BMSC3301
Science and Society project in Biomedical Sciences

# Creating Super Humans: Teaching ethics to young people.

**Emily Belinda Baker**

**SID: 200469167**

B.Sc. (Hons) Human Physiology

Faculty of Biological Sciences

University of Leeds

May 2012

Supervisor: Dr D Lewis

Submitted in accordance with the requirements for the degree of B.Sc. (Hons) Human Physiology. The candidate confirms that the work submitted in accordance with the Declaration of Academic Integrity signed by the candidate at the start of the academic year.

Signed

# Table of Contents

# 1. Abstract

Science in secondary schools provides a means by which topics that are shaping our society can be learnt. Different scientific avenues are being explored in order to cure disease, however due to exploitation of these advances some are being used to enhance performance in the sporting world. The aim of the project was to create, deliver and evaluate an interactive, curriculum enhancing session on two of these topics; saviour sibling treatment and gene doping for KS4 and KS5 students. The session was developed involving the creation of a presentation and videos to provide visual aids. It was then delivered to a number of schools and a range of KS4/KS5 classes. Evaluation was via student questionnaires, completed before and after the session. These assessed any change in opinion and knowledge. Teacher feedback was also gathered. From this data, graphs were plotted and displayed no significant change in opinion for either topic, $p$ = n.s. The results indicated a neutral mean acceptance for the use of saviour sibling treatment (2.5) however a low acceptance of gene doping (1.5). There was an increase in knowledge at the end of the session for all year groups, the highest being a 30% increase in the Year 9 classes. The results obtained presented extremely positive feedback from teachers and students, both answering either agree or strongly agree when asked if they would want further similar sessions in the future. This provided the conclusion that 1 hour lessons are effective in teaching interactive and stimulating ethics sessions.

# 2. Introduction

The Qualifications and Curriculum Development Agency states that the study of science in school *'fires pupil's curiosity about phenomena in the world around them, along with offering opportunities to find explanations'* (QCDA, 2010). Science helps children and young people discover how scientific ideas affect many areas of industry, business, and medicine thus contributing to technological change. Not only this, but students are encouraged to question and discuss ideas that could affect their own lives, as well as our society and potentially the future of the world. This clearly highlights the potential science has to impact children and young people. However there are various pedagogical factors that have to be taken into account in order to produce a successful teacher and effective lesson.

## 2.1 Learning Styles:

Learning is defined as the acquisition of knowledge or relative permanent change in attitude/ behaviour that occurs due to repeated experience (Kimble, 1963). This acquirement of new information is said to occur in different ways for different people, this has been termed 'learning styles'. According to Coffield et al. (2004) learning styles 'label a very broad and relatively fuzzy concept'. They are the way in which each learner begins to focus on, process, absorb and store, new and difficult information (Dunn, 1992). Over the years many theorists have proposed different models of learning styles, arguing that most individuals have a disposition to use the same strategy in varied situations. Acknowledging these varying styles and highlighting one's approach to learning will not only boost personal ability to learn, but will also challenge students to adapt to other ways of learning as well.

Many learning style categorisations have been established over the years including; 'impulsive' and 'reflective' styles identified by Kogan,. 'global' and 'analytic' learning styles established by Kirby, whilst Torrence and Rockenstein defined the styles 'right sided' and 'left sided'. Analysing a few of these categorisations shows that theorists have divided learning styles into a varying number of groups. Many have noted the importance of dichotomous pairing, Pask (1976) being a prime example of this. His theory defines learners as having either a holist or serialist learning style. He describes holist learners to understand whole concepts all at once, rather than sequentially. Therefore they find it unnecessary to break a task down into its components and mostly learn intuitively. The 'holist like' learning style is also referred to as comprehensive learning. Serialist learners on the other hand are defined by Pask as 'operational learners'. They learn by a step-by-step approach, isolating each

component in a specific order. Pask also refers to other students who are versatile in their learning style and therefore can apply either comprehensive or operational learning in certain situations (Entwistle, 1981).

Kolb (1975) took an alternative approach, his theory working on two levels; a four stage cycle of learning and then four separate learning styles. The four elements his model is based on are; concrete experience, reflective observation, abstract conceptualisation and active experimentation, Kolb argues that it is essential to possess all four different elements in order for effective learning to occur. These elements arise in a learning circle which can begin at any one of these points, however should work as a continuous cycle. Often the learning process begins with concrete experience, one carrying out certain actions and then observing the effects. This step then leads to reflection on consequences produced, so if the same situation arose the inevitable outcome would be known. Following on from this; grasping the general principle under which the particular instance falls is required, which leads onto the final step; application in a new circumstance. Kolb suggests that there is a tendency to orient towards a certain pole and therefore find themselves at a point between the extremes. Due to this observation Kolb developed his Learning Style Inventory (Kolb 1976) and proceeded to characterise four learning styles based on how people perceive information. These four styles include; divergers, assimilators, convergers and accommodators (Kolb and Group, 2000). Using Kolb's theory (Fig.1), teachers are encouraged to focus their own teaching strategies or methods to partially match student's individual learning styles but to also encourage growth in other styles. Smith and Kolb state, 'real education lies in helping learners grown in all four learning modes, in their favoured ones to be comfortable and successful in part of the time; and in their non-favoured ones, to stretch their learning abilities' (Kolb and Smith, 1986).

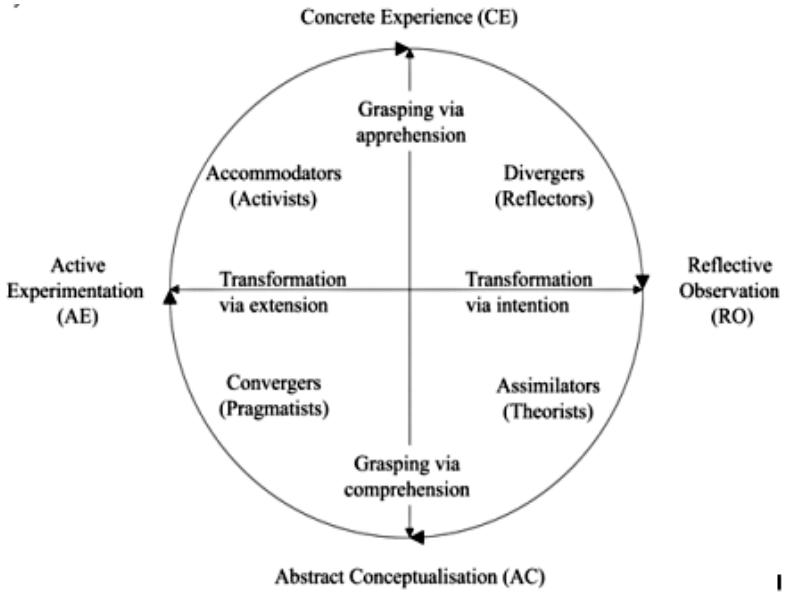



Figure 1. Kolb's Learning Style Model. Showing Kolb's four learning styles along with Honey and Mumford's four classifications. Taken from (Rodwell, 2005).

Kolb's Inventory has been criticised and problems have been highlighted, for example the fact that his model does not apply in all situations, like that of memorisation. Despite these issues his Inventory is generally accepted and is in fact one of the most widely used measures of cognitive and learning styles.

Kolb's work influenced many theorists and was the inspiration for Honey and Mumford's model, the Learning Style Questionnaire. Despite having directly derived their theory from Kolb's Learning Style Inventory, their approach to categorising learners is somewhat different. Their questionnaire probes general tendencies which lead to a conclusive learning style. These styles correspond to those defined by Kolb and describe learners as one of the following; activists, reflector, theorist or pragmatist. (Mumford, 1992).

There are many concerns about learning style instruments for example; Honey and Mumford's Learning Style Questionnaire derives measurement based on how questions are delivered. Most questions demand self-reporting preferences to learning methods, however research shows that this does not correlate to a subject's ability to learn in that preferred mode of instruction (Ackerman and Hu, 2011). Whether or not Honey and Mumford's questionnaire produces accurate results is unimportant in this review and so is the critique of learning style models/instruments, however the understanding of various learning styles is of use.

One of the most commonly known characterisations of learning styles is the VAK model established by Fleming in 1987. This defines a learner's preferred mode of learning in terms of sensory modality by which they take in new information. VAK is an acronym standing for visual, auditory and kinaesthetic. More recently Fleming updated his model to include the mixed sensory-learning modality reading/writing, therefore expanding its title to VARK. Fleming supports the view that some learners use many modalities in learning, however also argues that one modality is usually dominant (Tanner and Allen, 2004).Visual learners prefer to learn through imagery tools such as drawings and pictures. Auditory learners find it necessary to talk through work, listen to lectures, highlighting their need/like to learn through hearing. Reading/writing learners find it easiest to learn when given interaction with textual material, in comparison to kinaesthetic learners who preferentially learn through physical involvement (Fleming and Baume, 2006). However there has been controversy around this theory. It has been argued that most of what children learn is based on meaning. These sensory modalities are usually just 'vehicles' that carry the important, meaningful information that students are required to learn. Therefore the importance of the sensory modalities is lessened as students still need to extract and store the relevant information whether it is

presented visually or in one of the other forms (Willingham, 2005). Franklin (2006) argued against the VARK categorisation, in fact she contests the whole idea of learning styles, saying 'Of course every individual is different, with different strengths, abilities and areas of difficulty. All the more reason to understand the learning processes, rather than label our pupils; Labelling can only serve to annihilate this process of learning.'

Having highlighted a number of different learning styles it is clear that this notion has come to be one of the dominant themes in education and is now highly focussed upon in assessing educational standards. Therefore when planning the session the various learning styles of the students will be considered and elements included to suit differing styles requirements.

## 2.2 Differentiation in teaching:

Differentiation is the adjustment of one's teaching process according to the learning needs of their students. It ensures a student's potential is maximized and that diversity within the classroom thrives and is not suppressed (Carolan and Guinn, 2007). Sinason (1992) stated '*If we cannot bear to see when someone needs different provision, verbally and practically, we all end up being stupid'.* Differentiation is brought about in a number of different ways, one of which is the provision of support so the learner can bridge the gap between what he or she can already do to what he or she needs to learn (Graves and Braaten, 1996). One of the hallmarks of successful differentiation is the establishment of varied and numerous paths the learner can take in order to reach learning goals, whilst also knowing where the student may struggle and therefore acknowledging the best possible way to direct them. Another key factor within differentiation is producing a safe environment for students in order to encourage discussion, investigation and self-confidence. Noddings (2003) referred to this as a 'safe, democratic, diverse and inclusive environment….a 'caring classroom''. Therefore in order to develop a successful teaching session for differing year groups and abilities, differentiation must be implemented.

## 2.3 Assessment:

Palomba and Banta (1999) describe assessment to be '*the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving learning and development'*. It is vital in order to evaluate the success of teaching sessions, to consider the weakness of certain activities and ensure students are acquiring the most knowledge possible. However there has been great discussion as to what the most successful form of assessment is. There are two main types; formative and summative.

Assessment is formative when information is used to adapt teaching and learning to meet student's needs (Boston, 2002). In order to improve student success, instructional adjustments are made and opportunities provided for students to gain more practice. Formative assessment is a powerful pedagogical tool used during a lesson to modify teaching to suit students' academic ability (Aboulsoud, 2011). This is to guarantee positive achievements of the students are highlighted and then appropriate next steps quickly decided in order to ensure progression occurs and information taught is at the correct level (Harlen and James, 1997). Its role is to improve quality of student learning and not to be evaluative or grading. Formative assessment is commonly referred to as 'assessment for learning' (Wiliam and Black, 1996).

Summative assessment is comprehensive and is used at the end of a lesson/ programme to evaluate level of learning. It encapsulates all of the material learnt up to a given point. This point is seen as the finality (Taras, 2005), for example final year exams or end of term projects. It is also referred to as 'assessment of learning'. Summative assessment provides information about a student's achievement of specific learning objectives; however it has been criticized for a number of reasons. For example the timing that they provide information about the student's performance is too late, as well as the fact that one assessment cannot cover the whole topic and therefore only the areas that are easily measured will be assessed and furthermore taught, this is known as 'construct representation' (Popham, 1999). Despite this criticism it is clear that both formative and summative assessment contribute in different ways to the larger goals of the assessment process.

## 2.4 Reflective Practice:

The idea of reflective practice was first acknowledged in the twentieth century. Its definition varies between authors, however Richards (1990) defines reflective practice as ' *a response to a past experience and involves conscious recall and examination of the experience as a basis for evaluation and decision-making and as a source for planning and action'.* Reflective practice helps in understanding the links between what one does (practice) and what one needs to do to improve effectiveness. Some issues have arisen to do with this theory and its application to teaching. The first being is reflection mainly based on thought process or does it involve action as well? McNamara (1990) defined reflection as a special form of thought. However, others have stated the importance of reflective action, this being the persistent implementation of solutions once problems have been discussed, and it is this form of reflective practice that is vital for teacher improvement and progression. Secondly

what time frame does reflection have? Is it relatively immediate or more extended? Some theorists agree that most reflection involves contemplation about actions sometime after they have taken place, this requiring conscious detachment from the activity (Hatton and Smith, 1995). However others have voiced the idea of 'technical reflection', this being the almost instantaneous evaluation of the effectiveness of skills after an attempt at implementation, following this behavioural changes are applied (Killen, 1989). Despite the continued differing opinions on what reflective practice is, Calderhead (1989) concludes its role to be '*constructive self-criticism of one's actions with a view to improvement.'*. This generally highlights the relevance reflective practice has in education and therefore will be used throughout the course of this project.

## 2.5 Curriculum:

The national curriculum is assessed by a number of different exam boards in the UK. They each have different specifications for GCSE and A Level biology. For GCSE biology the AQA exam board specification requires knowledge on the genetic code and genetic disorders. It also includes understanding of embryo screening. For the 2014 assessments the specification has been extended and the fertility treatment IVF has been included. The OCR board also assesses knowledge of genetics, genetic testing and genetic engineering – the use of stem cells and cloning. For A level biology the AQA specification assesses understanding of gene therapy and genetic screening as well as requiring consideration of certain ethical issues. The Edexcel exam board involves assessment of similar knowledge also including ethical concerns with the use of animals for experimentation. This indicates that there will be some form of knowledge on genetics prior to the teaching session. Bioethics is a discipline of increasing importance. Prior to 2006, bioethics was taught in religious studies classes and as part of philosophy lessons. Post 2006 there was a shift in emphasis from just 'gaining' scientific knowledge to 'applying' this knowledge learnt. Encouraging science to become more of a subject matter discussed in society and not as a separate component. As such, it is now an element of many biology courses at Higher Education, but also features in the specifications for both A levels and now GCSE Science courses at Secondary School.

## 2.6 Resources:

Genetic engineering is a vastly debated topic and due to current scientific advances particularly in the area of clinical genetics as well as issues with genetic enhancement in sport, these areas are of significant importance. However despite this, resources for this area of science are scarce. http://www.sciberbrain.org/ is a website which provides some useful

resources touching on relevant topics which are surrounded by controversy. It offers powerpoints, videos, quizs and games which although slightly dated are interactive and helpful. The science discussed is relevant for KS4, however is not of the right level for KS5. Stories from the news are available dated up to 2010, therefore any advances or scientific break-throughs after this date are not provided. Other websites designed with the same purpose, to provide bioethics resources are; Bioethics Bytes, Nuffield Council on Bioethics and Bioethics Education Project (BEEP), each website differing in the resources they provide. Bioethics Bytes claims to emphasise on providing multimedia materials (film, TV, streamed media) as case studies, however there are limited resources available, as well as a lack of explanation of each topic, therefore providing poor support for teachers. Nuffield Council on Bioethics hosts a collection of varied resources, including powerpoints, question sheets and case studies, yet only 5 topics are expanded upon and most are irrelevant for the KS4/KS5 syllabuses. Finally BEEP provides an extensive range of topics, delivering good explanation of each subject matter as well as a case study and some discussion points. However there is also a lack of range in the resources available, limiting the variation for each teaching session. Therefore on a whole, provision of resources for teachers relevant for this bioethical area are limited.

## 2.7 Science Involved:

Advances in scientific knowledge have enabled the development of DNA techniques such as pre-implantation genetic diagnosis (PGD). Techniques like these allow doctors to select embryos that could be ideal donors for existing sick children, opening the possibility of creating so-called ‘saviour siblings’. The first successful saviour sibling treatment for the UK took place in December 2010 for a child with the rare inherited disorder Fanconi Anaemia. There has been continued debate about the morality of its use, some argue that these advances in science are ones that can save lives and therefore restore families. Simon Fishel, Managing Director of Care Fertility said *“The ethical issues are in favour of doing this work. We are trying to save the life of a child and achieve a family without the enormous burden of a son/daughter with a disorder who would otherwise die”*. However others see saviour siblings as created to be means to an end, rather than being individuals in their own right. Josephine Quintavalle, Director of Comment on Reproductive Ethics said that Max, the first UK Saviour Sibling, “*owes his life to his capacity to be of therapeutic use to his sick sister, otherwise he would not have been chosen in the first place”* (Walsh, 2010).

Due to the forthcoming 2012 Olympics, the topic ‘gene doping’ has also been one of great discussion. Humans have long sought to enhance themselves in order to excel above all

other competitors. In the past enhancement has been through advances in pharmacology, now, due to an exploitation of gene therapy (the modification of genes to prevent or treat illness), these same techniques could be applied to enhance a healthy athlete (Friedmann et al., 2010). The World Anti-Doping Agency (WADA) have defined gene doping as '*the non-therapeutic use of genes, genetic elements and/or cells that have the capacity to enhance athletic performance'* (Haisma and De Hon, 2006). These developments have aroused great controversy especially due to the upcoming Olympic Games.

### 2.8 Aims:

The aim of this project is to create, deliver and evaluate an interactive, curriculum enhancing teaching session on the use of saviour sibling treatment and gene doping for KS4 and KS5 students.

# 3. Methodology

### 3.1 Session Development:

The title given for the session was 'Creating super humans: Curing disease and enhancing performance'. In order to decide which specific topics the session would be based on, the KS4/KS5 curriculums were observed along with research into the latest scientific advances in genetic engineering. Within both curriculums there was some reference to genetics, including genetic technology and the use of genetic testing, therefore the lesson was built upon these areas. The topic saviour siblings was chosen for the 'curing disease' element of the session and gene doping selected to cover the 'enhancing performance' aspect. This is due to the fact both are up to date topics currently affecting our society, therefore are of real relevance and importance.

To provide a visual aid, two videos were produced using the software iMovie and modified to suit the topics chosen. Clips were taken from the film 'My Sister's Keeper' to present a range of characters and therefore opinions on the subject saviour siblings. Clips of different Olympic gold medallists in a range of sports were combined to introduce the topic gene doping.

To develop a presentation, the software Prezi at www.prezi.com was used, this being a 'cloud-based presentation software that opens up a new world between whiteboards and slides' (Prezi, 2012). The program provided a zoomable canvas which made it easy to explore ideas and the connections between them. It produced visually captivating presentations which were easy to use and were something the students would have unlikely experienced before. The presentations comprised of a detailed explanation of the subjects chosen, as well as different examples of animal trials, pictures and questions (See appendix A).

## 3.2 Focus Group:

On near completion of preparation of the session a focus group was performed, in order to assess timings and question suitability of the videos and level of science taught. A group of 6 students with non-scientific backgrounds were gathered and a complete run through of the whole session was carried out. Changes to the lesson were then made due to feedback given via a focus group questionnaire. This questionnaire worked by a four point likert scale. In order to quantify the data gathered, the likert scale was given numerical values; strongly agree = 4 to strongly disagree = 1. This method aimed to provoke honest feedback in order to improve the lesson (see appendix B)

## 3.3 Delivery:

Post completion of the lesson, it was delivered to a 3 different schools in the Yorkshire region. These schools ranging from a nationally acclaimed sixth form college to a comprehensive college in an area with an above average level of social disadvantage. The age group ranged from year 9 to A level classes, as well as the length of the sessions varying. Some schools provided 1 hour time periods and others just 40 minute slots. Most classes were situated in a lab setting, however due to the fact the session was mainly discussion based, this eliminated any issues with the classroom layout as nothing specific was required.

## 3.4 Evaluation:

To assess each session, reflective practice was used in order to improve the lesson and ensure the level taught at was age appropriate. To evaluate any change in student opinion or increase in knowledge, questionnaires were produced to be used before and after the sessions (see appendix C). This allowed students to display their opinion, also using a four point likert scale. Class data was pooled and mean values recorded. Statistical 2 tailed,

paired t-tests were carried out on this data in order to assess if there was a significant change in opinion in the different age groups. This was using a 5% significance level. Additionally student feedback was also obtained with the questionnaires to assess the positive aspects of the lesson along with suggestions for improvement. A teachers questionnaire was also produced (see appendix D) to gain further feedback and address different aspects of the session, from the presentation, delivery and relevance of videos, and their assessment as to whether the subjects enhanced the syllabus or not. Graphs were then plotted and tables drawn up. Finally ethical permission was given by the University of Leeds FBS ethical review committee.

# 4. Results

## 4.1 Focus Group:

The focus group gave extremely positive feedback, stating the lesson was pitched at the correct level, it was interactive and interesting and the resources used were relevant and useful. The group also suggested a number of ways to improve the session. This included shortening the videos, reducing the written information on the presentation and slowing down the pace of the session. All of which were noted, addressed and then implemented to ensure the lesson was to the highest possible standard. One of the alterations that took place was the inclusion of additional information on gene doping, along with an explanation of the animal trial 'Schwarzenegger Mouse'. The video 'Mighty Mouse' was inserted into the performance enhancing section as well, which complemented the animal trial providing a visual and humorous illustration.

## 4.2 Reflections:

Following each session reflective practice led to subtle changes in the delivery of the lesson. Language was one of the main things that was altered dependent on year group, as well as a greater explanation of the science involved for the younger ages. The first session was to an A level class in Greenhead College. On commencement of the lesson there were technical difficulties with the equipment, this not only cut the time period short, but there was also fear that the videos and presentation may not work. However these issues were resolved. After the session reflective practice was vital in order to assess how the lesson ran with less time and how the topics could be taught without the aid of technology. This practice was immediately implemented due to the second session, at Greenhead College, taking place during an electrical powercut. This meant the second half of the lesson on gene doping, took

place in the dark, with no access to videos or the presentation. Instead more question and answer time took place, more experimental examples were given and because the lesson's structure was based on group discussion, it was found not to be severely affected. In fact the teacher's feedback at the end of the lesson read *'Overall very interesting and well presented/delivered. You coped really well considering the power went off'*. This demonstrated the importance and influence that reflective practice has on teaching. Other than this due to alterations made after the focus group and successful planning there were very few changes that needed to take place.

## 4.3 Student learning:

The data below was obtained from 3 different schools, in 4 different year groups, A level, Year 11, Year 10 and Year 9. Their knowledge and opinions were assessed using a questionnaire at the beginning and end of the session.

Figure 2. below clearly displays the mean values of all students falling between agree (3) and disagree (2) irrespective of year group, these being 2.7, 2.6, 2.7, 2.6 (A level, Yr 11, Yr 10, Yr 9). The overall correlation for saviour sibling treatment being neutral due to the fact that there was an even distribution of opinions both in agreement and disagreement. Post session mean values show no variation eg A level 2.7 vs 2.6 (A level opinion before vs after), therefore displaying no change in acceptance of saviour sibling. Performing a two-tailed, paired t-test on the data, verified there was no significant change in opinion p = n.s.

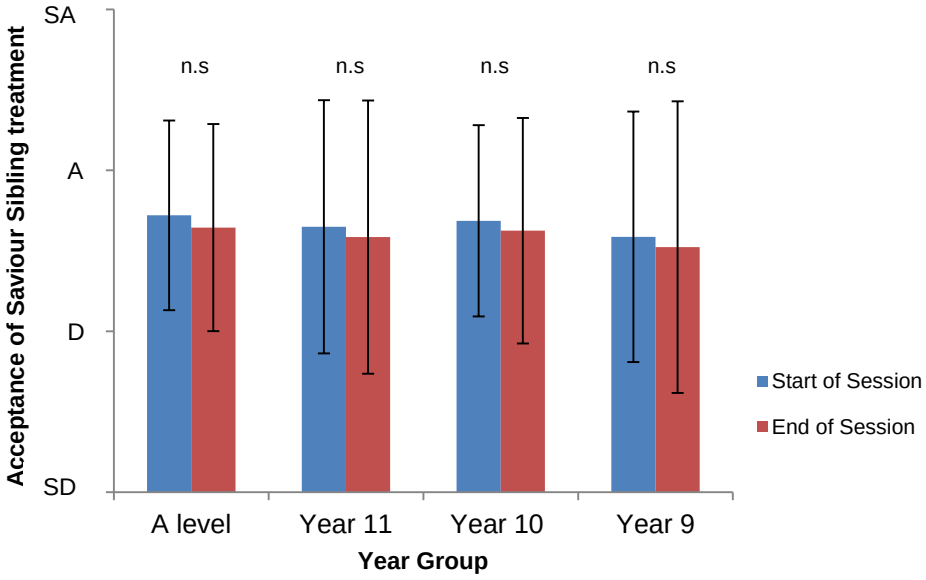



Figure 3. A graph displaying mean student acceptance of saviour siblings before (blue) and after (red) the session. Showing the mean values for all year groups to be almost neutral as no change in opinion before and after the session, p =n.s.

In comparison to the mean value for each year group being neutral in reference to saviour sibling treatment, the graph below (Fig.3) shows the acceptance of gene doping to be far

lower for all age groups eg Year 11, 2.6 vs 1.4 (Year 11 mean opinion of saviour siblings before session vs mean opinion of gene doping before session). The A level and Year 11 group's mean acceptance of gene doping shows to be near to 1 (both = 1.4), displaying the fact they strongly disagree. Similar to the result for saviour siblings p = n.s when a t-test was performed, confirming there to be no significant change in opinion before and after the session.

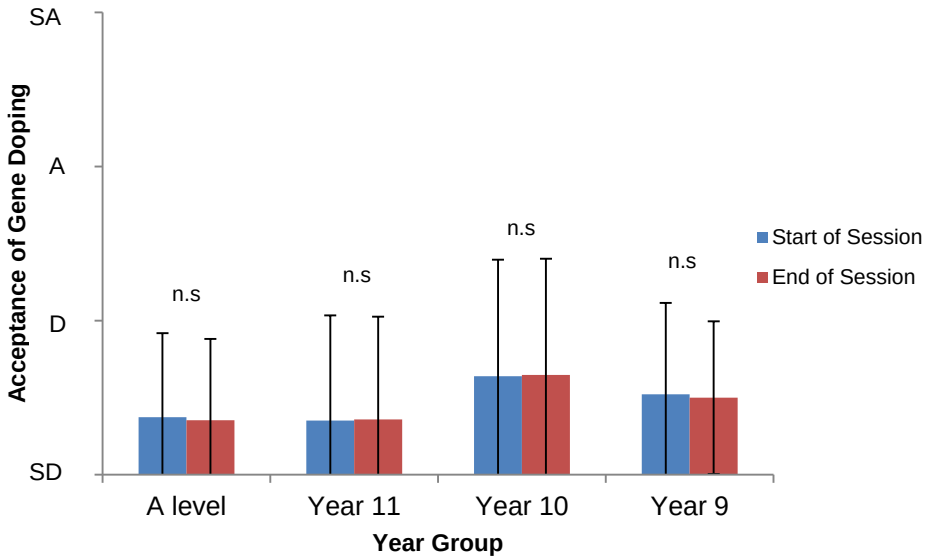



Figure 3. A graph displaying mean student acceptance of gene dopingbefore (blue) and after (red) the session. Showing a low acceptance and a lack of change in opinion, p = n.s.

From Table 1. below it is evident that the A level group finish the session with the greatest percentage of students understanding the content of the lesson (95%). However despite only approximately half of the Year 9 students being able to choose the correct definitions for saviour sibling treatment and gene doping at the beginning of the session (52%), the table presents the greatest percentage change from the beginning to the end, approximately a 30% increase, finishing the session with 83% of students answering correctly.

| Year Group | Before the session (%) | After the session (%) |
|---|---|---|
| A level | 74.14 | 94.83 |
| Year 11 | 78.72 | 85.11 |
| Year 10 | 73.97 | 90.14 |
| Year 9 | 52.17 | 82.61 |

Table 1. A table displaying the percentage of each class to choose the correct definitions of both saviour sibling treatment and gene doping at the beginning and end of the session. Showing a gain in knowledge.

Table 2. below highlights the range of things enjoyed by the different age groups. It is evident that the discussion element of the lesson was important to all 3 older year groups, 37%, 59%, 65% (A level, Yr 11, Yr 10). Whereas year 9 found the fact the session was fun/interesting and the videos to be imperative (65% and 63%). The material taught was also mentioned by all 4 different age groups, particularly the topic gene doping, which was ranked in 3 of the classes top responses, 27%, 39%, 23% (A level, Yr 11, Yr 9).

| Year Group | A level | Year 11 | Year 10 | Year 9 |
|---|---|---|---|---|
| **Top response** | Discussion (37%) | Discussion (59%) | Discussion (65%) | Fun/Interesting (68%) |
| **2nd top response** | Videos (32%) | Learning about gene doping (39%) | Videos (58%) | Videos (63%) |
| **3rd top response** | Learning about gene doping (27%) | Learning about saviour siblings (37%) | Fun/Interesting (24%) | Learning about saviour siblings and gene doping (23%) |

Table 2. A table showing the rank order of things enjoyed by the students, displaying the top 3 responses and the percentage of students who gave this response. The table highlights how the different year groups enjoyed different aspects of the lesson.

| Year Group | A level | Year 11 | Year 10 | Year 9 |
|---|---|---|---|---|
| **Top response** | Longer session (7%) | Longer discussion time (15%) | More practical activities (8%) | Longer session (5%) |
| **2nd top response** | Longer discussion time (5%) | Longer session (11%) | Less discussion time (4%) | More practical activities (5%) |
| **3rd top response** | More science (3%) | More practical activities (9%) | Longer session (3%) | More pictures (5%) |

Table 3. A table showing different suggestions in rank order for improvement of the session, displaying the top 3 responses and the percentage of students who gave this response. The table suggests different year groups hold different aspects of a lesson more important than others.

Similar to the feedback displayed in Table 2., Table 3. (above) distinctly shows the variation in demand for certain qualities in a lesson by the different year groups. The 3 eldest year

groups ask for a longer session 7%, 11%,3% (A level, Yr 11, Yr 10) and the A level and Year 11 classes suggest having longer discussion time 5%, 15% (A level, Yr 11). This is in comparison to the Year 10 groups recommending less discussion time 4%. The A level classes asked for more science within the lesson and to take away with them (3%), in contrast to Year 9 students who demand more pictures (5%). Finally 3 of the year groups ask for practical activities to also be included 9%, 8%, 5% (Yr 11, Yr 10, Yr 9). However, the percentages shown are minor, indicating that the majority of the students did not respond to this question and could suggest they did not feel the lesson needed improvement.

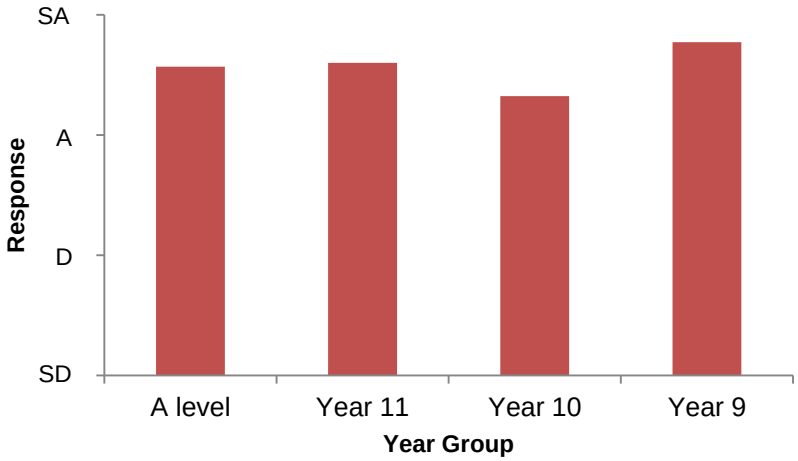



Figure 4. A graph displaying the mean response of each year group when asked if they would want further ethical sessions, showing positive responses.

The figure above (Fig.4) displays the mean response from all year groups when asked if they would want further ethical sessions in the future. With the values being displayed lying between 3 and 4 (agree and strongly agree), 3.6, 3.6, 3.3, 3.8 (A level, Yr 11, Yr 10, Yr 9), it is evident that there would be a demand for similar ethical sessions, once more confirming the success of the lesson.

## 4.4 Teacher Feedback:

The data below was obtained at the end of each session from the teacher of each class, via the teacher's questionnaire.

Having already shown the positive feedback gathered from the students, the graph below (Fig.7) clearly displays exceptional feedback from the teachers, the average for each question falling above 3 (agree). For 6 of the 8 questions the mean opinion was above 3.5 therefore showing the teachers strongly agreed with the majority of the statements. With the other 2 statements (*useful addition to the curriculum* and the *session being interactive and interesting*) having mean responses of just below 3.5 (3.3 and 3.4), highlighting the fact the feedback was extremely positive.

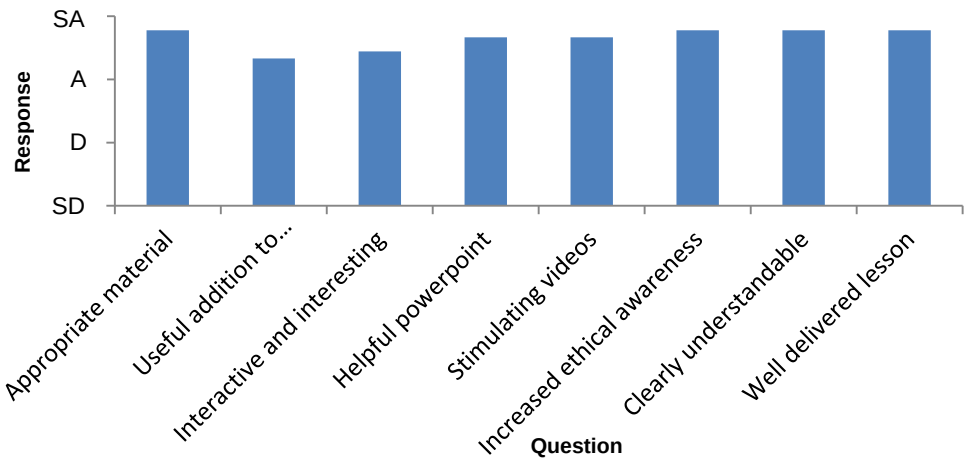



Figure 5. A graph displaying the mean opinion for different questions on the teachers feedback questionnaire. Showing the response to be positive for each question.

Below, Figures 6. and 7. display the responses given by the teachers of different year groups with reference to the suitability of content taught and style of delivery. The graphs demonstrate that the positive responses shown above in Figure 5. are given by all teachers irrespective of year group. Showing the material taught was age appropriate for all different year groups 4, 4, 3.3, 4 (A level, Yr 11, Yr 10, Yr 9) as well as the session enhancing the curriculum for all different syllabuses 3.7, 3.5, 3, 3 (A level, Yr 11, Yr 10, Yr 9).This once more confirms that the session was interactive and relevant for all students regardless of age.

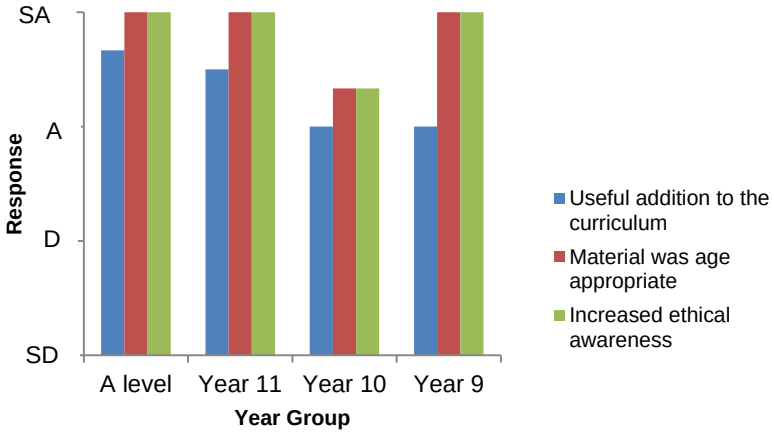



Figure 6. A graph presenting the responses of teachers of all year groups with reference to the suitability of content taught. Clearly showing positive feedback.

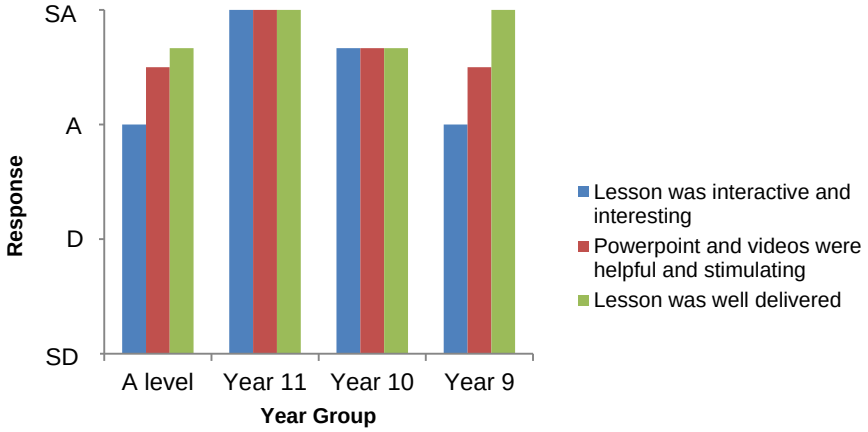



Figure 7. A graph showing the responses of all teachers from each year group when questioned about style of delivery. Once more displaying positive responses.

The table below (Table 4.) displays the positive aspects of the session highlighted by the teachers in the teacher's questionnaire. These questions required comprehensive answers to allow open and honest feedback to be given. The greatest proportion emphasised the discussions/group work and how interactive the session was to be the most positive features of the lesson (56%). Following this many stated the session was clearly presented (44%).

| Positive feedback | % of teachers |
|---|---|
| Group work/ Discussions | 56% |
| Interactive | 56% |
| Clearly presented | 44% |
| Stimulating videos | 33% |
| Relevant material | 33% |
| Excellent powerpoint | 33% |
| Engaging | 22% |

Table 4. A table showing teacher's feedback with reference to the positive aspects of the session. Displaying a number of differing elements of the lesson that the teachers thought were beneficial.

In comparison, Table 5. displays the teachers lack of criticism of the session, with the highest proportion of teachers suggesting there should be less discussion time (33%). This emphasises the lesson was successful due to the fact that the majority of suggestions were only proposed by a small proportion of the teachers (11%) and therefore there was nothing that needed dramatic improvement.

| Ways to improve the session | % of teachers |
|---|---|
| Less discussion time | 33% |
| Practical activities | 11% |
| More thinking time | 11% |
| Alter worksheet | 11% |
| Involve different students | 11% |
| Q&A sessions | 11% |
| Involve role play | 11% |

Table 5. A table showing teacher's feedback with reference to how the session could be improved.

When questioned whether they would want further ethical sessions for their classes in the future, 67% of the teachers strongly agreed whilst 33% agreed, particularly on the topics;

animal testing, stem cells, re-introducing native species and a physicals based session e.g. nuclear power and environmental issues.

# 5. Discussion

The aim of this project was to create, deliver and evaluate an interactive, curriculum enhancing teaching session on the use of saviour sibling treatment and gene doping for KS4 and KS5 students. The results showed neutral mean values for all year groups for saviour sibling treatment due to the varied responses of the students, differing year groups had a low acceptance of gene doping. It was also evident from the results that there was a lack in significant change in opinion p = n.s for both topics. However this was not a reflection of the knowledge gained, as this increased considerably in all classes. Finally both the student and teacher feedback was extremely positive, proving that the session was an effective means of communicating the topic and the ethical issues that couple the use of genes to cure disease and enhance performance.

## 5.1 Student opinions of controversial areas of science

The speed of scientific development is increasing, greater advances in the scientific world are shaping our society and therefore controversy is predictable. However public interest in science has also increased according to the 'Public Attitudes to Science' 2011 report (MORI, 2011). In the PAS study the public generally viewed science to be beneficial to society, with 80% agreeing that *"on a whole, science will make our lives easier"* as well as 54% thinking that *"the benefits of science are greater than any harmful effect"*, on the other hand 28% were neutral, posing the view that many still worry about the potential harmful effects science could have. The public were questioned specifically about different areas of science. When asked what their opinion was with reference to stem cell research the survey found widespread conditional support for stem cell research and therapies. However the conditions related to the source of the stem cell, controversial opinions being found relating to the use of embryo stem cells. Despite these ethical concerns many view it to be more immoral not to develop treatments for serious diseases. Having analysed the sessions results, they clearly display unsure opinions with reference to saviour sibling treatment (averages for all year groups falling close to 2.5 = neutral) therefore showing the same controversy the PAS study displays.

Another topic the public were questioned about was synthetic biology, the performance enhancement aspect of the session tying in here. MORI (2011) found that the public's opinion of synthetic biology depended on the end goal. 63% agreed with its use to address problems such as serious diseases, energy problems or global warming. Due to the fact that enhancing sporting performance is not a global problem it can be concluded that the public would not be in agreement of the use of synthetic biology for this purpose. This is also evident in the student's results, showing a low acceptance to the use of gene doping (mean values ranging from 1.3 to 1.6, 1 = strongly disagree, 2 = disagree). When questioned within the sessions why they thought gene doping was not ethically acceptable, the most common response was *'it is unnatural and unfair*. However, the study concluded that attitudes within science are not fixed, that people are willing to change their opinions to science based on what they see and hear. This was not evident subsequent to the session, with no significant change in opinion occurring for either saviour sibling treatment or gene doping, p = n.s (Fig.3 and 4). This suggests that perhaps the scientific explanation given provided enough information for each student to make an informed decision. Therefore despite having the opportunity to then think from different view points and debate their attitudes, this made no impact on their overall opinion. Confirming the success of session delivery, which was shown in Figure 5. with the mean response of the teachers for the statement *'was the session clearly understandable'* being 3.8 (agree = 3, strongly agree = 4).

## 5.2 Reflective Practice:

It has been theorised that reflection is 'an intrinsically good and desirable aspect of teaching and teaching education' (Calderhead and Gates, 1993). Calderhead (1989) presents reflection to enable teachers to become aware of the ethical and moral assumptions within their practice. This was vitally important to implement after each session. Due to the subject matter being ethics based, it would have been easy for personal opinion to underlie the information taught. This practice enabled each session to be reflected upon and alterations in language made to avoid this bias being presented. This ensured an open environment was produced in which students could voice their own opinions. Dewey (1910) highlighted the importance in developing skills of thinking and reasoning in order to base actions on reflection rather than impulse. This again was necessary in order to maximise clarity of teaching and correct information given to the students.

## 5.3 Differentiation:

Confucius stated that to teach people '*you have to start where they are'* (Tomlinson, 2005). Differentiation was specifically used when teaching the younger year groups, due to a distinct difference in knowledge. For example when presented with the question *'do you know what a genetic disorder is?'* they could not respond, in comparison to the 2 older classes who could give a clear answer. This is evidently displayed in Table 1. which shows A level and Year 11 to have the greatest percentage of students (74% and 79%, A level and Year 11) selecting the correct definitions for saviour sibling treatment and gene doping at the beginning of the session. The percentage of Year 10 students who were correct was still high (74%) in comparison to Year 9, where only just over half of the students selected the correct definitions (52%). Adjusting language was also vital, as well as further explanation of each topic required. For example ensuring the term 'embryo' was described rather than just assuming the class would already understand its meaning, this reduced the chance of students becoming lost and confused. This was indicated in Figure 5. with the teacher's mean response being 3.8 (3 = agree, 4 = strongly agree) when questioned if the material taught was clear to understand.

Differentiation was also implemented in the discussion time. A level students along with the Year 11 classes, showed real depth of discussion and an aim to voice their own opinions. This was lacking in the younger groups, therefore differentiation was required. A greater emphasis was put on asking provoking questions to stimulate discussion, alongside encouragement in order to produce a safe environment to voice their views. Reflecting on the results gathered from the teachers, Table 5. shows 11% of teachers highlighted the importance of involving different students to feedback post discussion, ensuring the production of an inclusive environment occurred (Noddings, 2003).

## 5.4 Feedback:

Assessing the feedback given by both students and teacher there is some comparison; this is shown in Tables 3. and 5. 3 of the year groups along with a small proportion of teachers (11%) state that to improve the lessons there should be practical activities involved as well as discussion. A student in the Year 10 class stated '*Maybe there should be more hands on work for those kinesthetic learners'*. In preparation for the session the differing learning styles were considered and various modes of learning were included. The videos and presentation were an attempt to cater for the visual learners. Teaching from the front was included to accommodate the audial learners. The different questions included in the presentation and

the worksheet were added to additionally provide for the reading/writing learners. However many aspects had to be weighed up when thinking of kinesthetic learners, firstly the inclusion of practical activities that were relevant for the ethically based topics. A suggestion was to include role play, different students taking on different characters; however the issue with this suggestion was lack of time. Some of the sessions were only 40 minutes long, therefore to involve role play, even for just one of the topics would have caused difficulty with the time frame. For future developments of the project, this issue would be further discussed and some form of practical activity included. This could lead to the two topics being taught as two different lessons, instead of one.

Another association between student and teacher feedback is evident in Tables 2. and 4. Ranked in their top 3 responses, A level, Year 10 and Year 9 state that the videos were one of the main positive aspects of the lesson (32%, 58%, 63%), along with 33% of the teachers also declaring this. This is as well as the presentation also being mentioned by the teachers (33%) as a useful and stimulating support of the session. This highlights the importance of visual stimulation and how technology has such a vital role in the classroom. Today's society is part of a 'technological age', one that has introduced a move into e-learning. This consists of instruction delivered via all electronic media, including the internet, DVD etc. (Govindasamy, 2001). This method of teaching provides exciting, diverse resources which are stimulating for the learner. Using the programme ' Prezi' presented the students and also the teachers with a new, interesting application. Due to the fact this resource provides a zooming canvas, ensured the information was delivered in a fun, captivating way and the important points were easily highlighted. Supporting this positive feedback with reference to the chosen use of videos and the Prezi presentation, was the fact that Greenhead College enquired about having a copy of each resource following the final teaching session.

Additionally within the comprehensive answers gathered, some students (7% of all students) mentioned that they enjoyed the fact that the session related to *'real life situations'* as well as stating they enjoyed different *'ethical opinions'* being highlighted (3% of all students). This is supported by the fact that 33% of the teachers thought the session's content was *'relevant'* (Table 4.). With the 2012 Olympics approaching, the session not only provided the student's with scientific information but a topic that is currently impacting the society they are living in. The first half of the lesson on saviour siblings also presented them with a treatment that has been ethically debated for a number of years, which has the potential to save many lives but could in future years be abused for lesser cosmetic purposes, some stating it is the start of a '*slippery slope'* (Sheldon and Wilkinson, 2004). Schmeck (1988) argued that everyone's

experience of learning is not the same. He reasoned that learning can be an interpretive process aimed at understanding reality, and teachers should consider different ways of promoting the formation of individuality and varieties of thinking. Table 2. displays the student's enjoyment of learning about these topics, with this being ranked in 3 of the groups top 3 responses (27% A level – GD, 39% Yr 11 – GD, 37% Yr 11 – SST, 23% Yr 9 – Both topics). This is supported by the teachers of the A level, Year 11 and Year 9 groups strongly agreeing (4) with the statement '*The lesson helped increase awareness of these specific ethical topics.'* the Year 10 average (3.3), showing these teachers also agreed (Fig.5). This suggests that the session successfully enhanced understanding of recent scientific advances, thus broadening their minds and potentially provoking a greater desire to learn about current scientific research.

A final comparison between the student and teacher feedback displayed in Tables 2. and 4. is the reference to the lesson's emphasis on interaction through group work/discussion. 56% of the teachers state this point when classifying the positive aspects of the lesson. The eldest year groups indicated that they enjoyed the group discussion, with this being the top response and therefore the most significant for these classes (37%, 59%, 65%, A level, Yr 11, Yr 10). This was supported by the fact that the teachers of all year groups agreed that the lesson was *'interactive and interesting'* with their responses being 3, 4, 3.7, 3 (A level, Yr 11, Yr 10, Yr 9) (Fig.6). Lastly a positive response was gained when questioning if the session enhanced the curriculum, all of the teachers agreed that the information taught supported the syllabus with each response being 3 or above (3.7, 3.5, 3, 3, A level, Yr 11, Yr 10, Yr 9) (Fig.6).

In conclusion having analysed the results from all questionnaires and taken into account the feedback given, it is clear that the session produced was a successful tool in teaching ethics to KS4/KS5. Due to the exceptionally positive feedback gathered from both students and teachers it can be concluded that the lesson was interactive and stimulating due to its discussion based structure and as a result of the resources produced. The lesson enhanced the curriculum for all age groups and highlighted the demand for more ethics based sessions, confirming the importance of bioethics and its teaching. The topics taught highlighted the importance of increasing the ethical awareness of students to current scientific advances, due to the fact they are developing at such a rapid speed and hold such controversial debate. The session showed that 1 hour lessons have the potential to be effectively utilised for teaching ethics and therefore could be used more in the future. More depth and time could have enhanced the session however due to set time periods and the

students attention spans being limited this was not a possibility. Finally the session developed debating skills and a broader mindset to others opinions, which is of great importance for higher education and general individual development.

### 5.5 Ethical Implications:

Due to the fact the session was based on discussion and did not involve animals or activities that could cause the students harm, there were no severe ethical implications. As the lessons were being taught to students under 18 years old, a Criminals Record Bureau check was carried out. Real consideration was taken when planning the lesson's content, and sensitivity was given especially to the area on saviour siblings due to the possibility that some of the children could be products of IVF. The project has the potential to encourage young people firstly in their GCSE and A level biology subjects, encouraging excitement for the subject and a desire to learn. Secondly it has the potential to entice students to want to pursue further education at university, due to the fact the session gives an indication of the opportunities university can offer.

# 6. Personal Reflections

Learning I was assigned a 'Science and Society' project filled me with positive expectation. Having not ever particularly excelled in lab reports I was enthusiastic at the idea of a project that was new to me and slightly different. I hoped it would enhance my presenting skills and allow me to explore an area of science I had not researched before. Reflecting on the course of the project, I can conclude that the it developed in me a real confidence in presenting as well as being able to explain complex topics and answer questions in a calm and simplistic manner. The subjects I chose the session to be based on I found interesting and very relevant. I feel I got to grips with using different computer programmes, allowing me to produce stimulating videos and presentations, these skills I feel will be of real benefit to me in the future. Having had such positive feedback from both students and teachers, as well as having Greenhead College ask for a copy of the resources I produced, I feel I have met my aim to create an interactive and interesting session. If I had the opportunity to undertake the project again I would try and incorporate more practical activities. Despite the fact feedback I received was positive and this was only mentioned by a few, I think it would have enhanced the session. Overall the project introduced me to scientific research and techniques that are currently being debated, it developed my presentation skills which will be of real use in future years and provided insight into teaching as a career.

# 7. References


ABOULSOUD, S. 2011. Formative versus Summative Assessment. *Education for Health,* 24.

ACKERMAN, D. S. & HU, J. 2011. Effect of Type of Curriculum on Educational Outcomes and Motivation Among Marketing Students With Different Learning Styles. *Journal of Marketing Education,* 33**,** 273-284.

BOSTON, C. 2002. The concept of formative assessment. *Practical Assessment, Research & Evaluation,* 8**,** 1-5.

CALDERHEAD, J. 1989. Reflective teaching and teacher education. *Teaching and teacher education,* 5**,** 43-51.

CALDERHEAD, J. & GATES, P. 1993. *Conceptualizing reflection in teacher development*, Routledge.

CAROLAN, J. & GUINN, A. 2007. Differentiation: Lessons from master teachers. *Educational Leadership,* 64**,** 44.

COFFIELD, F., MOSELEY, D., HALL, E. & ECCLESTONE, K. 2004. *LSRC reference*, Learning and Skills Research Centre.

DEWEY, J. 1910. *How we think*, D.C. Heath & Co.

DUNN, R. D., K. 1992. *Teaching Elementary Students Through Their Individual Learning Styles Practical Approaches for Grades 3-6. ,* Needham Heights, MA: Allyn and Bacon.

ENTWISTLE, N. J. 1981. *Styles of learning and teaching: An integrated outline of educational psychology for students, teachers and lecturers*, Wiley Chichester.

FLEMING, N. & BAUME, D. 2006. Learning Styles Again: VARKing up the right tree! *Educational Developments,* 7**,** 4.

FRANKLIN, S. 2006. VAKing out learning styles—why the notion of 'learning styles' is unhelpful to teachers. *Education 3–13,* 34**,** 81-87.

FRIEDMANN, T., RABIN, O. & FRANKEL, M. S. 2010. Gene Doping and Sport. *Science,* 327**,** 647-648.

GOVINDASAMY, T. 2001. Successful implementation of e-learning: Pedagogical considerations. *The Internet and Higher Education,* 4**,** 287-299.

GRAVES, M. F. & BRAATEN, S. 1996. Scaffolded reading experiences: Bridges to success. *Preventing School Failure: Alternative Education for Children and Youth,* 40**,** 169-173.

HAISMA, H. & DE HON, O. 2006. Gene doping. *International journal of sports medicine,* 27**,** 257-266.

HARLEN, W., GIPPS, C., BROADFOOT, P. & NUTTALL, D. 1992. Assessment and the improvement of education∗. *The Curriculum Journal,* 3**,** 215-230.

HARLEN, W. & JAMES, M. 1997. Assessment and learning: differences and relationships between formative and summative assessment. *Assessment in Education,* 4**,** 365-379.

HATTON, N. & SMITH, D. 1995. Reflection in teacher education: Towards definition and implementation. *Teaching and teacher education,* 11**,** 33-49.

KILLEN, L. R. 1989. Reflecting on reflective teaching: A response. *Journal of teacher education,* 40**,** 49-52.

KIMBLE, G. A. A. G., NORMAN 1963. *Principles of general psychology,* New York, Ronald Press Co. .

KOLB, D. A. & GROUP, H. M. T. R. 2000. *Facilitator's guide to learning*, Hay/McBer Training Resources Group.

KOLB, D. A. & SMITH, D. M. 1986. *Learning Style Inventory: A Manual for Teachers and Trainers. User's Guide*, McBer.

MCNAMARA, D. 1990. Research on teachers' thinking: Its contribution to educating student teachers to think critically. *British Journal of Teacher Education,* 16**,** 147-160.

MUMFORD, P. H. A. A. 1992. *The Manual of Learning Styles,* Berkshire, Peter Honey.

MORI, I. 2011. Publics Attitudes to Science. Available: Ipsos.com.

NODDINGS, N. 2003. *Caring: A feminine approach to ethics & moral education*, Univ of California Pr.

PALOMBA, C. A. & BANTA, T. W. 1999. *Assessment Essentials: Planning, Implementing, and Improving Assessment in Higher Education. Higher and Adult Education Series*, Jossey-Bass, Inc., Publishers, 350 Sansome Street, San Francisco, CA 94104; Tel: 800956-7739 (Toll Free); Fax: 800-605-2665 (Toll Free); Web site: http://www. josseybass. com ($32.95).

PASK, G. 1976. Styles and strategies of learning. *British journal of educational psychology,* 46**,** 128-148.

POPHAM, W. J. 1999. Where large scale educational assessment is heading and why it shouldn't. *Educational Measurement: issues and practice,* 18**,** 13-17.

QCDA. 2010. *National Curriculum* [Online]. Available: www.education.gov.uk.

RICHARDS, J. C. 1990. *The language teaching matrix*, Cambridge University Press.

RODWELL, J. J. 2005. The assessment of formal management development: A method, a baseline and the need to incorporate learning styles. *Journal of management development,* 24**,** 239-252.

SADLER, D. R. 1989. Formative assessment and the design of instructional systems. *Instructional science,* 18**,** 119-144.

SCHMECK, R. R. 1988. *Learning strategies and learning styles*, Plenum Press.

SHELDON, S. & WILKINSON, S. 2004. Should selecting saviour siblings be banned? *Journal of medical ethics,* 30**,** 533-537.

SINASON, V. 1992. *Mental handicap and the human condition: New approaches from the Tavistock*, Free Association Books.

TANNER, K. & ALLEN, D. 2004. Approaches to biology teaching and learning: learning styles and the problem of instructional selection—engaging all students in science courses. *Cell Biology Education,* 3**,** 197-201.

TARAS, M. 2005. Assessment–summative and formative–some theoretical reflections. *British Journal of Educational Studies,* 53**,** 466-478.

TOMLINSON, C. A. 2005. Traveling the road to differentiation in staff development. *Journal of Staff Development,* 26**,** 8.

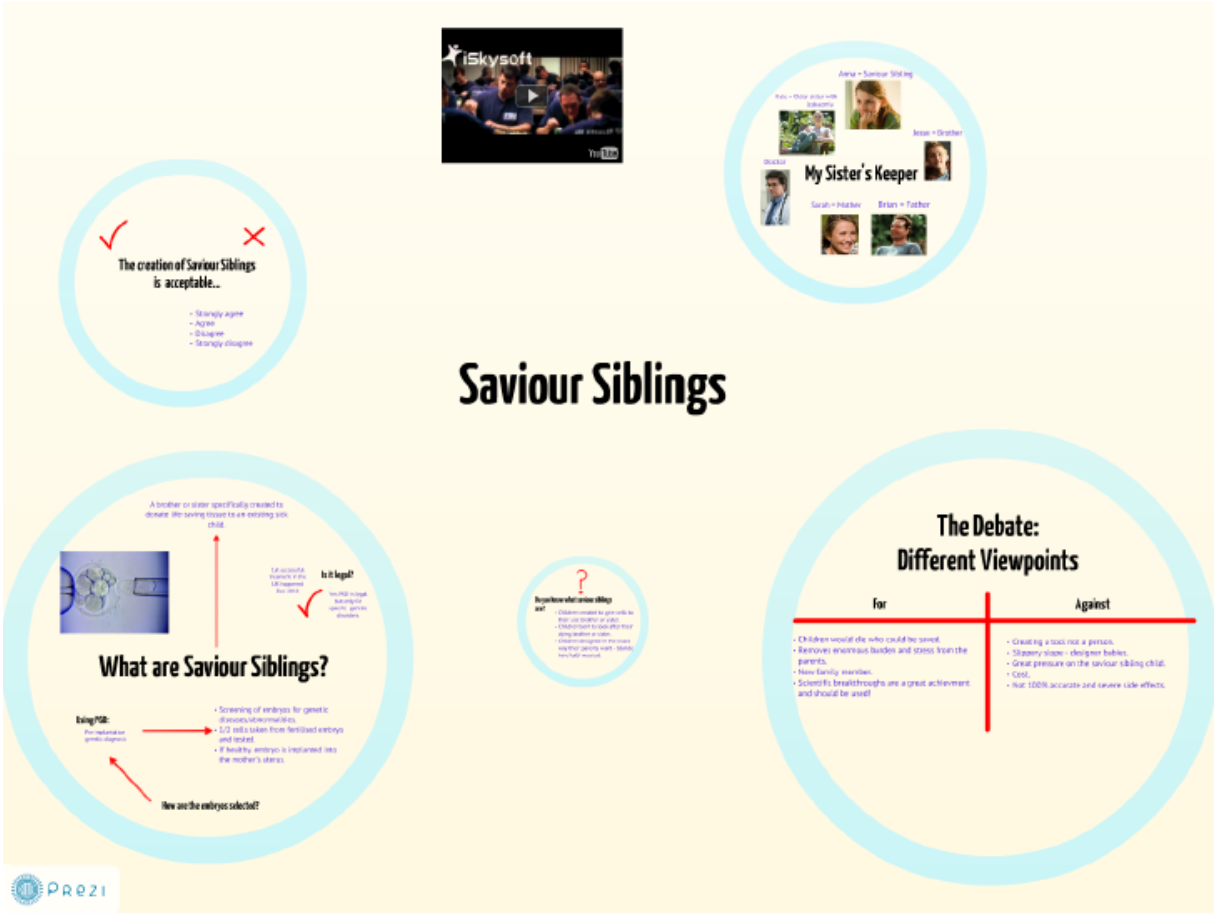
WALSH, F. 2010. First successful saviour sibling treatment for the UK. *BBC News*.

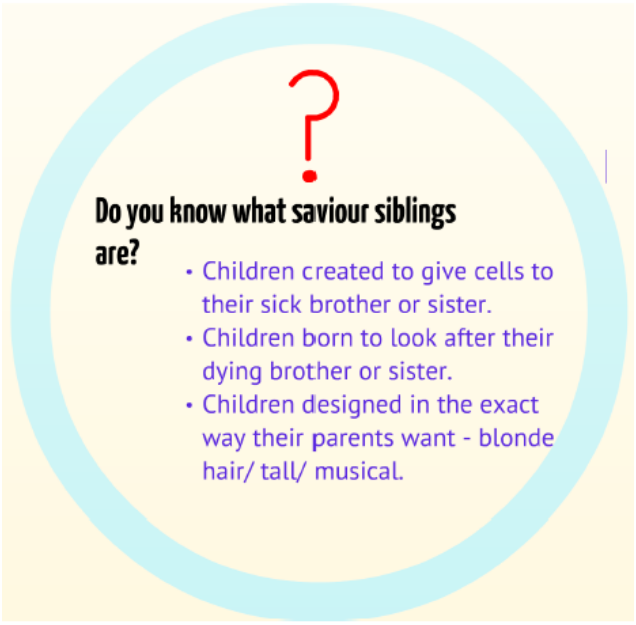
WILIAM, D. & BLACK, P. 1996. Meanings and consequences: a basis for distinguishing formative and summative functions of assessment? *British Educational Research Journal,* 22**,** 537-548.

WILLINGHAM, D. T. 2005. Do visual, auditory, and kinesthetic learners need visual, auditory, and kinesthetic instruction. *American Educator,* 29**,** 31-35.

# 8. Appendices

## Appendix A: Saviour Sibling Presentation




A brother or sister specifically created to donate life-saving tissue to an existing sick child.

1st successful treatment in the UK happened Dec 2010

**Is it legal?**

Yes PGD is legal but only for specific genetic disorders.

# What are Saviour Siblings?

**Using PGD:**

Pre-implantation genetic diagnosis

- Screening of embryos for genetic diseases/abnormalities.
- 1/2 cells taken from fertilised embryo and tested.
- If healthy, embryo is implanted into the mother's uterus.

**How are the embryos selected?**

Anna = Saviour Sibling

Kate = Older sister with leukaemia

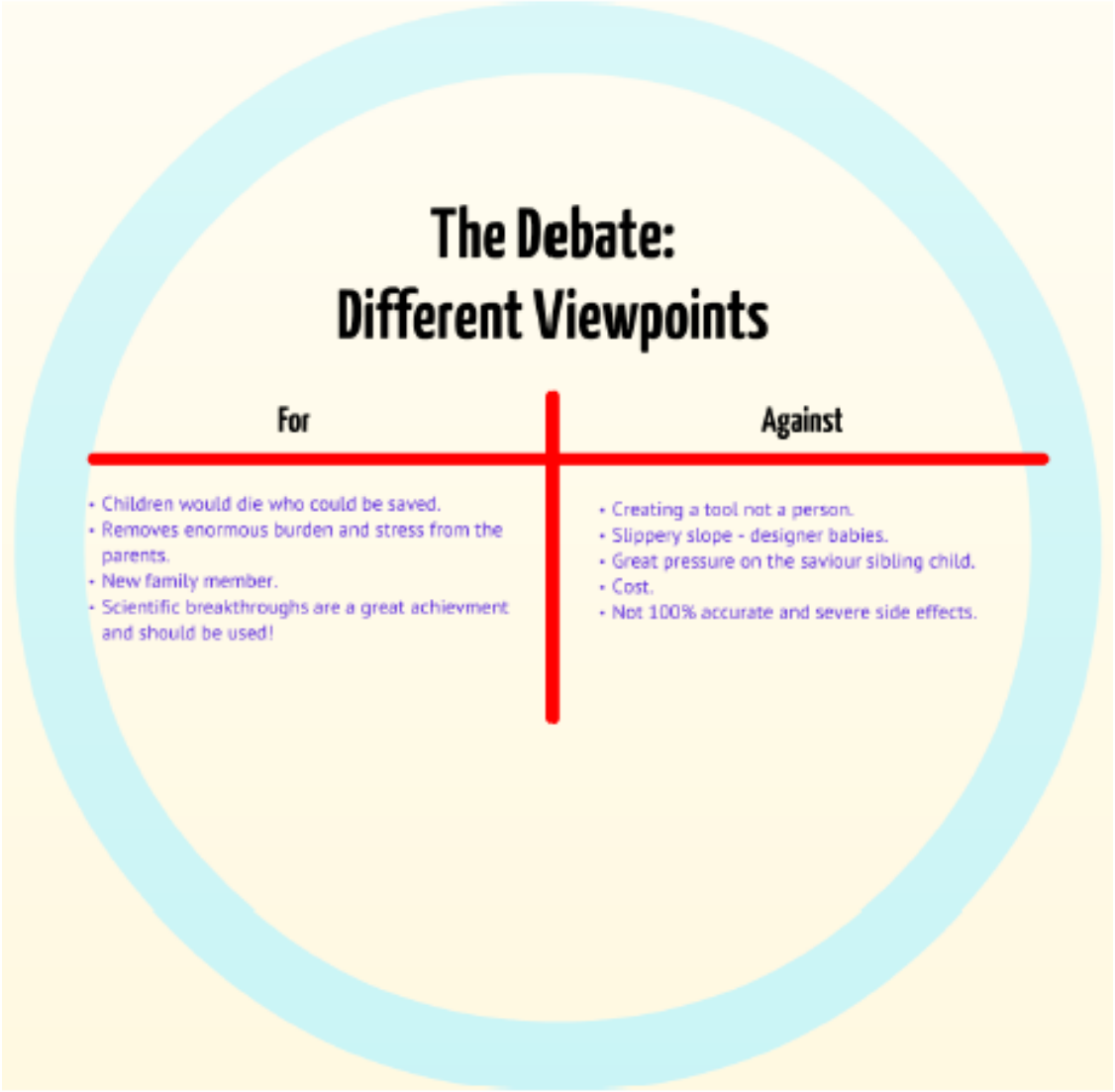
Jesse = Brother

Doctor

# My Sister's Keeper

Sarah = Mother

Brian = Father



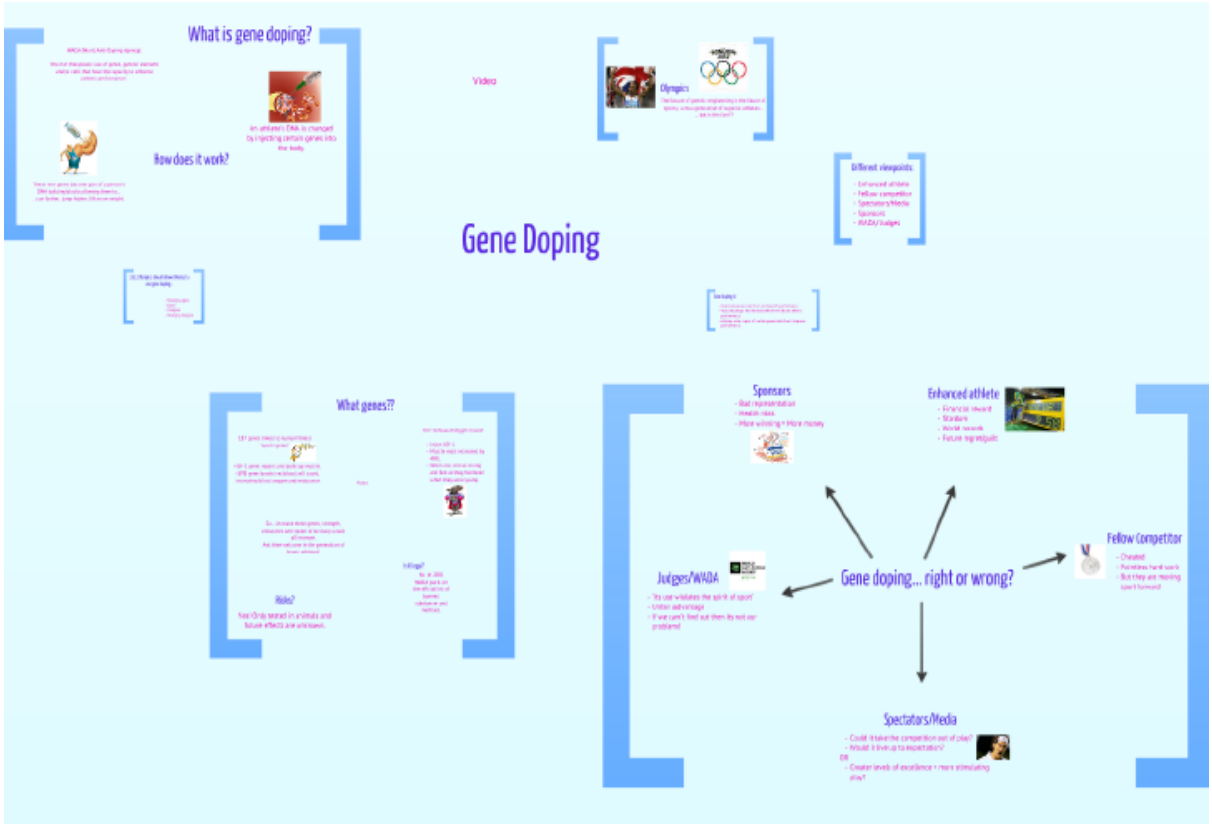

## For

- Children would die who could be saved.
- Removes enormous burden and stress from the parents.
- New family member.
- Scientific breakthroughs are a great achievment and should be used!

## Against

- Creating a tool not a person.
- Slippery slope - designer babies.
- Great pressure on the saviour sibling child.
- Cost.
- Not 100% accurate and severe side effects.

## Appendix B: Gene Doping Presentation

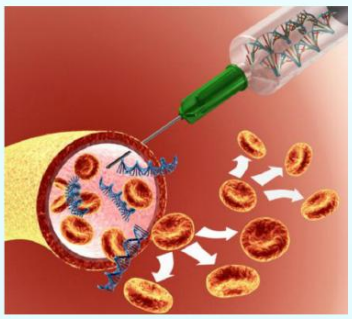



## Gene doping is:

- Removing genes which do not benefit performance.
- Injecting drugs into the body which will boost athletic performance.
- Adding extra copies of certain genes which will improve performance.

WADA (World Anti-Doping Agency):

"the non therapeutic use of genes, genetic elements and/or cells that have the capacity to enhance athletic performance."



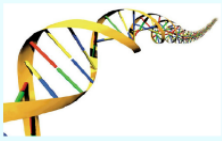
An athlete's DNA is changed by injecting certain genes into the body.

These new genes become part of a person's DNA building blocks allowing them to...
...run farther, jump higher, lift more weight.

## The 'Schwarzenegger mouse':

- Inject IGF-1.
- Muscle mass increased by 40%.
- When old, still as strong and fast as they had been when they were young.

## 187 genes linked to human fitness 'sports genes'



- IGF-1 gene: repairs and bulks up muscle.
- EPO gene: boosts red blood cell count, increasing blood oxygen and endurance.

## Olympics


The future of genetic engineering is the future of sports, a new generation of superior athletes...
... but is this fair??

## 2012 Olympics should allow athletes to use gene doping...

- Strongly agree
- Agree
- Disagree
- Strongly disagree

## Different viewpoints:

- Enhanced athlete
- Fellow competitor
- Spectators/Media
- Sponsors
- WADA/ Judges

## Enhanced athlete

- Financial reward
- Stardom
- World records
- Future regret/guilt


## Spectators/Media

- Could it take the competition out of play?
- Would it live up to expectation?

OR

- Greater levels of excellence = more stimulating play?

## Judges/WADA

WORLD ANTI-DOPING AGENCY
play true

- 'Its use violates the spirit of sport'
- Unfair advantage
- If we can't find out then its not our problem!

## Fellow Competitor

- Cheated
- Pointless hard work
- But they are moving sport forward

## Sponsors

- Bad representation
- Health risks
- More winning = More money

## Appendix C: Feedback Questionnaire - Focus Group

- **Overall did you think the session was pitched at the right level?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Did you think the lesson was interactive and interesting?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Was the material clearly understandable?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Was the powerpoint helpful in understanding the topics?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Would you change the powerpoint in any way?**

Yes ☐ No ☐ If yes please state how: _____

- **Were the videos relevant and stimulating?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Did the lesson seem rushed?**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

- **Were there any parts of the lesson you were confused about?**

Yes ☐ No ☐ If yes please state what parts: _____

**2 positive things about the lesson are:**

_____

**2 things you would change or additionally include are:**

_____

# Appendix D: Start of Session Questionnaire - Students

**Do you know what Saviour Siblings are:**

- Children created to give cells to their sick brother or sister. ☐
- Children born to look after their dying brother or sister. ☐
- Children designed in the exact way their parents want – blonde hair/ tall/ musical. ☐

**The creation of Saviour Siblings is acceptable.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

**Gene doping is:**

- Removing genes which do not benefit performance. ☐
- Injecting drugs into the body which will boost athletic performance. ☐
- Adding extra copies of certain genes which will improve performance. ☐

**2012 Olympics should allow athletes to use gene doping.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

## Appendix E: End of session Questionnaire - Students

**Saviour Siblings are:**

- Children created to give cells to their sick brother or sister. ☐
- Children born to look after their dying brother or sister. ☐
- Children designed in the exact way their parents want – blonde hair/ tall/ musical. ☐

**The creation of Saviour Siblings is acceptable.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

**Gene doping is:**

- Removing genes which do not benefit performance. ☐
- Injecting drugs into the body which will boost athletic performance. ☐
- Adding extra copies of certain genes which will improve performance. ☐

**2012 Olympics should allow athletes to use gene doping.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

**3 things I enjoyed about this session were:**

_____

_____

_____

**1 thing I would do differently is:**

_____

_____

**1 thing I learnt from the session was:**

_____

_____

**I would like more sessions like this.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

## Appendix F: Feedback Questionnaire – Teachers

1. **The material taught was appropriate for the age group.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

2. **The lesson provided information that was a useful addition to the curriculum and enhanced the syllabus.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

3. **The lesson was interactive and interesting.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

4. **The powerpoint was helpful in understanding the topics.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

5. **The videos were relevant and stimulating.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

6. **The lesson helped increase awareness of these specific ethical topics.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

7. **The information taught was clearly understandable.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

8. **The lesson was well delivered.**

Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐

**9. Three positive things about the lesson are:**

_____

_____

_____

**10. Two things I would do differently are:**

_____

_____

**11. I would want more ethical sessions like this for my class in the future.**

| Strongly agree | Agree | Disagree | Strongly disagree |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

**12. If yes, what topics?**

_____

**13. Any feedback?**