issues. Table 7 summarises the responses.

Table 7: *Teaching approaches from questionnaire responses*

Teaching approaches	times mentioned	more specific examples
Discussion	147	<ul style="list-style-type: none"> • after AV input; • arising from recent TV/press articles; • whole class discussion; • group discussion
Video	46	<ul style="list-style-type: none"> • stimulate discussion; • lead into class debate; • short clips broken up by discussion; • showing specific images, e.g. foetal scans to show development of foetus
Debate	22	<ul style="list-style-type: none"> • prepared speeches, formal, ample preparation; • stimulated by newspaper article; • debate videotaped; • neutral stance as chairperson
Group work	17	<ul style="list-style-type: none"> • groups given specific tasks, dilemmas; • informal grouping; • feedback of information to class
Role play	17	<ul style="list-style-type: none"> • e.g. HIV, immunisation, situations for first aid; • case studies
Factual information	9	<ul style="list-style-type: none"> • presenting statistics and asking for comment; • teaching science from a scientific viewpoint
Student research	8	<ul style="list-style-type: none"> • introductory work done, students given instructions regarding time and resources; • group presentations/report backs; • individual project work; • independent research to support a debating viewpoint
Case studies	7	<ul style="list-style-type: none"> • looking and discussing through a case study; • used to complete assignment
Newspapers/articles	6	<ul style="list-style-type: none"> • controversy used to stimulate debate; • cuttings to provoke discussion
Brainstorming	5	<ul style="list-style-type: none"> • whole class; • group
Drama	5	<ul style="list-style-type: none"> • as stimulus; • drama group workshop
Speakers	5	<ul style="list-style-type: none"> • use expertise; • e.g. eating disorders, IVF, AIDS • visiting hospital doctor, inviting discussion about making hard decisions
Didactic teaching	3	<ul style="list-style-type: none"> • whole class teaching
Peer work	3	<ul style="list-style-type: none"> • peer group teaching; • peer led discussion followed by presentation
Problem solving	3	<ul style="list-style-type: none"> • asking students how they would resolve a given dilemma
Chalk and talk	2	
Incorporating issues into normal lessons	2	<ul style="list-style-type: none"> • as part of a normal Geography lesson
Question + answer	2	
Seminar	2	<ul style="list-style-type: none"> • followed by discussion groups on GM foods
True/false agreement statements	2	<ul style="list-style-type: none"> • to get facts straight

Other approaches mentioned only once included visits (to London Lighthouse), card sorts, collaborative investigations, decision-making exercises; writing an essay; game (e.g. depicting spread of AIDS), handouts, literature, simulations, visual displays.

What emerges from the questionnaire data are the wide variety of strategies used and the interconnections between different approaches, thus reading a newspaper article is used to stimulate debate. With very few exceptions – chalk and talk, giving factual information – these approaches involve the students as active participants.

Ten per cent of Headteachers referred to teacher sensitivity to religion and culture. Teachers in interviews picked this up. Headteachers who mentioned teaching approaches advocated a dispassionate and unemotional positioning, although teachers discussing the sensitive context of the topics, pointed out emotions play an important role in classroom and group discussions.

7.2. Interviews

Those teachers interviewed used a similar range of approaches although the interview situation allowed teachers to reflect discursively on particular approaches not specifically mentioned by questionnaire respondents: using personal experience and teacher positioning.

7.2.1. Debate

Controversial issues lend themselves to classroom debate. Topics such as genetic engineering and genetic testing are formally debated within and between schools, although, in our interviews, inter-school debates were reported exclusively by teachers from girls' grammar schools. 'Our last debate was whether the DNA records of all citizens should be held on file.' (Head of English, School I). English teachers were particularly enthusiastic about debating as a method of addressing controversy and developing other skills.

'A lot of these issues have come up in ... formal debates where they have to take on a point of view that's different to their own. So they then have to look up information, find information, ... in order to persuade their audience ...and they find that quite enlightening, and they also find information that they dismissed before, ...and find that they perhaps haven't taken in all the information that they should have done before, and I often point out to them, sometimes it's easier to take on a point of view that you don't particularly believe in because ... the information is new to you, you can actually go and get fresh research to help your argument.' (Head of English, School K)

It appears to be a very useful strategy that enables students to research the salient points of different arguments and express their opinions. Teachers report students find debating particularly stimulating in presenting arguments with which they personally disagree.

Enthusiasm in debate brings its own problems of class management, although English teachers relish the challenge in managing these debates:

‘...those lessons are often the best lessons you have. Because the kids are absolutely electric, they’re alive, and this really gets them going. And you have to manage the debate, which in a class of 20-30 takes some doing, but that’s what the job is. You then need to steer it because you get the breadth of understanding of the whole issue.’ (Head of 6th form/English specialist, School J).

There are problems in making sure that the debate is not monopolised by a few vocal students and ensuring that everyone has the opportunity to air their views. Some teachers thought small group situations might be better and more secure for quieter students.

Humanities teachers used formal and spontaneous debates far more than science teachers. Indeed, the science teachers we interviewed do not frequently employ debates in terms of the presentation of opposing views in their teaching. When debates do arise in science lessons, the students often generate them. Several science teachers reported their concern about debates getting out of control.

‘I remember that there was something about genetics that came up, looking at animal testing. At the end of the video a couple of kids picked up on it and there was a debate and I wasn’t really involved. One child spoke vehemently against testing for cosmetics. And these sorts of issues are raised in an uncontrolled way and that’s part of the problem and can catch people unawares’. (Science teacher, School A)

7.2.2. Discussion

Teachers talked about different ways of holding discussions in the classroom. In English, short stories can be used to promote discussions. A short story called *Thunderbolt* implicitly deals with ideas of genetic engineering and cloning, and raises questions such as whether we should clone humans, looking at the benefits and drawbacks. Three different types of discussion have been mentioned: planned where a topic is given to a student to prepare, ‘hot-seating’ where they are given a topic to talk about off the top of their head, and deliberately chosen set books such as *Brave New World*.

Teachers in a school with a 40% Muslim population talked about the confidence children have in discussion underpinned by a strong religious belief.

‘Their beliefs are very strong in many cases which gives them the ability to talk knowledgeably about things...Because they’re confident in their beliefs they can defend their position. Year 11, when we’ve got contrasting beliefs, produces some really interesting discussions.... we’ll discuss it in a remarkably mature way.’ (Head of Science, School J).

7.2.3. Role-play

Teachers use role-play for generating empathy and to explore balanced arguments. *Salter's Science* was mentioned as offering good opportunities for role-play. It was used in the sixth form to explore genetic screening issues but science teachers remarked on lack of time to use role-play methods more fully.

7.2.4. Student research

The topicality of biomedical issues, the need to find out accurate and correct information, and personal interest were used to encourage students to do their own research. An examination course was quoted as promoting research skills:

‘...we do a health and welfare course in the 6th Form, which would cover AIDS and HIV, about disease basically ...Called Global Futures, and is part of the A level, ...it's got to be topical.’ (Head of Geography, School P).

Students' interests, the scope of an examination and links with institutions outside the school can provide exciting research opportunities for students, for instance in a study of dementia:

‘we have a programme of industrial placements in the ‘A’ Level Biology course (OCR Cambridge Board) and three students have just completed fairly detailed, in-depth studies with placements at the Medical Research Council ...dealing with dementia and serotonin defects in the brain etc. so they probably have hit that particular target in a degree of detail that perhaps is way, way in excess of my own knowledge.’

Teachers organising a research project may benefit from a lot of dedicated web-sites and appropriate articles in journals that can initiate an extended project.

7.2.5. Critical use of media

Because of the prevalence of biomedical and mental health topics in the media students can engage critically with the ways they are covered. The media is regarded by humanities teachers and some science teachers as a useful resource for critical appraisal and for generating debate:

‘...in the Lower 6th they're all collecting news items and they present them to the rest of the group. HIV, GMOs, screenings. By doing that and getting them to say why they thought it was interesting and getting them to discuss it and teaching them to put over the factual side to it’ (Science teacher, School I)

7.2.6. Use of controversy

A controversial issue can be raised in the context of a lesson to spark off debate, for example, whether mice should be used for dissection. Teachers encourage students to defend controversial points of view and stress the importance of humanising the teaching of controversial issues so not making it appear

remote as if taken from a text-book.

7.2.7. Drama

Using drama in class has been advocated to address issues through themes such as ‘discovery’ and ‘loyalty’ and larger issues, for example, depression. Y-Touring Theatre Company has been used by some respondents. A head of English, concerned about the high incidence of anorexia in the school, wondered if there was drama group that dealt with these issues. (Head of English, School N).

7.2.8. Teacher positioning

Teachers often find themselves in a difficult position when teaching controversial issues because students probe them for their own viewpoint. In some circumstances, teachers may play devil’s advocate to stimulate debate, in others they may take a neutral stance or attempt to balance arguments. Views on the positions teachers should adopt on controversial issues varied according to the context and the issue, some teachers saying they would take a particular position in one context, say devil’s advocate, and remain neutral in another context.

Some teachers felt that it was important they put across their points of view so that ‘students know you have opinions’ (Geography teacher, School D), a point on which most teachers were equivocal, qualifying that ‘you give your opinion but make clear its yours’, i.e. one possible opinion amongst many. (Group of teachers, School C). Other teachers said that on some issues you have to say what you feel, an example being HIV/AIDS where

‘you’re not particularly worried if you’re bigoted, so there are times in science when I say it like this, and I have no problem in doing that.’ (Science teacher, School C).

There were warnings against the dangers of brainwashing, some were adamant that teachers should not tell students what they think. Detaching oneself, in controversial topics, from one’s own viewpoint was a point made by a number of teachers. Only science teachers said that they gave the students facts and left them to make their own decisions.

Devil’s advocacy was explicitly mentioned by seven teachers, and implicitly by twice that number, as a means of promoting discussion.

‘I often play the devil’s advocate ... quite often I’ll throw something in that’s totally against my own personal view ... and that ...gets them rethinking. There’s the classic one about abortion. Syphilitic father, depressed mother, alcoholic etc, congratulations you’ve just aborted Beethoven. And it makes them stop and think that it isn’t black and white.’ (Head of Biology, School E).

While playing devil’s advocate is a common option in teacher positioning, it is vital to make clear to

students the strategy being adopted. As one teacher said, who might take an extreme position, or ‘shock tactics’ to stir up students on the cloning issue ‘you must close it down and make kids aware you’re not some rabid Nazi.’ (Head of Science, School E). The devil’s advocate position is used to ensure a range of viewpoints are heard. Teachers mentioned that students had very forthright positions on animals’ rights but there was a duty to take an opposing view to examine different positions, even though the view proposed was not one held by the teacher.

Students may resist challenging teachers, and use of devil’s advocacy is a way of breaking down barriers to encourage discussion:

‘...occasionally to stimulate an argument I’ll go in and take an extreme point of view. And I’ll make it as soundly and logically as I can and I hope they’ll tear me to pieces.’
(Head of 6th form; School P)

The devil’s advocate approach does rely on an appropriate response from the student and the danger is that a provocative remark may be left hanging if the class is unresponsive.

Presenting balanced views was seen by many teachers as desirable in itself, but its importance was emphasized particularly in the case of animal rights. In contrast, there was a suggestion of the role of teacher as ‘passionate advocate’ to encourage students to feel what an argument is like.

‘If they see you being passionate about (an issue)... I sometimes think that encourages them “look how wound up she gets about it” – they want to be like that as well maybe.’
(Head of English, School J).

7.2.9. *Personal experience*

Drawing upon personal experience to humanise teaching about controversial issues is a popular teaching approach. Different perspectives are used:

- directly related accounts from teachers’ personal lives;
- drawing upon student experiences; and
- teachers using other teachers to amplify an account from their own experiences.

Teachers justified giving personal accounts of their experiences to let students understand that these issues touched upon people’s feelings. Students responded well to the teacher’s honesty.

‘I had an amniocentesis, why, well if it was disabled I would terminate and I’m very, I’ve been in tears talking to the kids in the past, but I’ve been up front with them because from my point of view, there’s no point for me giving them a verbal description of things without them realising that these are factors that directly affect how you feel...’
(Head of Biology, School E).

Science teachers were prominent in discussing their use of personal experience which may reflect a greater confidence with the background subject knowledge. Sharing a difficult personal situation with students was endorsed by a number of teachers. Heads of PSHE reported that PSHE teachers were encouraged to express their own opinions and discuss relevant aspects from their personal lives but this depends on the level of confidence of the teacher. If teachers expect students to express their own feelings then they must be prepared, in a responsible way, to talk about theirs too. (Religion/Ethics teacher, School K).

Depression touches students' lives, English teachers reporting that conditions of depression occurred in literary texts and stimulated students to talk about family and relatives who suffered from the condition. Teachers, however, were wary of tackling issues of mental health and of discussing them openly in the classroom. (Section 6.4) Some teachers did broach mental health from a personal perspective, hoping this would help students to think about their own problems:

‘my mother suffers with depression and it’s very clear that there’s a genetic basis to that, ...and kids are always quite startled when we talk about that kind of thing in class...that’s a very personal bend from my teaching,...I would like to see that explored more because it is something which I think more kids have, if they don’t have a handle on it they would have experienced it ...at some point.’ (Head of Science, School E)

Some teachers cautioned on the fine balance to be struck between personal experience as an effective teaching approach against the possibility of self-indulgence. Students find the issue more stimulating when they can relate it to their own experiences. ‘After a video on sickle cell anaemia during a topic on blood one student said “I got that, does it mean my children are going to have it?” and we got into a discussion about what it means to have it and the chances of children having it.’ (Science teacher, School A).

Teachers reported that members of staff they knew had experiences that could amplify discussion of biomedical and mental health issues and could use the opportunity to contextualise them. A member of staff who had twins through IVF was willing to discuss her experiences with sixth form groups.

The way teachers approach the teaching of biomedical issues may be understood not only through their professional and scientific training but also through their personal experiences and this should be taken into account in understanding the challenges facing teachers. For the teacher from School E who had experienced an amniocentesis there were clear emotional difficulties in teaching the topic and she was willing to make her feelings clear. However, teachers have been less willing to touch upon these topics and a clear understanding of the emotional hurdles teachers may face has to be taken into account in materials produced and training given.

7.2.10. Sensitivity to context

An approach to an issue was often influenced by the teacher's sensitivity to the context of a class such as age, religion, gender, culture or knowledge about a particular condition.

7.2.10.1. Age

Addressing a topic often depends on the students' maturity or need. On the animal rights issue, for example,

'... children of eleven, twelve, thirteen are very, very opinionated about (animal experiments), usually anti, whereas in years 10 and 11 they've got a more distanced view of it and they understand the difference between animal experiments for medical use and for cosmetic use.' (Head of English, School E).

Given the interest in animal rights amongst students even before secondary education, teachers have suggested that focused discussion about this issue could start at primary school. One approach is

'Philosophy for children, it's P4C in short, it's an American program ... designed to start at the age of 7, ...it's actually very good for animal experiments.' (Headteacher, School P)

Students would be better protected and prepared for problems arising if these issues were addressed earlier in a sensitive manner: eating disorders, nature/nurture and depression were quoted. It was felt that schools had a responsibility to help students understand conditions such as depression so they might, for example, recognise symptoms in a parent or other family member. Teachers felt that eating disorders needed to be addressed early on in the curriculum.

7.2.10.2. Religion

Some biomedical issues, such as xeno-transplantation, raise religious dilemmas among Muslims because an organ may originate from a pig or another forbidden animal. Teachers in school J with a 40% Muslim intake reported on the tension between the religion telling students one thing and the wider culture another, and the role of the teacher in helping students to come to terms with this dilemma. Students and teachers had enthusiastic discussions and respected each others' points of view.

'Most Muslims would only consider transplantation from another Muslim. They're taught it's wrong to consider anything else. When I challenge that, in as gentle a way as possible, they say from the science point of view they can see it makes sense. But they don't feel – even if it was a life-threatening situation – that they could reconcile their beliefs with such a transplantation (from non-Muslim to Muslim) taking place.' (Head of Science, School J)

Discussing controversial issues in a multicultural context tended to enhance debate and understanding of different cultural perspectives.

Christian groups, namely pro-life and the Plymouth Brethren, are reported to be most averse to the discussion of issues, such as abortion. Some teachers felt nervous about a backlash from certain groups in the local community, others reported on letters of complaint from parents. While religious education teachers thought there was a reasonable amount of information from Christian, Jewish and Muslim groups on sensitive issues, there is a need for more information on perspectives on biomedical issues such as xeno-transplantation from minority eastern faiths such as Sikhs and Hindus.

7.2.10.3. Gender

There are some issues that girls feel more strongly about than boys: animal rights and cloning are two that have been quoted by teachers. Comfort and confidence in discussing sensitive issues, such as eating disorders and transplantation, are important. Teachers report that girls are more comfortable discussing issues in the absence of boys although a teacher added that she would ‘hate to think there are issues you should only talk about with girls’. (Head of English, School J).

7.2.10.4. Conditions/disorders

‘The beauty of English is that you can discuss something without personalising ... I had a girl in my class who was anorexic, and her friend was very worried about her. She delivered a speech talking about beauty without and beauty within, and people’s perceptions of themselves, and did it matter. It turned out to be a plea from this girl to her friend, but it didn’t come over like that if you didn’t want it to.’ (Head of English, School I)

Teachers reported strategies and sensitivities concerning eating disorders – anorexia and bulimia. Students often approach teachers at the end of a lesson to discuss their concerns in private. Experienced teachers feel confident about discussing eating disorders openly although all teachers said it had to be handled sensitively, off-the-cuff comments causing offence. One teacher talked of despair and ‘feeling of utter helplessness, because they’re committing suicide in front of your eyes.’ (Head of English, School N). There was felt to be a need for school materials addressing eating disorders. Teachers in girls grammar and independent schools often related problems of eating disorders to depression and anxiety in examinations.

Where mental health was discussed teachers stressed the positive side particularly to self-esteem. Students may need support in dealing with depression within the family. When a sensitive issue on the syllabus, or in PSHE, was likely to be discussed some teachers offered students the option of an ‘escape route’ beforehand, e.g. leaving the classroom.

When working in schools with a cross-section of the population well-judged sensitivity is important when talking openly about issues such as the genetic basis for cancer. In some communities, because of increased prevalence, this awareness of a medical condition in a group is heightened but students are often keen to talk about a genetic condition either they or a relative have. For instance,

‘the people who teach the biological areas have worked here long enough to be aware that if you talk about sickle cell, it is not improbable that somebody in the room actually has that. I mean often we would know and they would say, yes, I’ve got that and talk to the class about it... Other times, they prefer not to, or it might be a brother or another relative and so I think the importance is possibly use of language and never to be dogmatic and never to, kind of, make statements which are actually very worrying to those people that aren’t in any way substantiated by fact ...for example, to say, so in a case of extreme sickle cell, this could lead to somebody dying in a low oxygen environment. That would be very worrying and very distressing to people and I think, probably working somewhere like this, staff are more attuned to those sorts of things because it is a real issue for people and it isn’t, within various communities, and it is not something which is just a textbook kind of issue as indeed with things, say, for example, malaria and drugs surrounding that.’ (Head of Science, school L)

7.2.10.5. Nature/nurture

The topic of nature/nurture was mentioned as a way of encouraging students to make the most of their potential and not to feel that they may be trapped in poverty:

7.2.11. Spontaneous discussion

Many issues are raised spontaneously by students and then negotiated between teacher and student either inside or outside the classroom. Dolly the Sheep, GM foods, eating disorders and mental health issues are frequently-mentioned topics.

7.2.12. Other strategies used

These include games where students exchange labels to demonstrate how AIDS is spread, anonymous question and answer sessions where questions can be written on a piece of paper, folded and placed in a box. Students are also encouraged to write speeches. One Biology department (school B) created an exhibition on GM foods in Science Week which stimulated a great deal of debate in the college.

8. To indicate the successes and impediments to success in delivering issues based education

There are many factors that influence the effectiveness of teaching issues-based education. In interviews teachers expanded in some detail on successes and impediments to success they had both experienced and anticipated. Questions D2 and D3 (Appendix B) asked teachers about ways of assessing social and ethical issues. Although approximately half the respondents used informal and formal assessment methods it became clear in interviews that few teachers had experienced effective modes of assessment of social and ethical issues in science. Assessment is therefore discussed across different sub-sections.

There were commonalities of experience between teachers across the curriculum but also important distinctions in different subject areas, these are highlighted where there are significant differences. The main issues to emerge are:

- issues of balance
- citizenship
- teaching general studies
- up to date information
- students' knowledge/opinions
- media influence
- perceptions of subject
- collaboration between subject areas
- fear of controversy
- timing
- teacher confidence and expertise
- the syllabus
- teaching through PSHE
- issues related to school context
- time constraints
- mental health

Due to the size and nature of this section, specific recommendations are made at the end of sub-sections 8.1 to 8.8. Sub-sections 8.9 to 8.16 reflect findings in earlier sections but do not contain recommendations.

8.1. Issues of balance

8.1.1. *Questionnaire*

The importance of having a balanced point of view was a strong feature of comments made by headteachers and senior school managers in response to Section C, 'What do you think are the main

issues about teaching social and ethical topics linked to biomedical research' and any further comments. Sixty headteachers, approximately 30% of headteacher respondents, mentioned 'balance' or connected notions of 'impartiality', 'lack of bias' and 'objectivity'. Few headteachers qualified these terms, although comments about balance could be categorised:

- impartiality/neutrality/non-judgmental often linked to giving the factual or accurate information;
- avoiding personal bias;
- obtaining unbiased resources or access to balanced evidence; e.g. 'happy to teach it as long as every issue has a balanced input.'
- covering a range of viewpoints/looking at both (or all) sides of the argument;
- countering biased views in the media;
- balance related to a values-base or school ethos, e.g. views should be balanced and clear but 'confirm the prevailing values of a broadly Christian nation'; schools 'cannot indoctrinate' and can only give a line 'when it fits in with the laws of the society it operates in.';
- rational weighing of arguments, pupils should be taught to evaluate conflicting evidence.

Very few heads of department commented on the notion of balance, possibly because the question in Section F of the teachers' questionnaire is linked to the teaching of social and ethical issues *in their particular school* rather than asking for broader views. All the themes listed in the categories above are reflected in the interviews with teachers.

8.1.2. Interviews

Some teachers explained why it was important that the teacher is seen to have an unbiased viewpoint in terms of the impact on young people and the authority that teachers hold.

'...children pick up so quickly if you start trying to shove ideas down their throats or biased opinions ... and they get very angry about it if they are confident enough to express their anger' (Head of English, School K)

Although many teachers had anxieties about presenting biased and opinionated viewpoints fears about teachers abusing their position in this way are largely unfounded. Guidance is available about the risk of bias in teaching controversial issues¹¹ although the guidance could be exemplified, particularly in relation to biomedical science. Where there are sensitive concerns in the school, teachers think it is important to be seen to be unbiased. A geography teacher exemplified this point, teaching about modern farming methods in a school community, where a lot of students come from farming families.

Personal and political ideologies sometimes made it very difficult for teachers to present what they thought might be an unbiased viewpoint. Several teachers acknowledged the problems of disentangling

¹¹ DfEE/QCA Education for Citizenship and the teaching of democracy in schools. Qualifications and Curriculum Authority, 1998

an unbiased view from one's own world-view. 'You can't avoid your own personal prejudices and life experience affecting the way that you deliver certain topics.' (Head of Psychology, School H).

Teachers recognised that their religious beliefs were a very powerful component of a worldview. Introspection in identifying one's own ideological viewpoint was seen as an important pre-requisite for maintaining a balanced perspective, articulating a worldview as a means of demonstrating that it is only one among other competing views.

Equivocation about the expression of viewpoints may be reflected in the lack of school policies in dealing with these issues. Although many teachers thought discussions of these issues should be left to their professional judgement, there are clear differences in what teachers feel are appropriate procedures. There is a tension between those teachers who feel it is acceptable to express an opinion in class discussion provided they make it clear it is their *personal* opinion; others feel it better not to enter into debate.

Presenting all sides of the argument was another way balance could be struck. For a minority of teachers, holding a balanced viewpoint was held to be unproblematic; if students were presented with a variety of opinions, balance could be maintained. Teachers thought it was necessary that a variety of viewpoints were expressed in class discussion. Some teachers advocate exposing students to a range of quality newspapers to 'find the balance point on an issue'. (Head of PSHE, School R, noted not recorded). This implies that the quality newspapers represent the full range of political and social views on bioethical issues - a position that could be refuted. Other teachers found the question of an appropriate balanced viewpoint less straightforward. If teachers did not have the relevant information it was difficult to ascertain whether one was being unbiased. An associated problem was the complexity of some issues.:

'...we talk about global warming and you can look at it from a number of different perspectives depending on who you've read ... the impact on the Gulf Stream ... deflecting waters further north and so on. And then you read somebody else's article, so you've got to keep a balanced point of view on it. And that's obviously what we've got to do. Otherwise we'd be soon castigated by governors and parents and inspectors that we were influencing people.' (Deputy Head, School H).

The need to be seen to be balanced appears instrumental in allaying fears of indoctrination - a theme echoed in questionnaire and interview responses. Some of the issues in biomedical sciences are deeply complex, the technologies are rapidly changing as are the legal and ethical perspectives. Even with a substantial amount of information at the disposal of the teacher, viewpoints are multi-faceted and the notion of a balanced point of view is itself problematic.

'... the fact that I am aware that there're various different viewpoints and the fear of giving a very one-sided viewpoint. I mean, because I don't know enough about the

topics, I'm sure that I have got a biased viewpoint.' (Head of Psychology, School H)

To have a balanced picture about different issues, given the huge wealth of information from various sources of influence, poses a real pedagogic problem in terms of informing rather than influencing opinion. A variety of strategies were given for avoiding bias, some teachers preferring to put the onus for debate on outside agencies with the relevant expertise, often 'visitors to the school', or 'video diary-inputs' would avoid teachers' prejudices influencing discussion of the issues.

Those teachers who wanted to reflect a range of viewpoints accepted that avoidance of bias was not possible. Some qualified this approach saying they were happy to use material they understood to be biased but would ensure they also challenged that viewpoint, thereby addressing the problem of finding suitably unbiased materials.

Teaching the factual information, with the appearance of impartiality, predominates among the science teachers interviewed. With two exceptions from the science teachers interviewed (Physics teacher, School D; Science teacher, School I) science teachers did not feel it was their remit to discuss the ethical aspects of an issue; once the science had been taught it was up to the students to make up their own minds.

'in the same way that I don't want people imposing their views on me, I don't want to impose my views on other people, so I try and stick to evidence and what things are in a very factual way ...' (Biology teacher, School Q).

'I'm very much a sort of, "well here's the information, you know, you choose what to do with it" sort of thing.' (Head of Science, School F)

Some teachers felt uncomfortable with this point of view, leaving students to make up their own mind could also have a profound impact.

'we want our girls to be able to debate, argue, but should we also be setting standards as to what is acceptable or not, or do we continually leave this as an open door policy "here's the information – go away and think about it and reach your own conclusions". And a teacher can have a very profound affect on handling this without necessarily intending to put forward their particular view.' (RE teachers, School I)

Respect for differing viewpoints was an important aspect of balancing arguments in class although teachers acknowledged the problems of maintaining a balance between promoting an atmosphere of tolerance and open-mindedness in the classroom and dealing with unacceptable viewpoints. This demands sensitivity where statements of right or wrong had to be seen in the light of an individual's circumstances.

‘I think actually if someone expresses the view that it’s very anti another section of society, then yes ... there’s a difficulty because you’ve got to support them and explain, and get other people to join in so that you’re not hurting the child who’s said perhaps what they’ve heard at home. And you’re valuing what they’re contributing, but at the same time, you’re letting them see that there is an alternative. Actually I find it enriches the discussion.’ (Head of English, School N).

Humanities teachers generally accepted the challenge of dealing with a variety of viewpoints despite the attendant pitfalls. Dealing with students from a plurality of backgrounds could be an opportunity to encourage students to appreciate there are a variety of ways of seeing things.

The school ethos was also felt to be important in underpinning respect for viewpoints extending from relatively trivial matters to the discussion of complex issues. Articulating an ethical position on one matter must be consistent with a position on another. For example, teaching about a controversial area in a way which brooked no discussion would be inconsistent if the teacher chose to point out to pupils the importance of open public debate on, say, DNA tagging.

‘There has to be this underpinning code of values which are broadly accepted which are permeating the school.’ (Headteacher, School F)

While tolerance and respect for all views were accepted by teachers some were troubled by an implied relativism that it was up to the students what they chose to think. Most teachers in all subject areas regaled against any suggestion that they should tell students what to think when asked how they might help students to make a judgement. But not all views do have equal validity:

‘You can have all sorts of views about eugenics but at the end of the day I think most people would agree that breeding – supposedly perfect - human beings is not on.’ (Physics teacher, School D).

Few teachers made ethical concepts explicit in their teaching. Those that did included teachers running the vocational GNVQ Health and Social Care course. Some RE teachers explicated the teaching of ethical viewpoints such as encouraging students to understand the consequences of their actions and to understand the ethical reasoning behind different viewpoints.

Teachers were certainly aware of the problems implicit in tolerance and balance but there was little appreciation of the use of ethics as enquiry to help students make judgements on a rational and reflective basis.

It is clear that few teachers are teaching ethical concepts in a way that allows students to use them to help make judgements. Where ethical concepts are explicitly referred to it is RE and psychology

practitioners that are doing this. The consideration of ethical issues in relation to social issues, such as those that constitute the theme of this report, presupposes the cultivation of attitudes in the classroom such as open-mindedness, willingness to listen and respect for others' points of view. Teaching must also allow a value-base to be articulated from which students can consider the ethical base of different arguments.

Recommendations

Teachers need training and experience to deal with ethical issues. This training should include developing understanding of the nature of ethical enquiry and the classroom teaching strategies that support discussion of moral and ethical issues. Teachers need to be able to rehearse arguments for themselves before they can feel secure about ethical debate in the classroom. It may then be helpful to consider a case by case approach to exploring ethical concepts rather than a generalised approach. A training programme might look at a specific issue such as xeno-transplantation to research:

- the underpinning science that needs to be understood so a reasonable debate can take place;
- the moral and religious values that could be brought to bear on the issue;
- the different ethical positions that could be discussed;
- the complexity of the argument and that there are different ways of responding to and understanding the issue;
- the problems in transferring ethical positions from one case to the next.

A précis of some of the ethical issues underpinning the work of the Nuffield Council on Bioethics could provide a useful resource for examining different case studies .

8.2. Citizenship

The questionnaires and the interviews were completed before the new national curriculum was published. There were few mentions of citizenship in the questionnaire responses and discussions of citizenship in the interviews were speculative even though the consultative document was available and there had been considerable discussion about the new orders. About twenty per cent of interviewees discussed the relationship between teaching the programmes of study on citizenship and contemporary socio-scientific issues.

There is scepticism that the new Citizenship programmes of study will be overlaid on an already crowded curriculum and will not allow the scope to develop these issues. No humanities teacher expressed enthusiasm about Citizenship in the curriculum, some referring to it as an old style civics course. 'Citizenship is about not rocking the boat' (Sociology teacher, School I). Citizenship is perceived as a way of redressing students' lack of interest in contemporary politics both at a national and local level. Debate, argument, putting forward opinions and participation should be the hallmarks of Citizenship according to a range of humanities teachers. Science teachers are more optimistic than humanities practitioners about addressing socio-scientific issues in the context of Citizenship but they also feel that there is not enough scope at Key Stage 4 to include socio-scientific issues in the framework of the Citizenship curriculum.

Recommendations

If Citizenship is going to be participatory and address socio-scientific issues then:

- there needs to be more exemplification of biomedical science in citizenship than there is in the Initial Guidance for Schools at Key Stages 3 and 4¹² and in Curriculum 2000;
- examination boards need to include specific references that focus on the ways a Citizenship course could address these issues;
- assessment should include criteria for knowledge of science concepts and for exposition of a considered point of view.

8.3. Teaching General Studies

General Studies is a popular option at 'A' and 'AS' level and, given its specifications, should be an appropriate site for teaching the social and ethical aspects of biomedical science. In the sixth form, teachers report that General Studies tends to displace PSHE and that the questionnaire topics (Appendix B, question B.1) are more suited to General Studies than PSHE. General Studies is perceived as very broad without covering issues in depth. Teachers who mark General Studies papers report that questions on socio-scientific issues do not produce high quality answers.

'I've just marked 300 scripts with a question on animal experiments and what comes across very strongly, and the board will tell you this, ... it's just an emotional argument on one sort of level and trying to get them beyond that is so difficult ... everybody over the years has known it's quite a complex issue but it doesn't get across to the students.' (Head of Politics and General Studies, School B)

Sixth form students specialising in Humanities find science-based questions in examinations difficult to answer and teachers report that the students either lack the scientific knowledge or are not able to use it. While General Studies aspires to an integrated approach between departments, in effect this does not seem to happen, and sharing of resources and ideas between departments is ad hoc, if it happens at all. The outcomes from a General Studies course suggest that in the scientific domain students find it difficult to develop systematic arguments. This may be due to the superficial overview that a General Studies course can encompass.

Recommendations

Criteria for resources that are needed are that materials should be easily available, such as newspapers and updated websites, and that they stimulate students to think critically about a topic in an examination situation.

¹² Qualifications and Curriculum Authority (2000) *Citizenship at Key stages 3 and 4: Initial Guidance for Schools*, QCA 2000.

General Studies does appear, however, to be a more promising option than PSHE. In science, one way forward may be to make links to topics in more specialised ‘A’ and ‘AS’ levels such as biology, although this would only benefit science students. Resources associated with the course should highlight the ethical and social dilemmas and make explicit the science knowledge needed.

8.4. Up to date information

8.4.1. Questionnaires

With such new technologies advancing at an increasing rate teachers across the curriculum are finding it difficult to keep up to date with details of the associated science, practical applications and issues that are relevant to the lives of the students and the theme of the curriculum. Approximately one quarter of teacher responses to the questionnaire emphasized the importance of knowledge and information for in-service training, and approximately half of these specifically referred to up-to-date information.

8.4.2. Interviews

Science teachers usually mentioned specific information they would like such as updates on issues in animal experimentation from active researchers or updates in legislation on issues such as embryo testing because the

‘law appears to be lagging behind the technology... We’ve the science to be able to do certain things like reverse the menopause, and we haven’t got any legislation for those kinds of things. The girls find it extraordinary and they can’t accept it.’ (Science teacher, School I).

This quote highlights the ways in which the rapid rate of change in biomedical technologies offers useful learning opportunities in response to students’ sense of surprise and the difficulty in finding ethical and legal solutions to the problems posed.

Humanities teachers felt there was a lack of resources dealing with topical biomedical issues and they had to rely on the immediacy of the media. They did not want to feel ‘like someone who had just read the newspaper’ (Head of Humanities, School J). They needed materials that had technical information about contemporary developments in the biomedical sciences but at a level appropriate to non-scientists.

Problems of dealing with rapidly changing issues in the biomedical sciences were noted by all teachers, particularly PSHE co-ordinators, who felt they had a remit to address topical issues. Non-specialists are therefore in need of accessible information with the flexibility to be updated.

Recommendations

We suggest:

- constructing a dedicated and regularly updated website that provides a resume for teachers

highlighting the ethical debate and the social implications of biomedical issues. This could be developed from the Nuffield Council on Bioethics publications;

- publicity about web-sites and other materials is made available through the relevant teachers' organisations such as the National Association for the Teaching of English (NATE).

8.5. Students' knowledge/opinion

8.5.1. Interviews

Teachers felt that students knew very little about the social and ethical aspects of the new biology and, while students had strongly held views these were not supported by evidence or knowledge. Parental influence, newspaper headlines, the sheer complexity of the issues and the predominance of stereotypical views were all listed as factors that contributed to a degree of ignorance.

Teachers mentioned a range of issues about which students had preconceived notions or were misinformed. By far the most prevalent are animal experiments and animal rights. Students are perceived to be very much in sympathy with the animal rights lobby. A resume of student conceptions appears below.

- Antibiotics as a panacea. 'Pupils very often see antibiotics as a cure for almost every disease or at least every infectious disease. ...it comes to many as a surprise that they won't be given antibiotics automatically...' (Head of Biology, School R)
- Cloning. Teachers mentioned that students have an idea that clones emerge as fully formed human beings.
- Test-tube babies are born in a test-tube. 'They don't understand ...in-vitro fertilisation. I never had a child who was able to tell me what that is until we discussed it.' (Head of RE, School C)
- Students are reported to have very polarised views – most against but some for - on genetically modified foods.
- Students find genetic engineering very difficult to understand.

Teachers reported a considered and accepting attitude about some issues.

'(HIV and AIDS) seems to be less of an issue. Students are far more accepting of it now. They've grown up with it... I can remember it being invented!and you'll get a student talking about an example of people being discriminated against because they're HIV ... and that natural justice that so many students have is brought to the surface ...'
(Head 6th form, School J).

Possibly, students' views shift when an issue is not new and not the focus of media debate. Growing up with an issue may explain differences in attitude between school students and older people. Even with genetics and its applications, 'most of the students seem to have realised that they've grown up with it and I don't think they ever sort of question it.' (Head of Science, School F).

Overall comments from teachers suggested that:

- students are influenced by 'screaming headlines' in the press;
- students had very strongly held viewpoints particularly on animal experiments;
- important gender differences (girls are much more passionate than boys about animal experimentation, girls tend to be against cloning whereas more boys think it is acceptable);
- the more emotive the topic the more entrenched are students' points of view; and
- fuller acquaintance with the topic does not necessarily promote change because minds have already been made up and students' views are very difficult to shift.

Research on young people's attitudes towards biotechnology, such as the BIOCULT survey¹³ has been published, and similar attitudes manifest themselves in the rest of Europe.

Recommendations

Science teachers need to use newspapers in their teaching to bring to light the status of knowledge and the interest positions behind media reports. This should be incorporated in pre-service and in-service training, the latter possibly being run by English or sociology specialists. Attitudes towards animal experiments and vivisection begin to form before secondary school. Primary pupils should have a forum in which to discuss issues such as animal rights and have the opportunity to formulate their arguments based on moral and ethical principles.

8.6. Media influence

8.6.1. Interviews

Mention of the role of the media produced different reactions in interviewees broadly along subject and administrative grounds. Science teachers, headteachers and their deputies were derogatory about the role of the media: it militated against balance and any sensible discussion of the issues.

‘we should be prepared to set a structure ... to deal with developments such as newspaper screaming headlines so that we can respond to what the pupils are getting with a balanced approach rather than just leave them at the mercy of the mass media.’ (Head teacher, School C)

‘Brainwashing students’, ‘scandalous’, ‘emotive’, ‘sensationalising’, ‘Frankenstein food nonsense’ were typical terms used by science teachers in describing the media or more specifically the tabloid press. Broadsheets were viewed with respect; they were perceived as giving both sides of the argument on scientific issues and students were encouraged to read broadsheets as they were more likely to contain ‘facts’.

¹³ European Commission, *Cultural and Social attitudes to biotechnology: analysis of the arguments, with special reference to the views of young people*, Luxembourg: Office for Official Publications of the European Communities, 1998

Humanities teachers were sceptical of the media but most welcomed tabloid headlines and articles as ways of generating debate... 'stuff comes out in the newspapers the whole time... (and) provokes people into discussion, and in a way the more outrageous the better.' (Head of English, School K). Interviews with English teachers suggest that the focus of discussion is the underlying values of the article rather than content accuracy.

Newspapers were perceived as the main source of information for students on topical issues, although the television, radio and the internet were also mentioned. Science teachers often used programmes like *Equinox* and *Horizon* for teaching purposes, and the news on the radio in the morning could relate to something teachers were doing on the day.

While teachers were concerned with students' lack of interest in topical events, and the news in general, they also signalled their worries that students had very strong prejudices about issues like animal rights and cloning. This reflected a contradictory approach to the media among teachers.

'Kids pick up stuff from the newspapers that Dolly's prematurely ageing.' (Head of Science, School F).

'And our sixth formers do not read newspapers and do not watch current affairs programmes or the news and I find they are dreadfully ignorant of many issues like that.' (Head of Science, School O).

Both these comments suggest that students must engage with topical events even to have a certain level of awareness, however inaccurate or misplaced.

Students engage with the media and do read or, at least, scan newspapers but they may respond to them in different ways from their teachers, integrating the information from the media in the context of their peers' views, the values of their family and the local community. Teachers also report that teenagers see things in very 'black and white' and do not necessarily appreciate the subtler points of an issue.

Comments in the questionnaires and from interviews suggest that teachers have an underlying concern about the role of the media and its influence on students' views. While science teachers use the media in their teaching research indicates that students tend to interpret science reports in the media with a degree of certainty greater than that expressed by the authors. Even top-level students were unable to interpret correctly media reports in the press.¹⁴

Recommendations

¹⁴ Norris, S and Phillips, L (1994) Interpreting pragmatic meaning when reading popular reports of science' *Journal of research in Science Teaching*, 31(9) pp 947-967

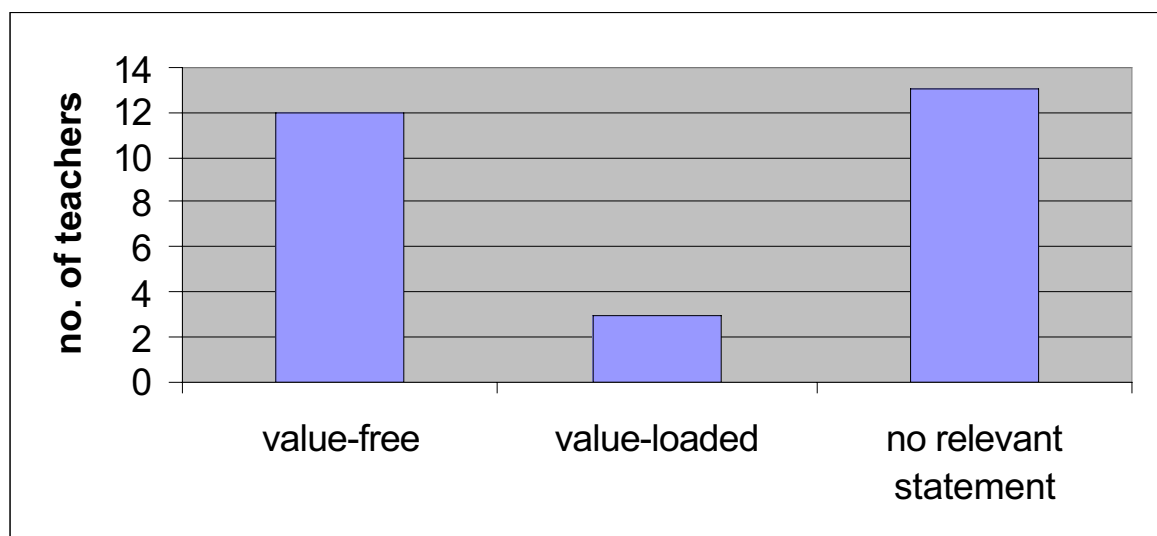
There is a clear indication that students need to be taught how to interpret the language in popular newspaper reports, identify the appropriate clues and relate that knowledge to their own developing understanding of a topic.

8.7. Perceptions of subject

8.7.1. Interviews

Teachers across the curriculum have an implicit epistemological model of science being about technical value-free facts while the humanities deal with the social, moral and ethical issues. Figure 2 categorises the models of science teaching held by science teachers.

Figure 2: *Epistemic models of science held by science teachers*



N=28

‘Value-free’ refers to those teachers making statements in interviews that explicitly perceive science as about facts, not values or opinions or ethics. Those that perceived science as value-loaded acknowledged that the teaching of science had to take account of moral and ethical issues. Teachers who made ‘no relevant statement’ were sometimes ambivalent, for instance social and ethical issues could, under ideal conditions, be addressed in the science curriculum but the syllabus constraints were too great. The demands of the science syllabuses, particularly at GCSE and A-level, appear to sustain the model of science concepts as distinct and unrelated to ethical issues. The problem of dealing with opinions in teaching science is typified:

‘When we talk about the ethics of anything you’re going to give an opinion rather than something that’s fact based. Once you start giving an opinion then you express disagreement. Then they treat the whole of the subject in the same way that they treat your opinion in that they disagree with it personally. So they might end up treating your fact based stuff in the same manner.’ (Science teacher, school A)

Whether this concern is broadly felt by science teachers is not known but it does retreat from a view of science that encourages interpretation, tentativeness and complexity.

The science curriculum is thus thought to tend against promoting critical thinking and dealing with dilemmas.

‘There’s nothing in the science course that says “what’s your opinion about this?”. It tends to be factual about what they know about it rather than an opinion. But ...we ... do that in critical writing in English ...’ (Head teacher, School O).

Although all the science teachers we interviewed covered topics in biomedicine, social and ethical issues were touched upon only if there was time, or if they were raised by students. Science teachers establish the facts and often feel it appropriate for students ‘to reach the decision themselves’, (Head of Science, School J) or to take part in decision-making in other areas of the curriculum. PSHE teachers, however, hardly addressed the social and ethical aspects of an issue (section 8.14).

The transmissive ‘giving of facts’ was a common theme among science teachers.

‘the transplantation issue we deal with particularly at A-level... so they understand the biology of it, but other than whether it is good or bad we don’t deal with the ethical, it’s purely factual; this is how it works biologically.’ (Head of Science, School L)

Discussion about issues in science lessons is perceived as enjoyable by students but also as affording an element of light relief from the rigours of learning the hard science concepts. Students are then

‘...only too happy to have a break from the formal lesson to discuss, say in-vitro fertilisation...’ (Biology teacher, School Q)

One of the key problems of using science to teach broad themes covering the social and ethical lies in the rules that relate to the use of talk. Pupils draw a strong distinction between subject discourses and ‘talk’ which they see as not related to subjects. Chat in lessons has an illicit feel to it, associated with being ‘off-task’ or something to get away with. It belongs to the world outside and is different from subject discourse¹⁵. In science, therefore, discussion about social and ethical issues may also be perceived by students as non-science and of low status.

Training needs, in some instances, are related to examinations and therefore assessment priorities.

‘It’s hard enough to keep up with the technical side of your subject and in many ways

¹⁵ Whitty, G., Rowe, G and Aggleton, P. ‘Subjects and themes in the secondary-school curriculum’ *Research Papers in Education*, 9, 2, 1994, pp. 159-81

since this side is not really examined (author's italics) I would probably not devote time to going on a course, you know, in all honesty' (Head of Biology, School K).

In terms of running controversial discussions in the classroom arising from newspaper headlines students need 'the straight facts, which from a scientific point of view it can be done, but from an Arts point of view it can't be done.' (Head of English, School K). This statement resonates with other comments that perceive the divide between science and the humanities. When science teachers address biomedical topics they see themselves as teaching value-free facts whereas humanities teachers discuss the 'issues' with students, often with little or no use of the knowledge taught in science.

Teaching value-free facts in science would be more likely to inhibit class discussion of controversial issues with an ethical dimension than an approach, which encouraged questioning and exploration of value positions.¹⁶ This may be partly due to the specifications of the curriculum but our interviews also suggest this may be the preferred teaching style of many science teachers. There are also consequences for the assessment of students' understanding and responsiveness to consideration of ethical issues in science. If students are to be assessed then they need the opportunity to both articulate and listen to others' points of views and the classroom environment would need to encourage open-mindedness and debate as an important aspect of pedagogy in science.

In their teaching, humanities practitioners do not perceive a need to know the science content although a number acknowledged the problem of not knowing enough behind the science. Humanities teachers often want materials like fact-sheets which cover the science content accurately but simply, the following observation is an example of the need for access to technical information.

'I don't check the content of the material used in the speeches and controversial issues, . . . and that's actually not at that stage what I'm most interested in. I mean, interest in their ability to write speeches and their ability to evaluate and to persuade, so they could bring in all sorts of sensational material and I wouldn't really have the knowledge base. It would be very useful as a teacher...to have a regular, routine, factual base ... so on occasions we can say well that's factually incorrect...' (Head of Sociology, School H).

This comment was one of the few exceptions; most humanities teachers interviewed thought that the science knowledge was at best incidental to their teaching because it did not impinge on their treatment of a particular issue, even when that may have a strong base in scientific work. A sociologist, for example, would be primarily interested in 'the notion of control, power and the decision-making in our society and relationships between this and the media and democracy...' (Head of Humanities, School A). A politics teacher would look at 'the pressure groups and how they behave as opposed to the actual details and the issues behind them...' (Head of Politics and General Studies, School B).

¹⁶ Newton, P., Driver, R and Osborne, J (1999) 'The place of argumentation in the pedagogy of school science' *International Journal of Science Education*, 21 (5) pp. 553-576

It may be preferable to keep the disciplines of science and humanities apart.

‘I think the scientific side of this is fine but it is dealt with in science. Humanities is looking at the moral issues behind it. Now, I am not saying we shouldn’t have the facts there, but if we start doing the facts, in terms of any detail, then it is easy to get away from what we are doing and end up sort of teaching the science. I’m not awfully happy with the answer because it sounds as if I’m saying ... we want the judgement without the facts ... but ... the focus we are concentrating on is the moral aspect of it.

...what I perceive my job to be is to, say, look at the moral issues behind the Holocaust (and the gas chambers). The chemical composition of Zyklon B makes no difference whatsoever... and if you talk about Hitler’s policy of eugenics, I don’t necessarily need a full genetic breakdown to be able to explain what we are looking at.’ (Head of Humanities, School O).

The chemical composition of Zyklon B may well be irrelevant to an understanding of the Holocaust. But a careful interpretation of the relationship between natural selection and evolution, and an understanding of the principles of genetics may help students to appreciate the questionable scientific validity of eugenics and the ways in which science can be distorted for ideological purposes.

Attempts have been made to find appropriate criteria for underpinning ideas of and about science that would constitute understanding for personal action¹⁷. Millar has suggested, among others, knowledge of the atomic/molecular model of matter and the gene model of inheritance. But part of the problem lies in the use of this science knowledge base, the reworking of science knowledge.¹⁸

This problem of recontextualising knowledge is apparent in answers given in General Studies examinations and when Arts students attempt questions with a science context in A-level English.

‘... in English, in the sixth form, there was an essay on the paper on the advances in science, and whether it was a good or bad thing. And lots of them had tried to answer the question but they didn’t have enough scientific knowledge to be able do so. They’d all mentioned Dolly the Sheep, and they’d mentioned GM food, but it was only like two little paragraphs, and they didn’t really have enough knowledge because they’re all artists doing English, History, Geography, whatever.’ (Science teacher, School T).

This apparent divide in the curriculum between science and humanities ostensibly resists the bringing

¹⁷ Millar, R., (1996) ‘A Science Curriculum for Public Understanding’, *School Science Review*, 77(280), March 1996, pp7-18

¹⁸ Layton, D, ‘Science Education and praxis: the relationship of school science to practical action’, *Studies in Science Education*, 19, 1991, pp 43-79.

together of facts and opinion. The teaching of facts to underpin opinion is related both to the depth of study, confidence and the knowledge base of the teacher. The term, 'informed opinion' is used frequently in questionnaire responses but what constitutes 'informed' is not made clear. Empirical research suggests that technical knowledge of the science is often irrelevant to the decision-making process.^{19, 20} By signalling points of public concern and ethical dilemmas when planning a topic teachers may be able to gauge what level of science knowledge is sufficient to avoid, at the very least, misinformation.

A number of teachers have found ways of marrying ethical issues with the source of science factual knowledge. Confidence in teaching may be helped by an active and committed attempt to understand contemporary debates so that insights into the factual knowledge and the ethical questions feed off each other.

'To get in touch with all these people – with Wellcome, all the advisory commissions, even if they only send you their information. Probably the conferences that I've gone on. ... it helps with both (science and ethical issues) because if you're confident with the science theory then you can give the scientific input and you feel more confident in allowing the discussion on the ethics to flow from then, because you can correct if they're making mistakes on the assumptions on a scientific basis.' (Science teacher, School I).

GNVQ Health and Social Care promotes looking at real life science issues through ethical lenses. In approaching these courses the ethical issues are explored first.

'We explain what ethics is, we look at the underlying principles that underpin an ethical approach. We debate how people in health and care situations deal with ethical dilemmas, which is a combination of theory, experience, codes, law, common sense, looking at the needs of clients, balancing them off. And then we apply it to ...health and care situations on a medical basis where we look possibly at euthanasia, Jehovah's witnesses with blood transfusions, limited resources, that's our focus.' (Head of 6th form, School S).

A salient feature of these courses is that they are vocationally based and the teaching is rooted in real life situations. The factual knowledge is fed in as students have a need of it. Here the science knowledge is dependent on the ethical dilemmas so teachers can judge what science students need to know to understand the ethical dimensions of a situation. The polarity between knowledge and opinion is no longer a factor because there is a mutual interdependency.

¹⁹ Layton, D., Jenkins, E., Macgill, S and Davey, A., *Inarticulate Science?* Studies in Education Ltd, Driffield, 1993

²⁰ Irwin, A and Wynne, B (eds) *Misunderstanding Science?*, Cambridge University Press, 1996

Recommendations

We would suggest that an evaluation of the way GNVQ Health and Social Care is both taught and assessed may shed some light on how ethical principles, social issues and substantive science concepts can inter-relate. Social and ethical issues are, by and large treated as an afterthought in traditional science teaching as opposed to GNVQ, and comments by science teachers suggest that greater weighting of these issues for assessment purposes would be one way of changing the way they are perceived by science teachers. More attention needs to be given to the way in which ethical arguments are assessed in the context of the science curriculum. While knowledge of substantive science concepts can be weighted in assessment it is more problematic to assess the ways in which students interpret social and ethical implications in the context of a specific issue. Much more prominence has to be given to appropriate teaching approaches, particularly in pre-service training.

8.8. Collaboration between subject areas

8.8.1. Questionnaire

Lack of collaboration is evident in the questionnaire responses by teachers to Section F1 and F5 (Appendix B) asking about level of coverage of social and ethical issues. Fifty responses referred to co-ordination between subject areas but the vast majority of these commented on lack of collaboration, or ad hoc collaboration: there was no mention of any planned whole school co-ordination between different subject areas. Where possibilities of cross-curricular collaboration were addressed in questionnaires two models were posited: co-ordination by a dedicated team of specialists and different disciplines dealing with an issue over a period of time. The problems and challenges of cross-curricular collaboration were taken up in interviews.

8.8.2. Interviews

The organisation of national curriculum subjects in state schools appears to militate against both teacher and interdepartmental collaboration.

‘In a school like ours with very rigid departments, independent departments with their own subject areas it is sometimes difficult to find a place for things which are not on the syllabus, and a lot of these issues lend themselves to cross-curricular approaches, don’t they?’ (Deputy Head Teacher, School E)

This analysis of the problem found an echo among administrators and teachers in the state schools we visited. These topics might also fall through a system of mapping on to PSHE.

‘I was surprised to find that while I thought we were addressing issues to do with the ethical issues of scientific research, more than we were, when I sat down and thought about it there were significant gaps, and where you would expect it to be, like in the

PSHE programme there was no highlight, no profile there. I was quite surprised, I found that from the questionnaire. It made me think for the first time, specifically about that issue.’ (Head Teacher, School C)

Where inter-subject collaboration does occur, mostly it is informal. Teachers might, for example, discuss matters on an ad hoc basis in the staff room. Examples are an RE teacher checking with a science teacher to see if the material is presented correctly on a topic on inherited diseases; a science teacher approaching the head of RE to anticipate religious sensitivities when teaching about xenotransplantation. Another example, in a further education college involved social science students going to an exhibition, presented by the biology department, on genetically modified foods. Other instances of collaboration involve sharing of resources.

Of the twenty schools visited only three schools have any significant level of cross-curricular collaboration and only one co-ordinates inter-subject collaboration at any planned whole school level at Key Stage 4.

Teachers identified one of the problems of collaboration – that science teachers and humanities teachers would be looking at different aspects of the same topic. In RE ‘we’d be looking at the moral and ethical issues (of GM foods) whereas they (science department) would be primarily interested in the make-up of it’, (Head of Humanities, School J) In school J, however, the Head of Humanities thought there was good awareness of content covered in different subjects because a newsletter is circulated explaining what topics have been taught.

Teachers mentioned the organisational problems of collaboration, particularly between humanities and science: ‘...if we ...had to co-ordinate with science – are they doing it (the topic) just before we do it? – I think you have a lot of horrendous problems there ...’ (Head of Humanities, School O)

There are two examples of systematic collaboration from school J, one informal and one formally built in to the planned curriculum. When teaching a cross-curricular sixth form session about eating disorders and depression ‘we sat down as a group with three teachers – a scientist and a D&T teacher. Three different backgrounds brought in... We said “what’s really relevant to 6th formers’ lives? How can we help?”’ Information was exchanged between teachers in the planning.

The collapsed days run by school J are of considerable interest because they incorporate cross-curricular planning. Science teachers have an input into the teaching of moral and ethical issues in RE. A year group is taken off curriculum to do RE in a series of five days, pursuing themes such as ‘science and religion, religion and medical ethics’ (RE Co-ordinator, School J). The assessment is through RE but science teachers become involved and make a greater contribution on the science side.

‘Brain tissue transplants and animal to human transplantation we cover specifically as an RE topic. We had a moral and ethics day. We deliver our RE curriculum instead of one

period a week, we have collapsed days, and I help to put together some of the material we used to get people to confront these major moral issues... If we believe someone has an important input they could bring to a particular topic then we'd use them and we'd always try to put them in the context of the other studies they're doing' (Deputy Head 6th form/Psych teacher, School J).

Potentially the collapsed days, or RE days, offer a form of collaboration with the assessment in RE but other subject teachers have the opportunity to take part in an integrated teaching model incorporating both science and ethics. It is likely that the subject that is the context for assessment, in this case RE, has a hegemony over selection and direction of content.

'the approach to the RE days we do has really been education about religion. ... when I first started talking to the RE department, I made a mistake and I was shot firmly down in flames, that it was something to do with moral education and issues such as this. And they made it very clear that it wasn't.' (Head of 6th form, School J).

Recommendations

Based on evidence from School J, and comments from teachers in other schools who have either had experience of teaching through collapsed days in previous schools or where collapsed days are run in the sixth form, these may be an effective model of collaboration if the following features are in place:

- learning group off formal curriculum timetable;
- planning between teachers of different subject areas, particularly English, RE and science;
- an integrated model of teaching;
- assessment through one particular subject area; and
- equal participation by all teaching partners in terms of decision-making.

8.9. Fear of controversy

8.9.1. Questionnaires

Approximately ten per cent of headteachers stated their concerns about teaching controversial issues, these mainly related to sensitivities of parents and families of pupils.

8.9.2. Interviews

There was concern, expressed both in questionnaires and interviews, that teaching certain issues would generate complaints from parents or governors, and therefore they were best avoided. For example, a poster display on eating disorders and the use of ECT had produced a complaint from a teacher-governor who felt the portrayal of ECT trivialised a serious and useful method of treatment. (Head of Science, School F). Teaching HIV/AIDS was another source of anxiety because of fears of contravening Section 28²¹.

²¹ SECTION 28 (LOCAL GOVERNMENT ACT 1988)

Inerrantist beliefs in students were perceived as an impediment to teaching controversial issues, teachers citing objections from groups such as the Plymouth Brethren and Jehovah's Witnesses.

8.10. Timing

8.10.1. Interviews

The appropriate age and level of maturity at which to teach controversial topics was raised primarily in interviews although there were occasional comments in the questionnaires from teachers and headteachers that related age to these issues. HIV/AIDS, eating disorders, drugs education and sex education are felt by teachers to come too late in the curriculum. Contraception is first discussed in one school in Year 10 when 'a lot of the students have been sexually active for a good two or three years anyway.' (Head of English, School S). Key Stage 4 was far too late to start teaching about HIV/AIDS but 'parents might object.' (Head of English, School E). The need for addressing these issues earlier in a student's school career was summarised:

'I think we have a duty to raise issues like (eating disorders) ... because the pressure that some of these children are under it never fails to appal me how some of them are brainwashed. They are totally bound up in what shape and size they are. In every year we never fail ...to get a year when there isn't someone with one of the eating disorders and ...there are some issues that you have to bring forward because the time is right when they need an almost protecting issue... also the nature/nurture and the depression ...
...there's so many issues that I think my priority list will always be what affects the children then, what do they need to know then and possibly some of these (issues) would come later, they can come to them as they develop.' (Head of PSHE, School E).

Other teachers echoed the viewpoint expressed here although there was one cautious note by an assistant headteacher 'that they (the students) do leave their childhood very quickly'. (Assistant headteacher, School F).

In terms of the new genetic technologies, there was only one dissenter who believed that the scientific information and understanding and the way science works, rather than the social and ethical dimension, needs to be taught pre-16.

'...to discuss some of these issues properly you need a group of 16 plus (ie older than sixteen) to have no idea of what's going on, and then to use it like in a PSE programme or some kind of AS level' (Head of Science, School S).

The idea of not addressing social and ethical issues until post-16 was not mentioned by other interviewees although one open questionnaire response indicated these topics should be taught to 'students who would have the maturity and mental powers to weigh the issues involved.'

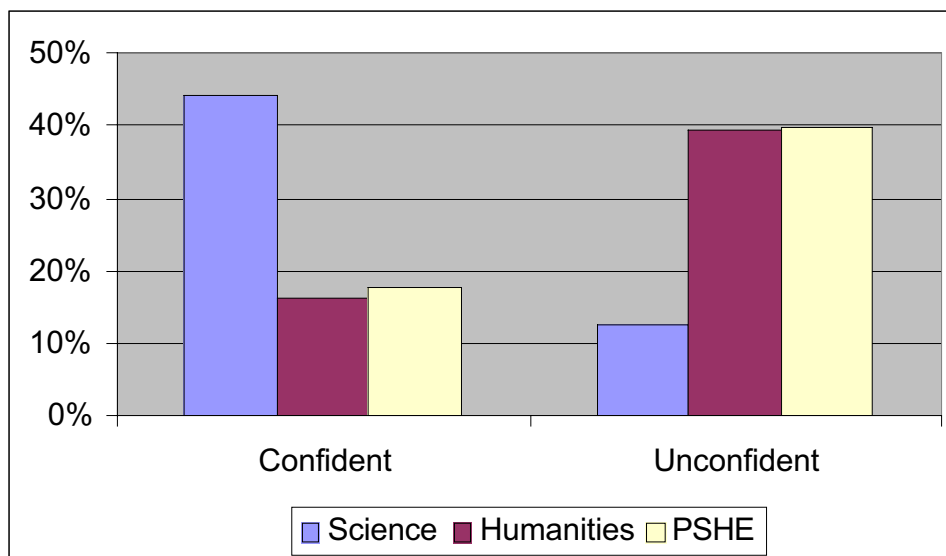
8.11. Teacher confidence and expertise

8.11.1. Questionnaires

Teachers were asked two questions in Section F about confidence in teaching social and ethical issues a.) arising from scientific research and b) in general. Figures 3 and 4 show the comparison between Heads of Science, Heads of Humanities and PSHE Co-ordinators. The data is contradictory. Figure 3 suggests that the scientific research aspect may predominate over confidence in dealing with controversial issues while Figure 4 indicates humanities teachers and PSHE co-ordinators are more at home teaching most areas of controversy.

Figure 3: *Percentage responses to the question:*

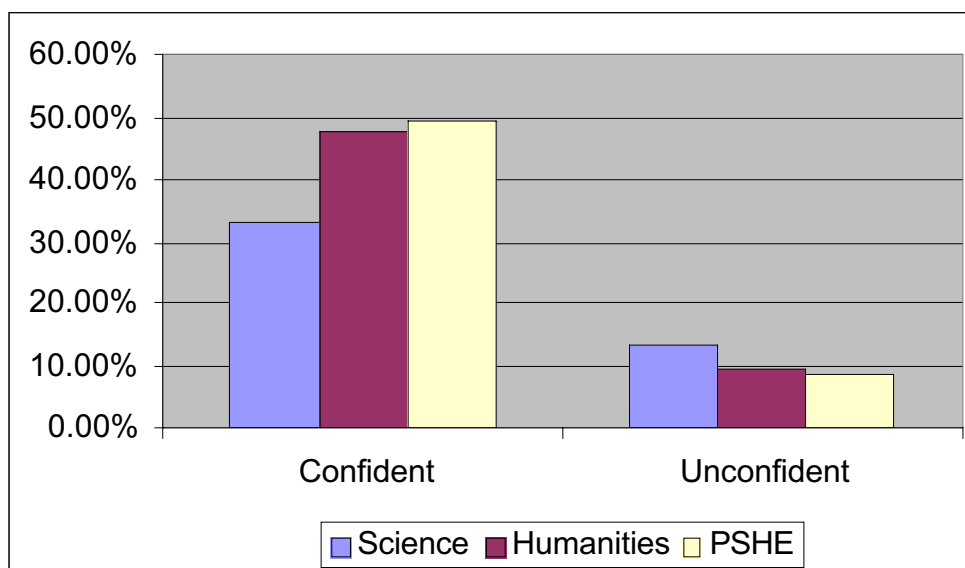
'How confident do you feel about the teaching of social and ethical issues arising from **scientific research**?' (*Percentage per subject group*)



N=367 (N₁=150 science teachers, N₂=99 humanities teachers, N₃= 118 PSHE teachers)

Figure 4: *Percentage responses to the question:*

'How confident do you feel about the teaching of social and ethical issues **in general**?' (*Percentage per subject group*)



N=357 (N₁=144 science teachers, N₂=96 humanities teachers, N₃= 117 PSHE teachers)

Teacher confidence appears to be crucial in the effective teaching of issues-based topics. In interviews, there were many reports in the context of PSHE of teachers not being compelled to deal with science-based topics, or those with a content that might raise sensitivities, because they were unsure of the subject matter. There were twenty comments from headteachers in the questionnaires, approximately

10% of respondents, on the need for teacher confidence to teach controversial issues in science successfully. Science teachers also felt that non-scientists would feel ‘insecure’ in PSHE because of lack of knowledge of certain topics. (Science teachers, School A). Few humanities teachers felt there were any direct problems with their science when teaching socio-scientific issues *in the context of their own subjects*, although there were some exceptions. (Sociology teacher, School H; RE teachers, School I) (Section 8.10).

8.11.2. Interviews

Science practitioners were concerned about non-scientists teaching issues-based science topics. Ability to deal with questions was perceived as a clear difference, science teachers arguing that they could deal more adeptly than humanities teachers with issues if the technical information quoted by students was clearly wrong. Doubts were expressed about non-scientists teaching the social and ethical aspects of scientific issues because this may encourage misconceptions to persist.

‘...one does worry as a science teacher that when issues like cloning are being dealt with that people dealing with it are clear about the science of it and are not ... presenting the view which we sometimes get through the media. Cloning is a brilliant example because it seems to me that at least half the population think a clone is a fully formed adult. ...people are trying to deal with ethical issues concerned with this but they’re not necessarily getting the science right.’ (Physics teacher, School D)

Similar comments about the competence of non-science teachers addressing controversial issues in science were made at the seminar held at the Wellcome Trust.

Interviews suggested that teachers’ lack of confidence in teaching issues-based biomedical topics was much more prominent when teaching through PSHE than through their own subject area. However, it is essential that humanities teachers have the requisite information and guidance to address their own misconceptions.

8.12. Syllabus

8.12.1. Questionnaires

Forty teachers referred to the content of the syllabus they were teaching as influencing the extent of coverage. Approximately thirty respondents felt the syllabus constrained the teaching of social and ethical issues while the rest thought there was adequate coverage in the syllabus. The increased take-up of geography and history at the expense of an integrated humanities course at GCSE was mentioned as a major constraint.

Teachers use a wide range of syllabuses from different boards. Although very few questionnaire respondents mentioned GNVQ Health and Social Care, it featured prominently in the interviews and, as an examination course, comes closest to building in a consideration of ethical issues into topics of

mental health and biomedicine.

8.12.2. Interviews

While most teachers felt it was important that the national curriculum, GCSEs and the new AS/A2 levels had the capacity to address current socio-scientific issues they were wary of a more prescriptive curriculum being imposed upon them than they have already. Teachers were in favour of a greater emphasis in the curriculum for controversy and discussion but they also felt that the curriculum was already overcrowded.

Science teachers felt that creativity and innovation were limited by an overly rigid and narrow curriculum. The demands of the science national curriculum were thought to inhibit the flexibility to respond to topical events or issues.

‘We are so blinkered in terms of the national curriculum, we monitor it, we check it, we do our analysis of data to improve our targets, we are very skilled at doing that. But are we actually providing children with the desire to take science further and if we could somehow bring in modern issues into our science teaching and say, look this is alive, this is what it’s about, you could be part of that in three or four years time...’ (Head of Science, School A)

The double award GCSE syllabuses were said to be too overcrowded and prevented discussion of social and ethical issues. It is difficult to disentangle the problems science teachers face in addressing social and ethical issues in an overcrowded curriculum from an implicit feeling of powerlessness over a curriculum in which science teachers feel they have very little control.

The English Language GCSE syllabus was seen to be least prescriptive although there were different perceptions of its relationship to biomedical issues. There is no constraint on teachers’ freedom to develop any topic they wanted in English. (Head of English, School J) but another head of English wanted to see the syllabus freed up from prescribed authors and instead be given prescribed areas such as the ‘nineteenth century’ or ‘poetry’ and to have the opportunity to discuss biomedical issues in that context. ‘But I can’t see the government (agreeing to) something as controversial as this into the English curriculum because it would give English teachers the opportunity to be too subversive.’ (Head of English, School E). A third view expressed concern that English was being squeezed out of the English curriculum.

‘increasingly ... I am supposed to be using my English lessons to teach about sex education and moral issues and this and that and English as such gets put on the back burner very often, and it’s the English that I’m an expert in. I am not an expert on family planning and what the Church teaches about this or GM food or ... I get worried that the whole teaching profession and the education the children are getting, is becoming diluted because they are being expected to know so much about things their teachers cannot be

expected to know.’ (Head Teacher, School G).

This last view highlights a problem felt by teachers in both questionnaires and interviews that unreasonable expectations are made of their knowledge base in dealing with controversies..

8.13. Teaching through Personal, Social and Health Education (PSHE)

8.13.1. Questionnaire

Questionnaire responses by teachers relating to the coverage of social and ethical issues in their school/college suggests that PSHE was an appropriate site to address social and ethical issues although there was little elaboration. Responses to the question in Section F1, which specifically mentions biomedical research, indicates the topics listed in Section B receive very scant coverage in PSHE.

8.13.2. Interviews

All the schools we visited teach PSHE or a cross-curricular theme very similar to it. In some schools there is a distinction between Personal and Social Education and Health Education and they have two separate co-ordinators, e.g. School E. Further Education colleges operate a different tutorial system. For the purpose of this section and for clarity we will only refer to PSHE in secondary schools.

PSHE would seem to be a good curriculum site to teach issues-based topics because it ostensibly brings together personal and social issues with the subject teachers’ specialism. Biology teachers, for example, contributing towards PSHE might find that they have a greater freedom to address biomedical issues through the timetable slot of PSHE.

Few teachers interviewed thought that PSHE was an appropriate place for teaching issue-based topics in science. Problems with PSHE are that:

- it is not compulsory;
- it is not examined;
- it has low academic status, both in the eyes of subject teachers and students;
- it has maximum time allotted to it of one hour per week per class group, often this is only forty minutes;
- its purpose is often unclear to teachers;
- its main content is often related to sex and drugs education;
- personal and social issues are often crowded out when teachers use it to make up time in their own overcrowded syllabus;
- teachers lack confidence addressing topics outside of their subject area;
- when devising PSHE programmes co-ordinators may have to take account of many different subject

interests;

- the individual personal approach underpinning PSHE sessions works against issues-based teaching;

Each of the points above were emphasized by more than one teacher, few teachers had any positive comments to make, and there are few accounts of effective practice in this area through the interviews. It may be that PSHE has a more effective role with younger students at Key Stage 3 where examination pressures may not be so great. With older pupils the emphasis changes because by the time students are in the sixth form a lot of time is taken up ‘with unis (universities) and landlords and tenants, and all those kinds of personal issues that they’ll face ...– if they do biology they’ll address them (social and ethical issues).’ (RE teachers, School I).

PSHE could pose more problems than it solves, according to some subject teachers, because issues that PSHE is thought to address may slip through the net. As the RE teachers indicated, a core subject may be a better arena to ensure important issues are dealt with.

‘In the case of contraception I appreciate we’re not allowed to teach how contraception takes place, or how children can get contraceptive advice, but I do think they should be aware of all possibilities with contraception. They don’t necessarily get that in PSE... there are some staff who are wary about teaching anything about contraceptive methods, who put it off until the end of the topic and then there won’t be time for it and then it’ll be by-passed. If it was part of the GCSE syllabus that’d ensure that everybody was given information.’ (Head of Science, School J).

Teacher confidence, or in some cases, anxiety, about some topics made it difficult to co-ordinate PSHE effectively. Those teachers who lack confidence in teaching certain areas are not compelled to teach them and PSHE co-ordinators and school administrators are sensitive to teachers’ concerns about teaching outside their realm of expertise. Teaching these issues through collapsed RE days or short RE courses may be more effective.

‘The short course in RE has been able to take some of these issues and has given a context to them ... but also given them a value ... A lot of schools have gone down the route of the short course RE. Because it’s much more issues based it does engage the students.’ (Deputy Head, School J). (See Section 8.13)

One school was in the process of developing a new model for teaching PSHE. Five teams of specialists are allocated to deal with five different issues.

‘the RE team which covers Ethics, Morality and Philosophy is made up of people from different disciplines from Maths to PE.’ (RE teacher, School D).

This model may offer one approach to ensure that teachers feel secure about their subject matter and are

supported by teams of experts with the latter doing most of the teaching. (See Section 8.13)

8.14. Issues related to school context

8.14.1. Interviews

School managers – head teachers and deputy headteachers – advocated sufficient flexibility in the curriculum to respond to the particular and local needs of the school and community, for example, higher profiles on health issues where schools are situated in parts of the country with high incidences of cancer and heart disease, and a head teacher felt there was a need to teach about specific issues such as pre-natal screening ‘because a lot of people in socially deprived areas ... don’t go in for it as much as they should.’ (Head teacher, School O).

Debates about GM technologies tended to polarise students according to their background, two teachers reporting the need to be sensitive to students coming from a farming background when discussing modern farming methods, and how students from a farming background were generally supportive of GM technologies – there appears to be a town-country split on the issue in school students.

According to a headteacher of a school in a socially deprived area, students with low self-worth tend not to ‘have much of an opinion about other things particularly things that are not in their immediate experience’ such as the issues concerned with human transplantation, ‘behavioural things, genetic things.’ (Head teacher, School O). It is therefore important to expand their horizons.

8.15. Time constraints

8.15.1. Questionnaires

Just over 10% of teacher respondents identified time constraints as impediments to teaching issues-based topics. Science teachers felt most constrained by time, twenty three in all; eighteen PSHE teachers mentioned time as a constraint, and four humanities teachers reported time as a problem. These differences are reflected in interview comments and reinforce the perception of the science curriculum as being overcrowded.

8.15.2. Interviews

Lack of time is a strand that runs through nearly all the interviews that are carried out in schools, irrespective of subject area. Headteachers and subject heads all referred in the questionnaires to lack of time for curriculum development, in-service training and for teaching social and ethical issues related to biomedicine in the school curriculum. Headteachers in interviews and through the questionnaire expressed irritation at yet new pronouncements coming from Government initiatives. Both a head teacher and assistant head teacher in the same school (F) opened up the possibility of parents taking responsibility for discussing these issues with children given the lack of time on the school curriculum. There is too much strain on PSHE, according to most head teachers and curriculum managers, which has approximately an hour’s allocation per week per class. It was acknowledged that there is an

organisational problem in exploring ways in which these topics could be mapped across the curriculum without being too prescriptive.

Subject teachers pointed to the syllabus, particularly GCSE and A-level, but predominantly the former, in constraining opportunity.

‘When pupils come up with a question ... you can only afford five minutes maximum in the lesson to have that discussion. You don’t have the luxury of everybody getting involved and interested and not getting on with the syllabus.’ (Group of Science teachers, School A).

Comments included there was about ‘half a second’ to discuss ethical issues in biology in the A-level syllabus, discussions were mainly ‘anecdotal’, i.e. off formally prescribed syllabus, due to lack of opportunity in the A-level syllabus, barely enough time to cover the science ‘let alone the ethics’. On the other hand a group of social science teachers cited a discussion that grew into a two hour debate but acknowledged this was a rarity given the usual time constraints.

Some teachers had informal strategies for overcoming the barrier presented by time constraints, by building in opportunities wherever possible to discuss these issues and not to allocate separate time.

‘There’s Sherlock Holmes ... and... I have to consider the stories and the times in which they were written. If either of those murders happened now there wouldn’t be the kind of mystery that the stories depend on because forensic science has moved on and... we can look at genetic fingerprinting and the ability to identify people from the tiniest fragments of evidence...If I spot an opportunity I use it.’ (Head of English, School G)

These opportunities, however, may be more prevalent in the English national curriculum than in science where there is greater content prescriptiveness.

8.16. Mental Health

8.16.1. Questionnaire

Topics in mental health are covered less than those on the genetic and reproductive technologies. In the questionnaire responses three times as many teachers cover AIDS/HIV compared to depression. Not surprisingly, mental health issues are addressed mostly by PSHE teachers. Just under 40% of PSHE specialists cover depression, i.e. mention depression at all, compared to 25% of Humanities specialists and less than one in ten science specialists. Biology teachers rarely take the opportunity to link studies on brain science to aspects of mental health.

None of the questionnaire responses referred specifically to mental health issues although there were frequent mentions of policies on sex education and drugs education.

8.16.2. Interviews

Interviewees reported that mental health issues are not built into the formal curriculum but are covered informally. There are some examples of how mental health issues are addressed. In a large college, a counsellor might ask the course leader on GNVQ Health and Social Care to address some problems generally with a group to avoid embarrassment to individual students.

‘they’re 17 and still wetting the bed for example and then I would go back ... to Health and Social Care and ask them what is on their ... curriculum. ...a couple of people that I’ve spoken to have brought the issues in so they can be discussed openly without that person feeling, “oh my God I’m odd, strange”, and that’s a very difficult thing to deal with and it takes a lot of courage for somebody to even come in the first place with something of that ilk. So in my position if I can I try and find out who’s doing what on their curriculum ...’
(Student Services, School B).

In the same college students on the GNVQ Health and Social Care course come across mental health issues in their work experience, for example, dementia. At sixteen they learn techniques of dealing with confusion and drawing people out of depression. Another example is a school that asked for information on schizophrenia because staff have noticed symptoms developing in sixth formers. Teachers feel that it is important to deal with mental health as early as Key Stage 3 before problems manifest themselves with older teenagers.

Teachers are nervous about teaching mental health. They use terms such as ‘taboo’, ‘touchy subject’ and ‘startled students’ and they are aware that they do not know what might be happening in a student’s home life. The main strategies of dealing with mental health are specialised teaching with students who have a form of mental illness, to invite in expert speakers, raising the issue in assemblies, encouraging high self-esteem and improvisation in drama. As mentioned earlier (section 5.2.10) eating disorders are frequently discussed.

9. To highlight experiences of teachers in approaching the social, moral, ethical and legal impacts of genetic research.

Much of the preceding discussion has highlighted the experiences of science teachers in approaching the new genetic technologies. Some of the features of this discussion for science teachers are the constraints of the science curriculum and time, the pedagogic model of the science curriculum that science teachers hold, the lack of collaboration with other subject areas and the need for resources.

This section explores the experiences of teachers in different subject areas in approaching these issues:

9.1. Science

The national curriculum, GCSEs and A-levels are seen as significant constraints in teaching about issues arising from genetic research. Science teachers see few opportunities for flexibility.

Treatment of science content within the context of another issue or topic was relatively rare amongst the science teachers we interviewed, and only a few cases of this happening can be exemplified. One teacher dealt with the dangers of the over-prescription of antibiotics in the context of selection pressures in determining the rate of evolution (Head of Biology, School R). A discussion about radiation in cells in the context of a physics lesson prompted one student to bring up the issue of cloning. (Physics teacher, School D). This particular teacher felt happier about issues being raised by students according to the context of the lesson rather than having to teach about specific issues. In the context of a post-sixteen human health and disease module there was an opportunity to address

‘genetic pre-disposition and ...the response to the treatment of that and the societal priorities in terms of health treatment and costs and economics against other options it’s dealt with ... in a very pragmatic and modern way.’ (Head of Science, School E)

9.2. English

The English curriculum is a promising site for the discussion of issues in the new genetics. As one Head of English maintains,

‘we deal with controversial issues all the time ... the only texts worth doing are those with controversial issues in them or else there’s nothing to talk about.’ (Head of English, School E).

Most of the English teachers interviewed made similar comments about the popularity of issues related to biotechnological developments in the English syllabus. *The Tempest* and *King Lear* proved to be popular texts for stimulating discussion on nature versus nurture. All literature is about ‘sex and death’ and therefore any science topics that related to either of these would be covered. (Head of English,

School I). Frankenstein is another popular text relating to the idea of Man playing God and provokes discussion about Dolly the Sheep. The English curriculum allows students to pick out emotive language and look at persuasive techniques. (Head of English, School S).

9.3. Religious Education

RE teachers addressed biomedical issues through an ethical or religious context. Students like talking about ethical issues and anything concerned with expressing an opinion, thus ethics is a popular option in an RE course. Girls in particular appear to enjoy discussing ethical issues concerned with the new genetics. (Head of RE/Ethics, School K).

Biomedical topics can also enable discussion about the perspectives of different religions:

‘But now we’ve got issues like if someone was dying ...they could be saved by having the heart from a genetically modified pig, but their ...religion forbade that, who has to make the decision? And we explored the idea that in some religions they organise it so that the individuals aren’t faced with that responsibility. The religion makes the decision for them. So they simply say “it’s forbidden under my religion”. So they don’t have that massive individual decisional responsibility. And we talked about whether people would regard that as a bit of a cop-out, that the individual was shirking the responsibility of whether or not that decision could be made. That was one of our best sessions. ...Particularly when we were talking about the use of abortive foetal material.’ (Deputy Head 6th form, School J).

9.4. History

The history of medicine in the GCSE history course provides a context for approaching scientific issues through history. (Deputy Head, School E). History is a forum for evaluating change over time thus teachers discuss changes in farming methods, including discussions about GM technology, and Dolly the Sheep to assess whether a change has been for better or for worse. (Head of history, School T).

9.5. Geography

GM technologies are included when teaching about crops and the role of multi-nationals. Looking at GM technology from an international dimension encourages students to balance up moral issues and how the right answer to a problem might depend on the situation of an individual within a production cycle:

‘what might be right for one person or might be right for one economy might not be right for another economy...’

10. To identify the types of resources and training required by teachers to support issues based learning associated with scientific developments

10.1. Questionnaires

Approximately two-thirds of teacher respondents had used resources that they had found useful in teaching any social and ethical topics. A slightly higher proportion of heads of science, 67.1%, had found resources useful in their teaching compared to heads of Humanities and PSHE co-ordinators, 58.8% and 57.6% respectively. About one-fifth of heads of science had not found resources useful in teaching social and ethical topics compared to about a quarter of heads of humanities and PSHE co-ordinators. These figures are unexpected because relatively few science teachers appear to actively address controversial issues in their lessons. It is possible that humanities and PSHE teachers are aware of the lack of resources because they tend to address social and ethical issues more fully. Nearly all teachers interviewed thought there was a real lack of resources. About 90% of respondents thought there was a need to develop resources, although the proportion of heads of humanities, 84.1%, was slightly lower. This may be because humanities teachers often develop their own resources and strategies for teaching social and ethical issues. (Table 8).

Table 8: *Have you developed any resources for the teaching of social and ethical issues of your own?*

	Head of Science	Head of Humanities	Head of PSHE	
No	112 77.2%	51 55.4%	78 69.0%	241 68.9%
Yes	33 22.8%	41 44.6%	35 31.0%	109 31.1%
Total	145 100.0%	92 100.0%	113 100.0%	350 100.0%

Teachers required a wide range of resources: by far the most common resource was video but IT materials, high quality worksheets, visual stimulus materials such as slides and posters, and articles from newspapers were also mentioned relatively frequently. (Table 9)

Table 9: *Resources required*

Resource type	No. of times mentioned
Video	99
Computer / software / CD ROM / internet, web etc	41
Worksheets	28
posters/pictures/slides/visual material	16
articles/newspapers	13
Case studies	12
Complete teaching packs / work packs	7
Activities/active learning	6
Questions	5
Speakers	5
Literature / texts	5
Multimedia/audiovisual	4
leaflets, pamphlets, booklets	4
Overhead transparencies	3
Scenarios	3
Packs on specific issues / single topic	3
lesson plans	2

In terms of the qualities and specific purposes of resources, the need for a balanced approach and up-to-date and accurate knowledge were the most frequently-mentioned qualities. (Table 10).

Table 10: *Required qualities of resources*

Quality required	No. of times mentioned
Unbiased/balanced/both sides/pros & cons	29
providing accurate information	25
Up-to-date/current	26
fact/factual	13
Interactive	8
For all abilities, incl. lower ability students	8
Short/not too time consuming	8
specific for each age group, all Key Stages	8
student centred/oriented/friendly	7
Clear	6
Integrated	6
Simple	5
For non-scientists	5
Affordable	4
Photocopiable	4
practical/hands on	4
Wide range/variety	3
Flexible	2
Accessible	2
linked to syllabus	2
not patronising	2
Topical	2
Accessible language	2

Approximately a third of teachers and headteachers stressed the needs for knowledge and information for training purposes. By far the greatest need was for current information for lay people. (See Section 8.4) 12% of respondents emphasized training in appropriate teaching strategies, particularly in leading discussions. Thirteen teachers thought it was desirable to have directed instruction in teaching ethical principles. Ten percent of teachers overall mentioned restrictions of time and cost.

10.2. Interviews

Although outside speakers are mentioned infrequently in the questionnaires, ten teachers interviewed thought expert speakers from outside agencies would be an invaluable resource. These would be able to support the teaching of controversial issues where the teacher's grasp of up-to-date information might be lacking. Many teachers felt sceptical about videos and websites, in particular, containing propaganda material, and that a critical approach was always necessary in the selection and use of these materials. About 10% of teachers interviewed mentioned the need for texts summarising 'for and against' to convey a balanced viewpoint. Advice on the appropriate use of resources was required both in terms of written advice and in-service training. Teachers, particularly non-scientists, stressed the importance of short, non-technical pieces of information which were not too time-consuming to read and incorporate into lesson materials.

The main purposes of in-service sessions were seen to be training in handling controversial issues. Humanities teachers were more explicit about the purposes of in-service training for teaching controversial issues than science teachers.

11. Conclusion

Teaching the ethical aspects of contemporary science issues is difficult for science teachers: few teachers, whatever their specialism, can handle this area with much expertise. This is not due to any inadequacy on the part of the teachers but to the complexity of the issues. The new genetic and reproductive technologies are loaded with imponderables: assessing risk as in the debate over transgenics, the complex nature of the scientific process (how much can teachers know whether experiments have been carried out with proper controls in place; the different assessments of the developing technology); and changes in both the nature of the ethical and legal processes as the technology develops. These are complex tasks for government appointed committees staffed by experts, let alone teachers who have pastoral, administrative and academic duties, and a varied curriculum over which they cannot possibly have full up-to-date knowledge all the time.

Nonetheless this should not necessarily lead to omission of teaching social and ethical issues arising from developments in the biomedical sciences. What is needed are exemplars of what teaching ethical issues in biomedical sciences might look like and criteria which guide effective teaching of bioethics. For science teachers the problem is particularly acute because controversy, debate and the tentative nature of knowledge do not constitute a significant part of their pedagogy. While humanities teachers are more used to debate and discussion about contemporary issues they often lack the substantive knowledge to address inaccuracies. Even then it is unlikely that most humanities practitioners teach issues from an ethical perspective, that is, weighing arguments using ethical concepts, for example personalistic or consequentialist models. Focused training in using ethical concepts for teaching about a range of issues is essential.

Even with exemplars and training in the concepts and procedures of ethical enquiry it is likely that these issues will be covered superficially at best. While our survey did not cover teachers' own attitudes towards moral and ethical implications of biomedicine, questionnaire responses and interviews revealed that teachers need to rehearse their own understandings and feelings towards a host of issues such as genetic screening, IVF treatment and mental health. Teachers may not claim to be experts but expertise and emotional confidence is important to know how to ask the appropriate questions or direct students' own research and explorations of these matters. Before there can be effective training it is important to understand teachers' own value-base and the detailed ways teachers deal in the classroom with the social and ethical implications of biomedical research.

The data from the project indicates that science teachers and humanities teachers have complementary strengths and weaknesses. While humanities teachers are more at home with controversy, science teachers are more likely to have a greater knowledge of the science concepts. Collaboration may offer useful possibilities; unfortunately science and humanities teachers rarely collaborate. One useful model of cross-curricular co-ordination that did emerge from the data is the 'collapsed day'. Teaching of these issues transcends subject boundaries and building on the strengths of different subject disciplines is a promising possibility.

Finally, if teachers are to be serious about teaching ethical issues in a science context, these issues need to be assessed through the science syllabus. The importance of assessment is also stressed by Nuffield 2000.²² However, science syllabuses rarely allow students to express ideas through discursive writing, something which is more familiar to humanities teachers. Models of assessment that reflect quality of argumentation using science, social and ethical concepts need to be developed and trialed.

²² Millar and Osborne, *op cit.*

Appendix A: Headteachers' Questionnaire

Appendix B: Teachers' Questionnaire

Appendix C: Interview Schedules

Interview Questions to the Head of Science/Humanities/etc. Department

Things needed:

Tape recorder – cassette – batteries

List of Topics - Issues

- *Say that all information is strictly confidential.*
- *Ask for permission for tape recording the interview.*
- *Make clear the interviewee can withdraw whenever he/she wants*

1. Questionnaires as starting point to discussion:

- In relation to the questionnaire you have read/completed, are there any points you want to clarify?
- Any questions you want to raise?

We are interested in how issues related to biomedical research are covered in courses in your department, either in subject teaching, in PSHE / RE, in tutoring, or in any other aspect of teachers' role.

[LIST OF TOPICS]

2. How important do you think it is to teach about these issues?
 - Choose one or two of these issues and explain why you think they are important
 - What are the benefits to students?
 3. Can you tell us about good and specific experiences of teaching about such issues or recall the types of positive/negative experiences?
Can you give an example of how you have enabled pupils to make a judgement about any of these issues?
 - *<If no, give scenario, e.g. testing babies for HIV+>*
How would you tackle a particularly complex issue in the classroom? <tease out teaching strategies/approaches>
 4. What do you think should be covered that isn't?
 5. What has successfully helped you to teach controversial issues and what are the impediments?
 6. Do you have a policy on how issues that may be controversial should be covered, such as genetically modified food?
 - Does the policy include guidance on how partial sources are used?
 7. Do Science staff work with:
 - Humanities staff
 - PSHE staff

...outside your departmental area in a cross-curricular way?
- (If 'yes') Please give specific examples.*
8. What sort of INSET/resources would you like?
 9. What changes to the National Curriculum would you like to see related to these topics?
 10. Do you feel there are any related areas we could have covered in this interview? Are there any additional questions we should include?
 11. Are there any questions you want to ask?

Interview Questions to the Head/Co-ordinator of PSHE

Things needed:

Tape recorder – cassette – batteries

List of Topics - Issues

- *Say that all information is strictly confidential.*
- *Ask for permission for tape recording the interview.*
- *Make clear the interviewee can withdraw whenever he/she wants*

1. Questionnaires as starting point to discussion:
 - In relation to the questionnaire you have read/completed, are there any points you want to clarify?
 - Any questions you want to raise?
2. What is your subject specialisation?
3. Who are your PSHE team? Is it a multidisciplinary team? How do different departments contribute?

We are interested in how issues related to biomedical research are covered in courses in your department, either in subject teaching, in PSHE / RE, in tutoring, or in any other aspect of teachers' role.

[LIST OF TOPICS-ISSUES]

4. What would your thoughts be about teaching these topics?
 5. To your knowledge, does teaching in your department cover issues related to biomedical research? Can you give specific examples?
 6. Does the PSHE programme of the school cover issues related to biomedical research? What do you think should be covered that isn't? What's left out?
 7. How is the PSHE programme drawn up? How can it respond to the topical issues?
 8. Where else are these issues covered in your department?
 - What about related charity work, voluntary work, assemblies...
 9. What about your own teaching?
 10. In your opinion, what might be the objectives of teaching social and ethical issues linked to biomedical research? What do you consider to be the wider benefits to pupils?
 11. What do you see as the main difficulties of teaching about social and ethical issues linked to biomedical research?
 12. Do you have a policy on how controversial issues should be covered?
 - Does the policy include guidance on how partial sources are used?
 13. Do PSHE staff work with:
 - Science staff
 - Humanities staff...outside your departmental area in a cross-curricular way?
- (If yes) Please give specific examples.*
14. What sort of INSET/resources would you like?
 15. What changes to the National Curriculum would you like to see related to these topics?
 16. Do you feel there are any related areas we could have covered in this interview? Are there any additional questions we should include?
 17. Are there any additional questions we should include?

Interview Questions to the Head of the School

Things needed:

Tape recorder – cassette – batteries

List of Topics - Issues

- *Say that all information is strictly confidential.*
- *Ask for permission for tape recording the interview.*
- *Make clear the interviewee can withdraw whenever he/she wants*

1. What is your subject specialisation?
2. Questionnaires as starting point to discussion:
 - In relation to the questionnaire you have read/completed, are there any points you want to clarify?
 - Any questions you want to raise?

We are interested in how issues related to biomedical research are covered in courses in your department, either in subject teaching, in PSHE / RE, in tutoring, or in any other aspect of teachers' role.

[LIST OF TOPICS]

3. What would your thoughts be about teaching these topics?
4. To your knowledge, are any of these topics covered in the school?
 - lessons, assemblies...
5. To your knowledge, is mental health awareness covered anywhere in the school?
6. Do you think these issues should be covered more than they are now at your school? What do you see as the main difficulties of teaching about social and ethical issues linked to biomedical research?
7. What changes to the National Curriculum would you like to see related to these topics?
8. Is your school doing any related charity work / voluntary service?
9. Is there guidance in the school for teaching issues that may be seen as controversial, such as genetically modified food, etc?
 - Is a member of staff responsible for overseeing the teaching of controversial issues? What is their status?
10. In your opinion, what might be the objectives of teaching social and ethical issues linked to biomedical research?
11. Do you feel there are any related areas we could have covered in this interview? Are there any additional questions we should include?
12. Are there any questions you want to ask?

Group Interviews with Teachers

Things needed:

Tape recorder – cassette – batteries

List of Topics - Issues

- *Say that all information is strictly confidential.*
- *Ask for permission for tape recording the interview.*
- *Make clear the interviewee can withdraw whenever he/she wants*

We are interested in how issues related to biomedical research are covered in courses in your departments or in your own teaching, either in subject teaching, in PSHE /RE, in tutoring, or in any other aspect of your role as a teacher.

[LIST OF TOPICS]

1. How important do you think it is to teach about these issues?
Choose one or two of these issues and explain why you think they are important
What are the benefits to students?
2. Can you tell us about good and specific experiences of teaching about such issues or recall the types of positive/negative experiences?
Can you give an example of how you have enabled pupils to make a judgement about any of these issues?
<If no, give scenario, e.g. testing babies for HIV+>
How would you tackle a particularly complex issue in the classroom? *<tease out teaching strategies/approaches>*
3. What do you think should be covered that isn't?
4. What has successfully helped you to teach controversial issues and what are the impediments?
5. What sort of INSET/resources would you like?
6. What changes to the National Curriculum would you like to see related to these topics?
7. Do you feel there are any related areas we could have covered in this discussion? In your opinion, are there any additional questions we should include in future group interviews?
8. Are there any questions you want to ask?

Appendix D: Brief Description of Schools

School A

A mixed comprehensive school in a London suburb; LEA-funded; 1120 on roll.

School B

A large FE college in a London suburb; 4000 f/t and 1500 p/t on roll. A multiethnic setting, with many students of Asian, African and Caribbean origin. Some of those are bilingual.

School C

A mixed comprehensive school; LEA funded; 785 on roll. A culturally homogeneous, rural school in a deprived area of Wales.

School D

A mixed comprehensive school at a small town in the outskirts of London; grant maintained; 1147 on roll. There are approximately 40 EAL and/or bilingual students, speaking, French, Spanish, Dutch, Danish, Italian, Japanese, Portuguese.

School E

A suburban mixed comprehensive school in the outskirts of a North England city; LEA-funded; 2060 on roll. A culturally homogeneous school.

School F

A mixed comprehensive urban school in a small city in North East England; grant maintained; 1200 on roll. Very small number of students from ethnic communities, some of whom are bilingual/EAL students.

School G

A comprehensive school which operates a fully selective system at 11+ (there are grammar schools throughout the county). Teachers at this school described it as a Secondary Modern. Situated in a relatively deprived, semi-rural area. 588 on roll, virtually homogeneous culturally.

School H

A suburban girls selective school of a Midlands town; grant maintained; 660 on roll; small minority groups.

School I

A girls independent school, situated in a suburb of a Midlands city.

School J

A suburban mixed comprehensive school of a Midlands town; grant maintained; 1014 on roll. A big Muslim community (40%), including bilingual students.

School K

A girls selective independent school in a very affluent suburb of London. The school selects girls on an academic basis at age 11; 730 on roll. Considerably multicultural, with a significant Jewish community.

School L

A large inner London FE college in a distinctively multicultural area (up to 50% of students are EAL students); 10400 on roll.

School M

An all girls' comprehensive school in a selective area; LEA funded; 1095 on roll. Situated in a suburban area in the outskirts of London, having a small percentage of ethnic community students.

School N

A girls comprehensive suburban school of a North England town; grant maintained; 780 on roll.

School O

A mixed comprehensive school located in a suburb of a North East city; LEA funded; 1265 on roll; culturally homogeneous.

School P

A mixed selective independent school in a Midlands town; 760 on roll; considerably multicultural.

School Q

An FE college in a culturally and socially homogeneous South East of England New Town; 2000 f/t on roll, with a small proportion of bilingual students.

School R

A mixed independent school in a small rural town; 560 on roll; culturally homogeneous.

School S

A mixed comprehensive suburban school in a Welsh town; 1375 on roll.

School T

A mixed comprehensive school in a suburb of a North England city; LEA funded; 1514 on roll. 95% of students are Christian, the rest are Muslim and Hindu. Bengali and Urdu are spoken by 2% of the students.

**Appendix E: Breakdown by Subject Specialism
of Teachers Interviewed**

Interviewees

I) Subject teaching

A) Science

biology:	17	}	36
physics:	4		
chemistry:	3		
unknown specialism:	12		

food technology:	1	}	3
design & technology:	1		
economics:	1		

B) Non-science

English:	12	}	40
RE:	8		
psychology:	5		
sociology:	4		
geography:	4		
history:	3		
philosophy:	1		
politics:	1		
classics:	1		
unknown specialism:	1		

II) PSHE / Health & Social Care / Student Services: 19

(specialism range: Biology, Counselling, Geography, Languages, Maths, Nursing, PE, Physics, RE, Sociology, other unknown)

III) Headteachers / Principals / Deputy Heads: 13

(specialism range: Computing, English, Geography, Languages, Maths, Music, PE, Physics, Psychology, RE, other unknown)

Total: 111 teachers interviewed

Appendix G: Seminar Programme



Thursday 2nd December 1999

The Teaching of Social and Ethical Issues
Arising from Biomedical Research

Seminar Programme

- 10.00 - 10.30 Registration and coffee
- 10.30 - 10.45 Introduction
Peter Finegold
The Wellcome Trust
- 10.45 - 11.00 Interim report on research findings
Anna Douglas, Jane Evans, Dr Sheila Turner
Institute of Education
- 11.00 - 11.30 Issues & discussion arising from the report
- 11.30 - 11.45 Coffee
- 11.45 - 12.30 Examples of good practice: Presentation from practitioners
- Science:** *Jean Douglas, Richmond-upon-Thames College*
PSHE: *Raf Fecondi, Anglo-European School, Ingatestone*
Whole-school issues: *Bob Reed, Anglo-European School, Ingatestone*
English: *Paul Kelly, Wolfreton School*
- 12.30 - 1.30 Lunch
- 1.30 - 2.15 First cycle of workshops:
1. **Teaching about Bioethics**
Marianne Talbot, Brasenose College, Oxford
Venue: *Burroughs*
 2. **The Human Genome Project and its implications**
Dr Michael Reiss, Homerton College
Venue: *Auditorium*
 3. **Using drama in teaching about genetic testing**
Lis Blake, Y Touring Theatre Company
Venue: *Meeting Room I*
 4. **Young people and mental health: issues for schools**
Dr Sophie Zeman
Venue: *Franks I*
- 2.20 - 3.05 Second cycle of workshops
(the above repeated)
- 3.05 - 3.45 Revisiting the main issues
Venue: *Auditorium*
- 3.45 - Tea

