Moral reasoning in genetics education

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Recent neuropsychological research suggests that intuition and emotion play a role in our reasoning when we are confronted with moral dilemmas. Incorporating intuition and emotion into moral reflection is a rather new idea in the educational world, where rational reasoning is preferred. To develop a teaching and learning strategy to address this moral reflection, a developmental research project aimed at empowering biology teachers for moral education in context-based genetics was started. The initial focus was on how intuitive and emotive considerations are dealt with in current moral education. Fifteen pre-university students were interviewed on their way of reasoning by confronting them with real-life situations. Next, eight experienced biology teachers were interviewed about their approach to moral education, and about their views on student reasoning. These findings were contrasted with suggestions found in literature on moral reasoning. All students used intuitive, emotive, and 'rationalistic' considerations during the interviews. Teachers reported that they observed students using intuition and emotion in their reasoning. However, the conceptual distinction between emotive and intuitive reasoning proved to be difficult for students and teachers. Neither the educational literature nor the interviews yielded an clear pedagogical approach in which such considerations played a role in moral reflection.
Key words: *Moral reasoning; Genetics education; Context-concept approach.*

Introduction

Today, three developments are challenging science teachers. The first is scientific. Now, more than ever, there is a rapidly increasing body of biomedical knowledge with important consequences for citizens. Recently, scientists have sequenced the human genome and this knowledge has had a huge impact on biomedical science. Scientists have tried to benefit from this knowledge, e.g. in tackling health problems like cancer, by developing gene-based pre-symptomatic testing (Collins, Green, Guttmacher and Guyer, 2003). Due to these new insights, patients are faced with an increasing number of decisions, each with its own ethical, legal and social implications. In their vision for the future of genomics research, Collins *et al* explicitly state that "high-school students will be the users of genomic information […] high-school educators need information and materials about genomics, to use in their classrooms" (Collins *et al*, 2003, p 841).

Secondly, there is a tendency in science education to make education more relevant by teaching science in context. Relevance can be a motivational learning factor for students (Boersma *et al*, 2007). Also, it can help to prepare for future citizenship (Aikenhead, 2006; Levinson, 2006). Education within the context of genetic testing in healthcare can empower students for future complicated decisions with moral implications.

The third development is a combined result of psychological and neurobiological findings. There are increasing indications that we make our moral decisions based on intuition and emotion. We use our arguments only to justify our position, after this position is taken intuitively (Damasio, 1994; Dijksterhuis, 2007; Sunstein, 2005). Thus, our usual rational approach to moral education is becoming out of date. Although there are researchers who have indicated that intuitive and emotive reasoning play an important role in informal reasoning by students (Sadler and Zeidler, 2005), the notion that we should incorporate intuition and emotion into our moral reflection is rather new in an educational world in which rational reasoning is valued and practised (Bögeholz, Höβle, Langlet, Sander and Schlüter, 2004; Dawson, 2003; Ratcliffe and Grace, 2003). If we want to prepare our students for future decision making, science education can do so by translating these psychological and neurobiological insights into classroom practice. Our research project aims at supporting biology teachers in developing the necessary expertise. Therefore, we wanted to find out what kind of moral reasoning students use, prior to any experiences with moral education in biology lessons, and what practical knowledge of student moral reasoning experienced teachers have.

Moral reasoning

Prenatal diagnostics or pre-symptomatic genetic testing in healthcare are relevant contexts for genetics education. In real life, these are controversial issues which confront people with difficult choices. Biomedical knowledge is not always decisive, test outcomes are not as unambiguous as would be desirable, and other people (i.e. family members) are also involved. People often make their choices on personal (moral) grounds, and not based on scientific knowledge. As future citizens, students may have to deal

with this scientific uncertainty and are better off if they know what genetic knowledge means to them personally, and how to value biomedical information. Thus, students will benefit from education that prepares them to deal with these kinds of choices in moral dilemmas (Ratcliffe and Grace, 2003). To achieve that goal, teachers can teach students how to reflect on their moral reasoning. This kind of reflection is rather new in science classrooms.

In this paper we build on the definition of moral reasoning that Haidt uses: 'a conscious mental activity that consists of transforming given information about people or situations in order to reach a moral judgement'. Moral judgements are 'evaluations (good versus bad) of the actions or character of a person that are made with respect to a set of virtues held by a culture or subculture to be obligatory' (Haidt, 2001 p 6). In his Social Intuitionist Model (SIM), Haidt states that moral judgement is caused by intuitions, and can be improved through social and reasoned persuasion. If we want to improve the moral reasoning of our students, we can create opportunities for moral reflection in a social setting.

First, we have to identify the different kind of considerations that can be used in moral reasoning. Sadler and Zeidler (2005) described three kinds of reasoning:

(a) 'rationalistic' reasoning with reason-based considerations;
(b) emotive reasoning with care-based considerations;
(c) intuitive reasoning with considerations based on immediate reactions.

In rationalistic reasoning, which is prominent in education, two types of arguments can be distinguished: (a) hypothetical, under assumption, but still logically reasoned; and (b) empirical, proven facts.

In emotive informal reasoning as described by Sadler and Zeidler, care-based considerations like empathy are considerations directed at others. We think it is worthwhile to extend emotive reasoning to include basic emotions like anger, joy, sorrow, fear and surprise (Evans, 2001). These basic emotions are self-directed, and are often also crucial in moral reasoning. These emotions, preceded by thoughts that are worth exploring and explicating, can be seen as value-indicators (Nussbaum, 2001).

In general, intuition is described as 'immediate knowing'. It involves "all psychological processes of which we are not conscious, although they do influence our behaviour (or our thinking, or our emotions)" (Dijksterhuis, 2007 p 40). Haidt (2001 p 6) focused on a more specific moral intuition: "the sudden appearance in consciousness of a moral judgment, including an affective valence (good-bad, like-dislike) without any conscious awareness of having gone through steps of search, weighting evidence or inferring a conclusion".

Besides this immediate knowing, rational ethical intuitionism defines another use of intuition, referring to *prima facie* duties. In this deontological ethical theory, *prima facie* duties are obligations that, on first examination, are intuitively known and self-evident – self-evident in the sense of being evident without any need of proof (Audi, 2004). In the 1930s, Ross proposed a list of *prima facie* duties like fidelity, justice, gratitude, beneficence and non-injury. Ross claimed that these duties are not self-evident from the beginning of our life, but they become so due to experience and "when we have reached sufficient mental maturity and have given sufficient attention to the proposition" (Ross, as cited in Audi, 2004 p 41). In high school, reflection on the expression of *prima facie* duties by students can be worthwhile, because mental maturity and sufficient attention can often be questioned. In our research, we will include this deontological use of intuition within intuitive reasoning.

Relevance of emotions and intuition for moral reasoning

Brain research indicates the importance of emotions in moral reasoning. People with damage restricted to the ventro-medial area of the pre-frontal cortex are not capable of experiencing emotions. They are not capable of making rational decisions that are socially acceptable (Damasio, 1994; Phelps, 2004). People with brain damage in the amygdala also show crippled emotional responsiveness to one's behavioural choices. They fail to make socially acceptable moral decisions (Damasio, 1994). Not only do we need our emotions to balance possible actions against each other; our emotions are also strong foundations of our intuitions (Nussbaum, 2001). The fact is that intuitions are built on past experiences, and on the emotional reactions felt during previous actions. In addition, feedback from significant others such as parents, and private reflections on these actions, also contribute. Because reflection and feedback can contain logical reasoning and factual information, intuition has an emotional and a rational input.

By definition, intuition is unconscious. Only after our unconscious mind has come to a conclusion we, acting as an advocate, think of the arguments to substantiate our 'opinion'. Although rational arguments are used to justify our choices, we rarely change our opinion due to these arguments (Dijksterhuis, 2007; Haidt, 2001). This 'post hoc' explanation is what teachers frequently require from their students in the classroom. But if the students are not invited to evaluate their intuitions, or to reflect on the origin of their emotions, it seems plausible that they will not improve their moral reasoning.

Moreover, although our thinking and acting might often be based on intuition and emotion, this does not mean intuition always leads to morally correct behaviour. Some intuitions and emotions are based on prejudices or 'gut-level' feelings and should be subject to rational scrutiny (Hunt, 2006). This rational scrutiny, or reflection on the intuitions and emotions that lead to certain actions, can increase cognition. Most situations allow more than one interpretation. The question is whether a person's interpretation is the only possible one. Do the emotions that established an intuition in the past still mirror their present values? When emotions are indicators of values, appropriating other values can change the emotional valuation of a situation. Thus, reflection can result in new cognitions, adjusting future intuitive actions (Haidt, 2001).

Use of emotions and intuition in moral reflection

When describing the aims of his SIM, Haidt argues: "the

central claim of the social intuitionist model is that moral judgment is caused by quick moral intuitions, and is followed (when needed) by slow, ex-post facto moral reasoning" (Haidt, 2001 p 5).

Due to reflection on this ex-post facto reasoning, people may be capable of changing their intuitions, either through private reflection, for instance initiated through role play, or through social persuasion, when they get feedback from people they respect.

> *Because people are highly attuned to the emergence of group norms, the model proposes that the mere fact that friends, allies, and acquaintances have made a moral judgment exerts a direct influence on others, even if no reasoned persuasion is used. Such social forces may elicit only outward conformity, but in many cases people's privately held judgments are directly shaped by the judgments of others.* (ibid p 7)

This influence mentioned in Haidt's model can be profited from in the classroom. Students can reflect on their moral reasoning with the help of fellow students and teachers they trust.

Research questions

In mapping the required teachers' expertise, we will first focus on a crucial element of that expertise, i.e. moral reasoning, and its promotion.

A review of relevant literature may help to identify the general characteristics of moral reasoning. Student reasoning has already been investigated among college students (Sadler and Zeidler, 2005) and high school students (Dawson, 2003) after lessons about DNA testing. However, we were more interested in the ways in which students reasoned prior to any experience with moral reflection in science education. We considered this to be pre-knowledge for teachers, and thus part of the sought-after expertise. Next, we wanted to find out how teachers perceived their students' reasoning and how their perceptions affected their teaching.

The research questions were:

1. What kind of reasoning do students use in discussing controversial genetics issues prior to any education on this subject?
   a. What kind of considerations do students use when confronted with controversial genetics issues?
   b. Are students aware of the considerations they use?
2. What practical knowledge do experienced teachers have of student moral reasoning?
   a. What kind of considerations do they discern in the moral reasoning of their students?
   b. What kind of considerations do they take into account in their teaching of controversial genetics issues?
   c. How do they take these considerations into account in their teaching of controversial genetics issues?

The answers to these questions should provide design criteria for genetics education in this context.

Method

Study 1: Student reasoning

Participants: To investigate students' reasoning, 15 students of 14-15 years of age were interviewed individually. The criteria used to select interviewees were: (a) that the selected interviewees should be representative of the full range of Dutch educational levels, vocational and pre-university; and (b) there should be a good mix of boys (7) and girls (8). All students had followed introductory lessons in Mendelian genetics during their junior secondary education.

Research instruments: The students were asked to classify their preferential considerations. The question was straightforward: what kind of considerations do you use when you have to make an important decision? When discussing cases later on in the interviews, the students were occasionally asked: how did you arrive at this point of view or at this decision? They were invited to express whether they relied on reason, emotion or intuition. In addition to this self reported pattern, their way of reasoning was probed by confronting them with real-life situations. They were asked what they would do and why. The dilemmas were presented to them in two scenarios. One concerned a young mother who was unsure whether or not she should accept her doctor's offer of prenatal diagnosis. The other case dealt with a young adult who wondered if he or she should undergo a pre-symptomatic genetic test. The test appeared to be relevant because of an affected family member.

Data analysis: The interviews were recorded and imported as audio files into the software Atlas-ti (Murh, 2006). Student considerations were extracted from their answers and classified according to the three types of considerations reported by Sadler and Zeidler (2005). Rationalistic considerations included arguments concerning the severity of disease conditions, the possibilities of modern medical treatment, the calculus of probabilities, etc. Reasoning was considered to be intuitive when a student immediately knew how to act, whether to approve something or not, and when a student referred to a *prima facie* duty. As mentioned before, for the case of emotive reasoning, we added basic emotions to Sadler and Zeidler's care-based emotions. The interrater reliability of the coding of the three types of considerations was checked by comparison with the coding of 20 interview fragments by a research colleague (Cohens Kappa = 0.89).

Study 2: Teacher expertise

Participants: For the exploration of teaching expertise, nine experienced biology teachers from eight different schools with an average teaching experience of 20.1 years were interviewed. Three of the nine were female, six male. Two worked at vocational schools, two in pre-university classes, and five at schools with vocational and pre-university education. Five worked at schools with a religious denomination, four at public schools.

Research instruments: The teachers were interviewed

using a semi-structured interview. In face-to-face interviews they were questioned about their perceptions of student reasoning, whether and how they addressed moral reasoning in their lessons and how they promoted moral reasoning in their classes.

Data analysis: The interviews were recorded and fully transcribed. They were imported as word files into Atlas-ti (Murh, 2006). The statements were analysed in a single case matrix (Miles and Huberman, 1994). The teachers' categorisation of students' considerations was classified according to the three considerations reported by Sadler and Zeidler (2005). The interviews of the teachers were analysed according to: self-reported knowledge and the application of the main concepts of our theoretical framework on moral reasoning; whether they paid attention to the different kinds of considerations or not; and the (unintentional) use of elements of Haidt's SIM. From their utterances we tried to induce a description of their teaching profile, the conditions they reported necessary for moral education, and the activities undertaken concerning moral reflection with their students.

Results

Study 1: Student reasoning

Self-reported considerations

None of the students reported the use of all three types of considerations in their reasoning. On being asked, 53% of the students reported that they acted on the basis of emotive considerations, or 'their feelings' as they put it. 20% thought they mainly used rationalistic considerations, or 'their head', and 26% said that they used both kinds of reasoning. None of them said that intuition was the main source.

Actual considerations

In line with the findings of Sadler and Zeidler (2005), all 15 students showed the three types of considerations in their reasoning (especially when their argumentation was longer) no matter what their self-reported reasoning had been. We will exemplify this with a quote from a student who mentioned only emotive reasoning in her self-reporting but, when discussing the dilemmas during the interview, used the other types of consideration. The quote deals with preventive mastectomy.

> Interviewer: *"What do you think about it?"*
>
> Student: *"Well, actually I think it is a bit of a nonsense."*
>
> Interviewer: *"Because?"*
>
> Student: *"Because you don't know actually whether you'll get it or not. For women it is important, after breast surgery you don't feel at ease, not feminine any more…. So I think it is a little bit…it is nonsense to operate upfront…the fear for it, for the uncertainty is a bit exaggerated because perhaps you will never get it. And when you get it, you can always try to operate then. To do it upfront, I think is a bit exaggerated."*

The student used care-based considerations (women not feeling feminine any more) and basic emotions (they fear it). But she also used rational reasoning by using logic (when you get it, you can always operate then).

> Interviewer: *"So you have heard about children with Downs Syndrome. Some people say that they are welcome, they let them be born. Others say: 'Well, first I want to think about that thoroughly'. What do you think?"*
>
> Student: *"I would let it be born, if it was my child."*
>
> Interviewer: *"……yes…"*
>
> Student: *"Not only do I know something about Downs children, but it would be my child! I will not let it be taken away; it would be my child."*

Here she used a rationalistic and an intuitive consideration. Because she knows something about children with Downs Syndrome she would let it be born; for her, this is empirical knowledge. This was labelled rationalistic reasoning. But the other strong motive was: "I will not let it be taken away; it would be my child". A consideration she did not explain further, as for her it did not need any further explanation. This was labelled intuitive reasoning because of the underlying *prima facie* value of non-injury.

Study 2: Teacher expertise – the experienced teachers

Teachers' view on student reasoning

The nine experienced teachers mentioned two different ways of student reasoning: rational and emotional considerations based on 'feelings or intuition'. Conceptually, none of the teachers differentiated between emotive and intuitive reasoning.

Reasoning in the classroom

Although the teachers all recognised two different types of reasoning, only one reported that she took these differences into account. She explicitly accepted the implications of emotive considerations.

> Teacher 5: *"Your feelings tell you very clearly whether you are doing wrong or right. But you can always use some rational reflection."*

However, in the conceptual framework we use, this moral guideline for appropriate behaviour based on 'feelings' would be labelled intuitive.

During classroom discussions and debate, all teachers reported that they reflected on the quality of rationalistic reasoning. Three of them mentioned the role of emotions.

Teacher 4: *"Emotions can block rational reflection about a possible decision."*

Although the teachers were aware of the different kinds of reasoning, this knowledge did not resonate in their choice of learning activities concerning moral reflection. At best, they started the lessons with narrative activities (video, case studies) to elicit care-based emotions like empathy, in order to get their students motivated.

The practice of promoting moral reasoning

The teachers could be roughly divided into two groups. Five out of the nine teachers started from the idea that the moral development of students was a personal constructive process, best stimulated in a social context. Student motivation was a central concept in their thinking.

> Teacher 1: *"A good context is simply something that gets my students involved … I'm convinced that when it is relevant, it will lead to motivation, to more attentive students, and to better learning."*

On average, these teachers used 16 different learning activities in their genetics lessons, varying from practicals and movies, to role play and debate. They reported that they used narrative activities like stories, films or personal experiences of their students to evoke empathy.

> Teacher 1: *"Empathy leads to involvement and motivation."*

> Teacher 4: *"Empathy enables students to change perspectives."*

They were supporters of activating teaching methods and used elements of cooperative learning. These teachers stressed the importance of the interpersonal perspective. They repeatedly (3 to 8 times) mentioned a safe atmosphere in the classroom and good relations with their students as essential preconditions for teaching about moral issues. Although the teachers included discussions about moral dilemmas in their biology lessons, they did not refer to the importance of liked and respected group members in moral reflection. Neither did they explicitly take emotive or intuitive reasoning into account. Even unintentionally, they did not use any elements of Haidt's SIM.

The other four teachers talked about the transfer of values. They stressed more often which values were worthwhile. Student inspiration was a central concept in their thinking.

> Teachers 5 and 6: *"Sometimes when I think it is necessary I take the Bible and say: 'Let's see what the Bible tells us to do'."*

These teachers used an average of seven different learning activities during their genetics lessons. Reading and working with a textbook had a prominent place in their lessons, next to storytelling and class discussion. One of these teachers explicitly mentioned emphatic involvement as a key factor; the others intuitively made use of this effect:

> Teachers 5, 6 and 7: *"Personal experiences are often a starting point in lessons."*

A safe atmosphere in the classroom and good relations with their students were also mentioned by these teachers when they were asked for the essential conditions for teaching controversial or moral issues. However, compared to the interviews with their colleagues mentioned above, these conditions played a minor role. They referred to them only once or twice.

These teachers did not report planned moral reflection, but spontaneous class discussions with moral dimensions. Neither did they use any elements of Haidt's SIM.

Conclusion and discussion

What kinds of reasoning do students use regarding controversial genetics issues prior to formal genetics education and what is the practical knowledge of experienced teachers about the moral reasoning of their students? Can we answer these questions now?

From the interviews we learned that all students used emotive and intuitive reasoning as well as rationalistic reasoning, although they were not aware of this. Neither the students nor the teachers conceptually made a clear distinction between emotive and intuitive reasoning. The teachers did not translate their knowledge of student reasoning explicitly into their pedagogical approach. Teachers did use care-based emotions like empathy for motivational goals, and empathy was also used to change student perspectives.

The teachers differed in the ways in which they promoted moral reasoning. Some represented a more constructivist approach, others a more classical approach (i.e. playing a more central role in the learning processes). Differences between these two approaches included the number of learning activities applied and how much the teachers directed the students in identifying which values were important. All the teachers agreed on the importance of a safe atmosphere in the classroom and good relations with their students for teaching moral issues.

The occurrence of the three types of considerations in student reasoning is in line with the findings of other researchers (e.g. Dawson, 2003; Sadler and Zeidler, 2005). However, our study differed from those in the fact that we suggested extending the classification of Sadler and Zeidler. We added basic emotions to emotive reasoning and *prima facie* duties to intuitive reasoning. Because we found both kinds of considerations in students' reasoning, we consider these results to be an affirmation of this refinement of the classification.

Although experienced teachers do not explicitly reflect with their students on emotive or intuitive considerations in moral issues, this study indicates that there are reasons to do so if we want to improve student reasoning through the teaching of science. Recent findings in neurobiology and psychology presented in this article provide arguments for a more prominent role for intuitive and emotive considerations in moral reflection. However, the fact

that neither the students nor the teachers conceptually made a clear distinction between emotive and intuitive reasoning made us aware that there are still some questions about the appropriateness of a strict distinction between these two types of reasoning for reflection on moral reasoning in the classroom.

Haidt's SIM appears to be an interesting possibility for improving moral reasoning. This promising model is one of the rare suggestions found in the literature discussed in this article.

Educational implications

The new insights into moral reasoning indicate that it is important to develop teaching and learning activities in which intuitive and emotive reasoning, as well as rational reasoning, are taken into account and that we accept the (partly) emotional basis of intuitions. It is also important that these findings are used to shape the feedback of respected peers and teachers to students. This could take place through learning activities that prompt students to inspect their subjective conceptions of a given situation or dilemma and to consider alternatives; or activities that invite them to look for the values behind their emotions, to reflect on other possible values and perspectives, and that ask them to subject their intuitions to rational scrutiny, e.g. based on relevant biological or medical information. In short, these findings can be used to aid moral reflection so as to teach the students how to improve their moral reasoning and, by doing so, empower them for dealing with future moral dilemmas such as those concerning genetic testing. To the best of our knowledge, this kind of reflection on moral reasoning is not currently being practised in secondary education.

There are still some questions about the appropriateness of a strict distinction between emotive and intuitive reasoning for reflection on moral reasoning in the classroom. These classifications proved to be helpful in a research setting and can make teachers who want to supervise moral reasoning more aware. But nevertheless, the distinction might be too complicated for student use.

We will continue our research with a focus on the design, implementation and evaluation of learning activities based on the ideas behind Haidt's SIM, starting from the premise that students already have an (intuitive) opinion before controversial moral dilemmas are discussed.

After listing relevant biological concepts and dilemmas in genetics testing practices, a team of biology teachers will translate these insights into their educational practice. These teachers will be monitored in order to describe the expertise they develop during that learning process and the kind of activities that contribute to their learning outcomes. Attention will be paid to the interpersonal perspective and the pedagogical climate. Hopefully their students will come to consider the teachers trustworthy enough to be persuaded to reflect on their moral reasoning and learn from that process.

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