Introduction

In recent years the mathematics education research community has been showing a greater interest in the linking of mathematics education with values (Bishop 1999; Bishop, Seah and Chin 2003), broader educational purposes (Heymann 2003), social justice (Gutstein 2006), and citizenship education (Skovsmose 1998). These developments have sought to shift perspectives on the nature of mathematics and mathematics education away from the view of mathematics as a "depersonlized, uncontextualized, non-controversial and asocial form of knowledge" (Brown 1996, 1289) towards a view of mathematics as fallible (Lerman 1990; Ernest 1991) and humanized (Hersh 1997; Lakoff and Núñez 2000). These concerns reflect our understanding of the shifting, political nature of knowledge and of how schools will need to respond to these shifts in the future. Indeed Hoyles et al. (1999, 3) predicted that "mathematics education in the third millennium will not just be about teaching and learning mathematics, but about the nature of knowledge and the place of mathematics within society". There is still some way to go in realising the second part of this description in mathematics classrooms.

In acknowledging the interplay between mathematics and human experience we begin to understand how mathematics works in, and on, society. Mathematics \textit{formats} (Skovsmose 1994), in a variety of ways, both the people and processes that make up the modern social world. In that sense it is a powerful subject and is, as Warnick and Stemhagen (2007) have recently argued, a \textit{technology}. This technology is deployed by Western governments as part of a core curriculum that seeks to further the aims of advanced liberal democracies. Moreover, as a technology, its use is always tangled up with moral questions. It is important for mathematics
educators to appreciate this role of (school) mathematics so that in turn learners can come to appreciate how mathematics works in society. If such a shift is to translate into actual educational practice in schools, it seems clear that certain political, socio-cultural and curricular conditions need to be in place (Noyes 2007). Such changes are hugely complex and politically sensitive, and this paper seeks to make sense of the challenges that are faced by educators wanting to move in this direction, towards Hannaford’s description of mathematics as “not so much a rational as a moral adventure” (1998, 186).

These broad concerns underpin the specific aim of this paper, which is to explore how moral education can be understood and might be developed in mathematics classrooms. Although there is a social/cultural dimension to school mathematics there is a great deal of similarity in mathematics education systems around the world. This homogenising effect has been brought about in part by recent international comparisons, e.g. TIMMS, and PISA, and the resulting efforts by governments to maintain position in what might be seen as an international skills race. However, the various forms of educational governance in these same countries also contribute to the formation of notable differences in classroom experiences of learning mathematics. In examining these differences we can see possible opportunities for and hindrances to developing moral education. Drawing upon our experiences of mathematics education in Canada and England, we want to highlight the challenges and possibilities facing mathematics educators who might want to develop a moral education dimension in their classrooms and how those challenges and possibilities are shaped in and by different contextual conditions of teaching mathematics.

In order to investigate moral education in the mathematics classroom we will first of all argue for a certain view of mathematics education and its role within the school curriculum. Having outlined our position amongst the contested philosophies of mathematics education we then turn our attention to what we mean by moral education. It is clear from the policy and scholarly literature that there are different notions of moral education argued for and different realisations of moral education in practice. Using our conceptual framework, we then present an analysis of the potential for engaging in intentional moral education in the mathematics classrooms of England and Canada. This notion of intentionality is an important one, and so we will consider whether or not, and in what ways, curricular documents and education policy explicitly address moral education in the mathematics classroom. This consideration of the possibilities for moral education needs to be grounded in the wider realities of schools. The two cases will, therefore, locate mathematics education in a broader understanding of the social, cultural and political contexts of schooling in these two countries. We consider the extent to which the conditions of learning school mathematics as they are framed by the mandated
curriculum, school policies and teaching practice allow, or inhibit, the development of moral education in the mathematics classroom.

**Perspectives on the Nature of Mathematics and on Mathematics Education**

Before considering how moral education might be developed in mathematics classrooms we want to briefly outline the affordances and constraints of two different perspectives on mathematics and mathematics education: absolutism and fallibilism (Lerman 1990; Ernest 1991). These two positions represent two sets of beliefs about mathematics (education) as discovered or invented, authoritative or contested, dehumanised or human activity, amoral or value laden, and so on. These different beliefs make possible different groups of classroom practices. Teacher beliefs are of course complex and so here we use this artificial dichotomy of absolute versus fallible for the purposes of considering the conditions for moral education in mathematics classrooms. In focusing on mathematics classrooms we need to remember that these classrooms are not independent of the broader school and social cultures in which they are situated.

Labaree (1997), according to Mcbeath (2004), outlined three different models of school purpose: democratic equality, social mobility and social efficiency. Mathematics education would typically be identified with the second and third of these purposes; mathematics is apparently needed to ‘get on’ in life and for social and economic efficiency. Governments worldwide proclaim the necessity of a mathematically well educated workforce for future economic prosperity (Wolf 2002). As the standard political tool for international educational benchmarking, school mathematics is instrumental, decontextualized, de-humanised, and it is these values that are now reinforced, often unwittingly and without resistance, in the mathematics classrooms of many countries. This relationship is not causal but rather the long-held and dominant ‘romantic’ view of mathematics has allowed it to be used in such ways, “contributing to the social and economic stratification of society” (Lakoff and Núñez 2000, 341). So school mathematics, of central importance in the global education rhetoric of ‘advanced liberalism’ (Ball 2007) has reinforced its status as the ultimate educational ranking device and the gatekeeper to learning and life opportunities (Volmink 1994). Those absolutist, authoritarian views of mathematics which make this possible, coupled with its ongoing pre-eminence as a social sorter, militate against certain types of practices developing in classrooms. Critiques of this mathematical hegemony (for example, Bramall and White, 2000) are not always met with open minds; so politics and power become entangled with children’s classroom experiences of mathematics.
However, another set of perspectives on the nature of mathematics and on mathematics education are more conducive to serving moral education as a purpose of schooling. If we take the view that mathematics is a human endeavour, and therefore fallible, alternative possibilities open up. As we said above these different positions are not simply views on mathematics education per se but reflect the contested nature and purpose of schooling in general.

In many countries small groups of mathematics educators have developed and described alternative mathematics education practices that can flourish under the broad notion of mathematics as fallible human activity. Despite the varied descriptions of this work (e.g. critical mathematics, mathematics for social justice, critical mathematical literacy, mathematics as general education) these projects have a common premise, namely that mathematics is a human endeavour. These different perspectives acknowledge the social role of mathematics (and therefore mathematics education); its formatting of many aspects of life (Skovsmose 1998) and its embodiment of values (Bishop 1999; Bishop, Seah and Chin 2003). Mathematics education incorporates a range of social practices that need to be understood and critiqued. Gutstein (2006) talks of ‘reading and writing the world with mathematics’ and of the need to develop both pedagogies of access and dissent. Gutstein is one of a group of US educators developing critical pedagogies (Gutstein and Peterson 2005) including what Marilyn Frankenstein (2005) calls critical mathematical literacy. Ole Skovsemose’s (1994; Skovsmose and Valero 2002) work on critical mathematics education in Denmark is well known and in Germany Hans Werner Heymann’s (2003) thesis on mathematics as part of a general education aroused considerable discussion. In the UK many have argued for a rethink of the curriculum (Ernest 2004; Gill 2004; Noyes 2007) that might lead to more socially just learning (Povey 2003).

These approaches to the construction of curriculum demand a range of pedagogies not traditionally seen in mathematics classrooms. More inclusive and collaborative classroom cultures impact upon the moral agency of students (Boaler 1997). Hannaford (1998) sees mathematics education as essentially democratic and yet this view seems antithetical to the hierarchical tendencies of competitive, ranking, sorting, absolutist mathematical beliefs. In the same vein Nel Noddings (1993) argues that mathematics classrooms should be politicised with students taking a more central role in what and how they learn.

All of these perspectives could be brought together under the heading of democratic education, although admittedly such a notion is inflected differently in the range of countries, schools and classrooms. Such a democratic education is itself closely related to what we describe here as moral education. Under Ernest’s (1992, 36) categories of mathematics teacher motivations many of those represented above would be included in the ‘public educators’ group, representing “a radical reforming tradition, concerned with democracy and social equity.” So, in
Labaree’s (1997) terms, understanding mathematics education as contributing to an aim of democratic equality is a good starting point for considering what Hannaford described as the “moral adventure” of doing (school) mathematics:

wherever [mathematics] uses its original habit of open and critical discussion, as if between equals, it demonstrates the power of democracy to reach into the heart of problems, to eliminate obscurantism, to combine people's energy and courage, and to produce the solutions that all eventually can accept...This is what mathematics does. And this is therefore what it is: not so much a rational as a moral adventure. (Hannaford 1998, 186)

We believe that the teaching of school mathematics can and should contribute to the moral development of students; but what are the connections between moral education and mathematical school education? The next section addresses this question from a theoretical point of view.

**Moral Education and Mathematical School Education**

The argument for the moral purpose of schooling, and therefore of moral education, is quite consistently expressed in the academic literature (Dewey 1975, Goodlad et al. 1990; Noddings 1992; Hansen 2001; Cambell 2003) as well as in literature directed more at the teacher practitioner (Lickona 1991; Borba 2001; DeRoche and Williams 2001; Gootman 2001).

Connections between mathematics education and moral education, however, are rarely found in the literature (for some exceptions see Güting 1980; Wicks 1981, 1982; Heymann 2003; Falkenberg 2006). Although the ‘public educators’ referred to in the previous section do not frame their respective scholarly work within the context of moral education, we see many aspects of what we consider the moral purpose of schooling and moral education to be already raised and discussed by them. We want to more explicitly define our view of the moral purpose of schooling and argue for a link between this view and the larger purpose of mathematics education as we see it: the larger purpose of mathematics education is grounded in the moral purpose of schooling.

We understand schooling to be primarily about helping students develop as human beings with moral agency within a particular socio-cultural and political context. At the same time we understand mathematics to be a fallible human endeavour. This view of mathematics as a human endeavour is embedded in the idea that moral agency is a particular central aspect of being human (Taylor 1985; Hill 2001), and it is moral education that helps develop (further)
students’ moral agency. We want to conceptualize our view of moral agency and, thus, of moral education through the notions of ‘moral understanding’ and ‘moving ideas’. For the first notion we draw on Mark Johnson’s (1993, 1996, 1998) work and for the notion of ‘moving ideas’ we draw on John Dewey (1975).

Moral agency is centrally characterized by a level of moral understanding. Following Johnson (1993, 1996), moral understanding means to be morally insightful and morally sensitive. The former is to capture the need to understand our functioning as human beings in general and as human agents in particular, to be able to discriminate, envision new possibilities and imaginatively explore the implications of our particular biases, judgments, convictions, and so on, and to have insights into how socio-cultural and political environments affect our functioning as moral agents, can enable or constrain human and societal development and flourishing. Being morally sensitive in Johnson’s (1993, 1996) sense means to have empathic imagination, that is the ability to

put ourselves in the place of another, [to] enlarge our own perspective through an imaginative encounter with the experience of others, [to] let our own values and ideals be called into question from various points of view.

Moral education, then, has the task of developing moral understanding in learners, thus, helping them to become morally insightful and sensitive.

In the sense of hermeneutical perspectivism (Gadamer 2003), our moral insightfulness and sensitivity, in other words, our moral understanding has to be grounded in a ‘perspective on the world’. It is only on the ground of what we bring with us in terms of our biases, judgments, convictions, and so on that we are able to be morally sensitive and insightful. Dewey’s (1975) notion of ‘moving ideas’ captures the idea that a moral orientation is necessary to frame our moral understanding. The idea of a (necessary) ‘moral orientation’ is the second central characteristic of our view of moral agency.

Dewey (1975, 2) suggests that the central task of schooling is the intellectual development of students, which is a moral endeavour, because

the business of the educator – whether parent or teacher – is to see to it that the greatest possible number of [intellectual] ideas acquired by children and youth are acquired in such a vital way that they become moving ideas, motive-forces in the guidance of conduct. This demand and this opportunity make the moral purpose universal and dominant in all instruction – whatsoever the topic.
Following Dewey, we see the development of intellectual ideas as centrally a moral endeavour. We want students to appropriate intellectual ideas in such a way that they do guide (move) them in their responding to and acting in the world, which, then, means that we want those intellectual ideas to affect students’ moral agency, their moral understanding.

Moral education is about helping students to develop their moral understanding. Dewey contributes to our notion of moral education not just by saying that students’ development of intellectual ideas is to be part of moral education but also by arguing that a central normative element in moral education consists in the questioning of what intellectual ideas should become ‘moving ideas’ that guide students’ engagement in the world.

The question, then, is “What ‘moving ideas’ would we like to see guide human moral agency?” Following our discussion in the previous section, these should include

- the idea that power in society can and should be questioned and needs to be critiqued;
- the idea that societal conditions contribute to the possibilities and constraints of individual and societal development and flourishing;
- the idea that a democratic social structure needs to include equality (democratic equality) and social justice.

We consider engagement with such issues as power, (in)equality and democracy to be of central importance in (moral) education, and this applies equally to mathematics education. Bramhall (2000) draws on Gadamer’s work to argue that mathematics (a utilitarian subject about ‘means’) should not be prioritised over those curriculum areas which are essentially about human ‘ends’ and the moral decisions that lead to those ends. However, if we take school mathematics to be something different from the mathematics of the academy, transformed by their differing sets of related cultural practices - what Popkewitz (2004) calls an alchemy - we might see how school mathematics education can engage purposefully with the life-worlds of young people and so be concerned with both means and ends.

In addition to the more general moving ideas in (mathematics) education just discussed, there are further mathematics-specific ideas that support those general ideas and, thus, the development of students’ moral understanding. We would like to mention three.

As Warnick and Stemhagen (2007) argue, mathematics is not morally neutral, and, following them, we suggest that this idea needs to become a moving idea in the teaching of mathematics. Engaging with mathematics, Warnick and Stemhagen (2007, 306) argue, means modeling reality through simulation. Mathematics is then inherently non-neutral because “such representations must leave out certain aspects of what is being represented. Indeed, this ‘leaving-out’ is precisely what makes the simulation useful.” (Warnick and Stemhagen 2007,
The choice of what is left out in considering a mathematical simulation of reality is a moral choice. For instance, choosing problems that have just one right answer or problems that leave non-quantifiable aspects of the larger context of the problem unconsidered (like emotions) will expose students to mathematical moving ideas that might shape the way in which students are guided in their approaching of real-life problem situations – although these would not be moving ideas we would argue for.

With Warnick and Sternhagen (2007, 311-312) we argue also that mathematics education needs to explore “the limits of the quantification model as a general model of problem-solving...Students need to become reflective about how problems can be conceptualized in many different ways.”

While Warnick and Sternhagen focus on the limits of the quantitative approach to problem solving as a moving idea of mathematics, Gutstein (2006) argues that the quantitative approach of mathematics can provide a powerful tool to uncover social injustice by quantitatively analysing real-life situations. We see this as an important mathematical idea to be made into a moving idea through the teaching of mathematics. For instance, comparing cost and size of houses by race (Gutstein 2006, 44) allows students to use quantitative tools to see correlations related to justice issues that they otherwise might not have seen.

Analyzing the Conditions and Possibilities for Moral Education in Mathematical School Education

Having explored the notion of moral education and of some of the wide ranging views of mathematics education we now begin to describe the teaching contexts in which the ideas that we are exploring might be developed. A comparison of the Canadian and English contexts allows us to see the similarities and differences between two systems, highlighting the affordances and constraints in each country. What we are trying to do here is outline the commonly found traditions and dominant policies which help to shape typical encounters in mathematics education. The cases are necessarily brief and are constructed so as to lead into the discussion of the future possibilities for moral education in Canada and England.

This turn in our argument from theory to practice presents us with a challenge. Moving from the rich scholarly debates above to the realities of classroom experiences seems to us like a big step. Nevertheless, in order to bridge that gap between what we have discussed above and what currently happens in classrooms we believe that it is important to look for potential bridging points and places at which aspirations and realities might meet.
Case I: Canada

To investigate the conditions (possibilities and constraints) for moral education through the teaching of mathematics in Canada we are analysing two aspects of the Canadian educational context: the schooling context in general and the curricular context in particular.

Our analysis suggests that enacting moral education through the teaching of mathematics is reasonably possible within the general schooling and curricular context for teachers in the Canadian school system, although the development of students’ moral agency and the addressing of the suggested moving ideas are not explicitly conceptualized as part of mathematics education in any of the contexts here considered. We can argue this from exploring two dimensions of Canadian mathematics education.

The Schooling Context. Canada has ten provinces and three territories. Formal education at all levels, primary to tertiary, falls under provincial and territorial jurisdiction, respectively. School curricula are mandated at the provincial or territorial level, though schooling is administered and teachers are hired locally at the level of school divisions (school districts). Legislation allows for provincial intervention in defined situations. The responsibility for monitoring the implementation of the provincially mandated curriculum lies with the school divisions with the exception of province / territory-wide mandated and ministry-designed summative examinations (see below). Let us consider this framework at another level through provincial school acts, standardized examinations, and resources and practices suggested for classroom teaching by some ministries of education.

Although schooling is administered at the local, school-board level, it is provincial school acts that legally frame this administration. There are some school acts that articulate a general purpose of the school system, while others solely deal with administrative matters. An example for the former is the school act of the province of Manitoba. In it the provincial government lays out the role and the purposes of the education system:

A strong public school system is a fundamental element of a democratic society.
. . . the purpose of the public school system is to serve the best educational interests of students . . . the public school system should contribute to the development of students’ talents and abilities . . . public schools should contribute to the development of a fair, compassionate, healthy and prosperous society

(Manitoba Ministry of Education, Youth and Citizenship n.d.)
From the perspective of Canadian school acts, moral education through the teaching of mathematics as understood in the previous section is at least a possibility in the sense that none of the acts excludes moral education in principle. Those school acts that have a preamble of the type the province of Manitoba has, in addition, invite – at least in principle – a dialogue about the interpretation of what the specific articulated general goals of public schooling mean in terms of the intended curricula and teaching practices. In particular, the position that “a strong public school system is a fundamental element of a democratic society” and that “public schools should contribute to the development of a fair, compassionate, healthy and prosperous society” allows serious consideration to be given to the role of moral education in schooling, even for the form of moral education suggested by us in the previous section.

Because it can be safely assumed that standardized examinations have an impact on what and how teachers teach their respective courses, looking at the different types and forms of standardized examinations is important for the purpose of this paper. Four types of such standardized examinations used in Canada: provincial summative examinations; provincial formative examinations; divisional summative examinations; and school summative examinations. Of those the three summative examinations are of particular interest to us.

Most provinces use provincially designed and administered summative standardized tests for their grade 12 mathematics courses (grade 12 is the final year of general schooling in Canada). These final exams contribute a particular percentage to the final grade for students in the respective mathematics course. In some provinces the examination results are reported separately from the course mark on the report cards. In addition, there are common school-based final exams in each school for most academic subjects. Such final exams are sometimes designed at the school division level.

These types of high-stakes standardized tests have a particularly constraining impact on teachers’ capacity to implement moral education through the teaching of mathematics. Since the development of students’ moral agency is not explicitly part of the mathematics curriculum in any of the Canadian jurisdictions (see the discussion below), any moral education through mathematics teaching will, thus, be constrained by standardized tests of the types described. However, since such external, standardized tests are limited to just a few grade levels – generally grade 12 – moral education can be given serious consideration in the implementation of the mathematics curriculum in Canada.

The provincial curricula are mandated for implementation, but in addition some provincial ministries provide suggested educational material or ideas for classroom teaching practice. Below are two examples that are relevant for the purpose of this paper to illustrate how two provincial educational authorities promote moral education in a wider sense in schools.
The British-Columbia Ministry of Education offers for voluntary implementation for grades K-10 the *Social Responsibility Performance Standards* (British Columbia Ministry of Education 2001). These standards articulate “expectations for student development” (p. 4) and are intended to provide teachers with a rubric to assess their students in four areas: contributing to the classroom and school community, solving problems in peaceful ways, valuing diversity, valuing diversity and defending human rights, exercising democratic rights and responsibilities. The developmental hierarchy shows direct influence of Lawrence Kohlberg’s (1987) hierarchy of cognitive moral development stages. Recently, the Ministry has added a voluntary “Citizenship and Social Responsibility Survey” to be used by school divisions (http://www.bced.gov.bc.ca/citizen_survey).

In Ontario, the most populous province in Canada, the Ministry of Education has recently started a Literacy and Numeracy Strategy, which has as part of it the province’s “character development initiative”:

The goal of the Character Development Initiative is to develop school environments in which all people - students, teachers, administrators and support staff - treat each other with care and respect. Specific goals include:

- Improved academic achievement
- Improved interpersonal relationships
- Safe and orderly schools
- Reduced behavioural problems
- Improved life preparation
- Improved employability skills
- Positive school cultures
- Responsible citizenship in classrooms, schools and communities”

( Ontario Ministry of Education n.d.)

Both initiatives suggest an explicit interest by the respective provincial governments in moral education or moral development. Teachers are encouraged to include aspects of moral education as part of their educational engagement with their students. However, in contrast to what we have suggested in the previous section, such engagement with the moral aspect of students’ development is not expected to be integrated into the subject matter teaching.

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1 The current premier of the province of Ontario has explicitly committed the Ontario school system to ‘character education’ (McGuinty 2003). See also Winton’s (2006) rhetorical analysis of the character education talk in one particular school division in Toronto.
particular, not into the teaching of mathematics. Furthermore, the purpose of moral education / development is in both cases quite different from what we have suggested for it in the previous section. Although it can be well argued that the aspects of human performance assessed in the British Columbia performance standards for social responsibility are grounded in central aspects of the moving ideas we suggested in the previous section, British Columbia’s initiative is only concerned with – as we might say – the assessment of the degree to which those ideas are indeed guiding students’ conduct, but not with the explicit development of those ideas as moving ideas in students. Also, the performance assessment is very much grounded in a behaviouristic framework and, thus, is less concern with ‘moral understanding’ as we understand it. The focus of the Ontario initiative is on “safe and orderly learning environment”, and character education is here understood as having students socialize through adaptation into the already established order and structure of a given school culture. This socialization notion of moral education is quite different from the one we have suggested in the previous section. Also, the notion of “character development” in the Ontario initiative is quite wishy-washy if “improved employability skills” and “improved academic achievement” are considered to fall under character development.

At the same time, both governmental initiatives show that in the Canadian school context moral education as we characterized it is indeed a possibility that can be seen as being supported by the two example governmental initiatives. The goals of “improved interpersonal relationships, “improved life preparation”, and “positive school culture” in the Ontario initiative can be directly connected to the moral moving ideas and the moral understanding we described in the previous section if those goals are interpreted as going beyond socializing students to function well in the already established social structure rather than to develop moral understanding that at times might provide the rationale to work against that established social structure. In the case of the performance standard assessment initiative in British Columbia, we see the provision of an assessment tool for students’ moral development as an indirect invitation to respond to the question of how schooling can influence students’ “social responsibility performance”. Our paper responds to such an invitation.

The Curricular Context. As mentioned, in Canada the curricula are written and mandated at the provincial level, though the implementation responsibility lies with the local school divisions. Because the curriculum, which lays out the learning objectives for students to achieve, is mandated, it is no understatement to say that the curriculum has the biggest impact on the content of the teaching of mathematics in Canada.

In December 1993 the four western provinces of Canada and the then only two territories have signed The Western Canadian Protocol for Collaboration in Basic Education Kindergarten to
Grade 12\(^2\) (later WNCP), signed on to the Protocol in February 2000. The main purpose of the WNCP is to provide a negotiated common K-12 curriculum framework for the signatories to the Protocol. Currently, there are curriculum frameworks in place for English language arts, international languages, mathematics, and social studies. The Protocol allows each signatory jurisdiction to implement the commonly negotiated frameworks in the way they see fit or not to implement them at all. A recent survey among the Protocol signatories has established for the then current K-12 WNCP Mathematics Framework (Western Canadian Protocol in Collaboration in Basic Education 1995-96) a self-declared 80-100% rate of implementation (McAskill et al. 2004, 119), with the exception of grades 8 and 9, which have a self-declared implementation range of about 67-92%.

Of particular interest for our analysis is the introduction section of the Curriculum Framework for Mathematics ("the Framework") in which the goals and the conceptual framework for the learning of mathematics, as well as assumptions about students as learners of mathematics, are articulated. After having listed the goals of mathematics education, the Framework lists "critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and encourage lifelong learning in mathematics" (WNCP 2006, 6). One such "critical component" is given as follows (WNCP 2006, 6-7):

> Students are expected to: . . . connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines . . . . When mathematical ideas are connected to each other or to real-world phenomena, students can begin to view mathematics as useful, relevant and integrated . . . . Learning mathematics within contexts and making connections relevant to learners can validate past experiences, and increase student willingness to participate and be actively engaged.

Of course, such real-world connections can be limited to calculating the fuel consumption on a vacation trip if the fuel consumption ratio of the car is known or to calculating the trajectory of a basketball thrown by a student in a game, but the "critical component" of connecting mathematical ideas to everyday experiences does allow to go beyond these kind of real-life connections and integrate intellectual ideas discussed in section two and make them moving ideas for students – and thus, have mathematics education contribute to the development of

\(^2\) The Western Canadian Protocol for Collaboration in Basic Education Kindergarten to Grade 13 was renamed to the Western and Northern Canadian Protocol for Basic Education (WNCP) when Nunavut – a territory newly created in 1999 – joined the Protocol.
students’ moral understanding. For instance, it is at the heart of Gustein’s (2006) approach to a pedagogy for social justice in the teaching of mathematics that students are – as the curriculum says – “making connections relevant to [them]”.

In our analysis of the general schooling context for the teaching of mathematics we have argued that this context does not explicitly link mathematics education with moral education. The same can be found for the curricular context. However, similarly as in the case of the general schooling context, the Framework does provide room for developing moral understanding and moving ideas of the type we suggested in the teaching of mathematics.

While the curricular learning outcomes which teaching is to help students achieve are mandated for Canadian teachers, instructional components of curricular documents have only the status of suggestions or recommendations: instructional suggestions of learning activities to help students achieve the respective learning outcome, assessment suggestion of ways to assess student learning with respect to the respective learning outcome, and recommended learning resources relative to the respective learning outcome. This professional autonomy in the realm of instructional decisions by the classroom teacher provides for a crucial condition of an integration of moral education into the teaching and learning of school mathematics.

Case II: England

Unlike the Canadian provincial education system, England (and Wales) has had a National Curriculum (NC) since the late 1980s. The centralisation of the education curriculum and the standardised national assessment of progress against this curriculum that has grown since the early 1990s has had a major impact on the ways in which mathematics education in England has been developed in recent years. So, whereas the NC mandated curriculum content for all school learners, the National Numeracy Strategy (in primary schools) and Framework for Teaching Mathematics (influential in secondary schools since 2000) moved beyond framing curriculum to include clear directions for pedagogic practice. At one level this brought a range of new pedagogic tools into many classrooms: counting sticks, number fans, mini whiteboards, etc. In addition, three-part lessons became commonplace, each including a 10 minute starter activity, a main activity and a concluding plenary. No doubt such a lesson structure might be used effectively, but the formulaic way in which many teachers responded has been limiting and has had the effect of creating a rather monotone teaching palate in some schools. Moreover this malaise has extended well beyond the walls of the mathematics classroom so that for a time learning became more consisent but more predicatable. These new aproaches brought with them a set of discourses which have been quickly adopted by teachers but have arguably had little effect on the underlying culture of many mathematics classrooms.
The core subjects of the NC in England are mathematics, science and English. Despite considerable development this curriculum has remained influential, and many would say constraining, since its inception. Only now, nearly twenty years later, has the Qualifications and Curriculum Authority (QCA) made a significant move to open up the potential for a more flexible curriculum for learners in the early years of secondary school.

The mathematics NC was originally atomised into 14 strands, each divided into 10 levels of attainment. The 14 strands were later consolidated into five broad content areas: using and applying mathematics, number, algebra, shape, space and measures and data handling. Shortly after the introduction of the NC a programme of national tests was established for children at the end of each Key Stage of schooling (ages 7, 11, 14, 16). The last assessment point in this series is the General Certificate of Secondary Education (GCSE) and although this is, in theory, a test of progress against the NC attainment targets the reality is that awarding bodies compete in a lucrative assessment market. For many years students who have completed their compulsory mathematics education at Intermediate level have to get around 25% of the marks in order to achieve the magical grade C that will assure them access to the full range of educational opportunities post-16.

The NC has two key principles:

- The school curriculum should aim to provide opportunities for all pupils to learn and to achieve
- The school curriculum should aim to promote pupils’ spiritual, moral, social and cultural development and prepare all pupils for the opportunities, responsibilities and experiences of adult life.

So the English NC includes an explicit reference to young people’s moral education. However, it is not all that clear what this moral education is and given that there are various ways of understanding moral education we might expect further clarification. There is a small amount of further ‘guidance’ in the mathematics NC document:

- *moral development*, helping pupils recognise how logical reasoning can be used to consider the consequences of particular decisions and choices and helping them learn the value of mathematical truth

There is an interesting assumption made here, namely that mathematics education can actually provide pupils with logical reasoning skills, which then in turn can be used in the moral domain of those pupils’ lives. There is also the assumption that moral engagement (‘moral understanding’ or ‘moral acting’) involves logical reasoning in an important way. Why should
logical reasoning used in a mathematical context transfer to a moral domain context? Moral understanding involves understanding situations and people and because mathematical logical reasoning is far simpler and ‘cleaner’ than what people encounter in a moral situations the link is not so clear.

Suffice to say, despite the mathematics NC’s lip service to spiritual, moral, social and cultural development, mathematics teachers in the UK have not been very successful in achieving these curricular goals. This advice on moral development is unhelpful and there is little more support for teachers in this regard. Relating to the aims of the NC aims Gill (2004, 115) asserts that

the current curriculum for mathematics fails to meet the claims made for it in mathematical terms and also fails to contribute to the overall ethos of the National Curriculum contained in the Aims and Values. Nothing less than a complete overhaul is necessary if it is to serve our pupils and the society they, and we, live in.

In England there is an enduring emphasis on mathematics as utility and in the light of ongoing twin-pronged national concerns about a) the supply of mathematics- and mathematics-related - graduates and b) the mathematical competence of the workforce in general, the curriculum of the future (especially the revised 14-19 curriculum) will include a compulsory qualification in functional mathematics. Despite the publication of a functional mathematics specification, the nature of mathematical functionality is still being debated in the mathematics education community. Suffice to say that utilitarian views of mathematics are tending to envisage it as a toolkit which is in some sense amoral. There is little evidence of understanding mathematics as a technology, the use of which has implicit moral assumptions.

In recent years there has been growing concern about the school curriculum in the UK; it’s overly prescriptive nature and level of relevance for the 21st Century. So the curriculum in the UK is undergoing dramatic changes (at least in theory). Following the influential government reports chaired by Tomlinson (DfES 2004) and Smith (2004) mathematics in the 14-19 age range is being overhauled in the next few years; although where it will end up remains unclear. Meanwhile, at lower secondary level there is a new curriculum that has a greater emphasis on process. However, a closer reading of these apparently progressive curriculum documents does not reveal any increased understanding of the social, cultural or moral in mathematics education:
Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the workplace, business and finance; and for personal decision-making. Mathematics is fundamental to national prosperity in providing tools for understanding science, engineering, technology and economics. It is essential in public decision-making and for participation in the knowledge economy.

Mathematics equips pupils with uniquely powerful ways to describe, analyse and change the world. It can stimulate moments of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more elegant solution, or notice hidden connections. Pupils who are functional in mathematics and financially capable are able to think independently in applied and abstract ways, and can reason, solve problems and assess risk.

(QCA 2007, 139)

Perhaps there is room here for moral consideration, ‘personal decision making’ must surely involve moral consideration and if one is seeking to ‘change the world’ (i.e. using mathematics as a technology) this too must have moral implications. However, whether and how this gets translated into classroom experiences is a moot point and one that has been discussed in the UK context (Winter 2001; Noyes 2007).

One enduring feature of school mathematics in England during these last twenty years of curriculum development is the powerful role of assessment in shaping classroom practices. Teachers at all levels have become adept at preparing young people to sit national examinations that not only impact upon learner trajectories but through publication in school league tables impact upon school trajectories and teachers’ performance management processes. So what is testable becomes of central importance to all: learners, teachers, schools, parents and government. This general surveillance of the school system and marketisation of school choice becomes even greater through the use of value-added measures that apparently show which schools are most likely to add the most value to parental investment (i.e. their children). In this culture examination success becomes paramount and teachers and learners become instrumental: outcomes count, process do not; marks speak, moral considerations are obscured. So mathematics education has become a victim of what Ball calls “the terrors of performativity” (Ball 2003).

It is easy to see how such an overemphasis on assessment – and children in England are considered to be amongst the most heavily tested in the world - can have limiting effect on the
potential for the moral, social, cultural in mathematics lessons to flourish. However, even if such a dominant testing regime were to be instantly abolished the culture that it has created would remain. Ability grouping for mathematics is almost universally accepted and supported by the bewildering array of text-books, many of which are tied to examination courses. Here again market forces dictate the way in which teachers think about their classrooms.

The underlying problem is that mathematics has been portrayed as utilitarian for a long time now and despite the efforts of a minority, who maintain a vision for mathematics education which might offer the opportunity for learners to develop moral reasoning in relation to mathematics, their voice is a relatively quiet one. Moreover, the deeply entrenched cultural view of mathematics education in England is not something that can be changed overnight (Noyes 2004). It has been recognised that there is a need in the UK for a more concerted plan for mathematics teacher professional development and the National Centre for Excellence in Teaching Mathematics has been established with such a remit. However, such professional development will have to go beyond the ‘how to’ (much of which is very necessary) and aim to develop these deeper understandings of what mathematics education should be about if there is to be a realistic hope of developing moral education in mathematics classrooms for all but a lucky few students.

Discussion

As discussed above, the moral purpose of schooling is to help students with the development of their moral agency by helping them develop moving ideas and moral understanding. Developing a moral orientation through moving ideas goes together with helping students develop their moral understanding in the sense explicated by Mark Johnson. Grounded in the view of mathematics as a fallible human activity, we have suggested three general worthwhile moving ideas that can be cultivated in the teaching of mathematics and discussed three mathematics-specific moving ideas that can support the development of these three general ones.

Such a vision of moral education is not explicitly promoted in either country through their respective authoritative documents about school purposes (school acts in Canada and the National Curriculum in England), neither is this the case for the specific mathematics curricula in both countries. What is, however, explicitly promoted in the mathematics curriculum in England is mathematics as a tool for thinking about moral issues as a contribution to students’ moral development: “helping pupils recognise how logical reasoning can be used to consider the consequences of particular decisions and choices and helping them learn the value of mathematical truth”. However, from our perspective on moral education, we see this connection between mathematics education and students’ moral development as problematic in two
respects. First, the articulated connection in the mathematics curriculum seems very artificial and uncommitted to us. Following the National Curriculum in England, which does list the moral development of pupils as a central aim of schooling, the mathematics curriculum links logical reasoning with decision making in the moral domain. However, we consider this reference to moral education quite superficial, since the mathematical learning objectives do not make any reference to how such linking is possible. How would pupils be helped to make this link and, more importantly, how would they be helped to practice and critically reflect upon the use of logical thinking in considering the consequences of their decisions and choices? The link is, thus, quite artificial and without commitment.

The second problematic aspect of the link lies in its underlying view of moral education. Two assumptions are made in making this link, both of which we consider problematic. The first assumption is that logical reasoning in the realm of ‘doing mathematics’ can be directly transferred to the realm of thinking about the (moral) consequences of one’s decisions. The literature on learning transfer provides strong evidence that in particular transfer from one experiential domain to another does generally not happen easily (Gick and Holyoak 1980; Detterman 1993); since Thorndike’s famous transfer investigations on the transferability of learning practices (Thorndike 1924), there can be much doubt about any straightforward transfer of more general skills (like logical reasoning) from one human experiential domain (like doing mathematics) to another (like thinking about the consequences of one’s decision).

The second assumption made is that the type of reasoning exemplified and practiced in the learning of mathematics is of relevance to reasoning in the moral domain. We question this assumption as well. As the talk about “the value of mathematical truth” in the link suggests, logical reasoning as envisioned in the link seems to be conceptualized from an absolutist view of mathematics, which we have critiqued above. Applied to logical reasoning in the realm of decision making, this absolutist’s view implies a great certainty in the validity of the derivation process as well as the validity of the derived answers (assuming the premises to be true). However, as Antonio Damasio (1994) has documented, human decision making in the social domain is centrally guided by our emotions. The assumptions to be made in decisions in the social domain are so complex and, thus, uncertain, that any level of certainty in logical derived ‘consequences’ of our decision are misplaced. How can I be able to logically derive the consequences on the feelings or the future life of others impacted by my decisions? We do not doubt that logical reasoning plays a role in moral deliberation. However, we question any claim of certainty or ‘truth’ in using logical reasoning to consider the (moral) consequences of one’s decisions, and we doubt the importance of logical reasoning in the way used in doing mathematics for moral deliberation.
In the Canadian schooling context there is no explicit reference to moral development of schooling, neither in documents that explicate the purpose(s) of schooling like school acts (some school acts solely deal with the administration of school education) nor the mathematics curricula. Nevertheless, as argued in the Canadian case study, there are possibilities in the Canadian context of linking the teaching of mathematics with moral education (as explicated in this article). We now want to argue that these possibilities are greater in the Canadian than in the English context, despite the fact that moral development is explicitly articulated in the English National Curriculum and in the more specific mathematics curriculum but not at all in Canadian mathematics curricula and school acts.

One reason why we see a greater range of possibilities of implementing moral education in the teaching of mathematics in the Canadian context than in the English context lies in the different use of standardized examinations. We have ample anecdotal evidence that if there is a school external standardized testing at the end of a course, what teachers teach in the respective mathematics course and how they teach the course is greatly influenced by the desire to prepare students as well as possible for the test. We are not aware of any national (England) or provincial (Canada) test in mathematics that assess students’ moral development, including moving ideas of the type we suggested. Hence, the more of such standardized tests are written, the less time teachers have to incorporate forms of explicit moral education of the type here suggested into their teaching of mathematics. Such standardized and externally designed mathematics tests are far fewer in the Canadian schooling context than they are in the English context.

Although external and standardized examinations in mathematics in both countries are not designed to assess students’ moral development (and we would not want this to be the case), it has to be recognized that the very process of assessing students’ understanding of mathematics through externally created, standardized testing – and the teaching that is preparing them for it – has an impact on students’ moral development, their moral understanding and their moving ideas – though an impact that is not of the type we advocate here. Expanding on Warnick and Sternhagen’s (2007) and Gustein’s (2006) arguments discussed in the third section of this paper, we can say that typical external and standardized mathematics testing in both countries suggests the ideas that mathematics sees only the quantitative aspects of problems, that mathematics is not used for understanding and addressing social problems, and that the purpose of doing mathematics is to find the answer that is already long established before the problem is posed to students. It is a particular, quantitative way of looking at the world that is experiences when asked to do mathematics. It should not surprise that many students dismiss this mathematical view of the world as artificial and irrelevant to them.
Another general difference between the Canadian and the English context as far as the possibility for moral education as part of the teaching of mathematics is concerned lies in the relative autonomy of teachers in the respective country. In recent years teachers in England have been strongly encouraged to adopt particular pedagogic practices, in part due to the influence of regular testing, and the assessment styles of those tests, but also through the heavily funded National Strategy for mathematics education. On the other hand, in Canada teachers have an almost complete freedom in terms of the pedagogy they use to have their students accomplish the learning outcomes mandated by the curriculum. Relative freedom in pedagogical matters of a teacher’s teaching is a precondition for any implementation of moral education (as explicated in this article) in the teaching of mathematics. (The relative pedagogical freedom in school teaching in Canada, of course, is also impacted by external examination.) We also believe that the ‘localization’ of educational decisions in Canada compared to the nationalization of educational decision making in the English context are a central contributing factor in this greater professional autonomy in Canada compared to England, allowing Canadian teachers of mathematics to integrate aspects of a larger purpose of schooling, like moral education, more easily.

These two trends in organizing public education are due, at least in part, to the historical developments in both countries. Canada has been a federation of provinces from the beginning, with four provinces founding Canada in 1867 and with the other provinces joining the federation – as provinces – one by one. The education system of England (and Wales), covers a much larger population with one government department and there has been far greater centralisation in recent years. This has distanced the classroom teacher from the machinery of policy making and governance and together with increasing teacher (and school) accountability and monitoring has generally worked to reduce teachers’ sense of autonomy. The differences in testing are due in part to these different levels of governance: more local / provincial in Canada versus centralized / national in England. Central control of the education process (England) includes a centralized accountability process, which is what the external and standardized testing is primarily about. A tradition of more localized control and power (Canada) provides a stronger support for a view and practice of accountability that is more localized, right down to the classroom teacher level.

There is one characteristic that both contexts of mathematics teaching in Canada and England have in common: there is a general commitment of the schooling authorities (provincial governments in Canada and the Qualifications and Curriculum Authorities in England) to the moral development of students. However, in both cases, as discussed in the case studies, the
commitment is more at the suggestive level than at the specific curricular – and, thus, prescriptive – level.

With these possibilities in place – though unevenly distributed among the two countries – why have mathematics teachers not picked up on these opportunities to influence students’ moral development? There are most likely several factors, but one we are certain of is a widespread view among mathematics teachers of mathematics as “as a depersonalized, uncontextualized, non-controversial and asocial form of knowledge” (Brown 1996, 1289), which makes it hard for teachers to conceptualize mathematics education contributing to students’ moral development because of the perceived nature of mathematics. This has – from our view of the moral purpose of schooling – an important implication for mathematics teacher education: mathematics student teachers need to be helped developing an understanding of mathematics as a human endeavour that allows addressing aspects of social problems and the human aspects of doing mathematics.

References


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