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BOYLAN, Mark

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Mark Boylan, Sheffield Hallam University

m.s.boylan@shu.ac.uk

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Abstract

The relationships between mathematics, mathematics education and issues such as social justice and equity have been addressed by the sociopolitical tradition in mathematics education. Others have introduced explicit discussion of ethics, advocating for its centrality. However, this is an area that is still under developed. There is a need for an ethics of mathematics education that can inform moment to moment choices to address a wide range of ethical situations. I argue that mathematics educators make ethical choices which are necessarily ambiguous and complex. This is illustrated with examples from practice. The concept of ethical dimension is introduced as a heuristic to consider the awareness of different forms of relationship and arenas of action. A framework is proposed and discussed of four important dimensions: the relationship with others, the societal and cultural, the ecological and the relationship with self. Attending to the different ethical dimensions supports the development of a plural relational ethics. Navigating ethical complexity requires embracing diverse and changing commitments. An ethics that takes account of these different dimensions supports an ethical praxis that is based on principles of flexibility and a dialogical relationship to the world and practice.

Keywords

Mathematics education, Ethical dimension, Metaethics

Introduction

Mathematics education involves actions informed by beliefs about what is important or worthwhile; thus, mathematics education involves value and values, including in relation to fostering well-being or conversely diminishing it. The consideration of value involves variously moral reasoning, ethics and attending to justice, care and similar qualities. When I refer, in this paper, to value in mathematics education, it is such matters I am concerned with rather than other values such as aesthetics and truth, notwithstanding their importance in mathematics or their relationship to ethics. There is a need to examine these too in relation to ethics and justice in mathematics education. However, my concern here is narrower.

How we speak of such matters and the language we choose to use entails commitments to, or the prioritising of, particular values and to advocating for particular positions or standpoints in moral philosophy. Recent concern with value in mathematics education has often been from a sociopolitical perspective and framed through a consideration of equity and social justice. This has made important contributions to understanding the effects of mathematics education in society and the sociocultural influences on school mathematics. So far, arguably, the sociopolitical current has been less successful in providing guidance that can inform decisions about immediate and moment to moment actions in mathematics education or in articulating the moral principles that inform these sociopolitical standpoints. Further, there are issues in our field that are as yet underexplored, for example mathematics educators' response to the ecological crisis in which mathematics is increasingly implicated in diverse ways.

This paper complements the arguments made by others that ethics should be attended to in mathematics education (see Atweh, 2013, 2014; Atweh & Brady, 2009; D'Ambrosio, 2010; Ernest, 2013; Neyland, 2004; Roth, 2013; Walshaw, 2013). Depending on the philosophical position taken, issues of justice and fairness may be seen as part of ethics. Others, for example Levinas discussed below, consider that justice is related to but distinct from ethics. From this viewpoint, ethics pertains principally to the interaction with those we are in direct relationship with. However, the stance I take here is that ethical reasoning does concern our personal choices, but requires considering relationships that extend beyond the personal or those we are directly connected to.

I contribute to ethical discussion in mathematics education in four ways. Firstly, I highlight that ethical action is ambiguous and ambivalent, thus supporting an ethical standpoint that affirms the importance of ethical judgement that attends primarily to relationship rather than to ethical rules. Secondly, I extend the previous discussion of relational ethics in mathematics education (Atweh, 2013, 2014; Atweh & Brady, 2009; Neyland, 2004; Roth, 2013) to consider the nature of relationality and the role of mathematics as a mediator and object of relationship. Thirdly, I propose the concept of ethical dimension as a useful lens to support mathematics educators to fluidly navigate the complexity of ethical dilemmas we face. I propose and discuss three principal meanings of ethical dimension. The first is as a field of relational awareness. We are in myriad simultaneous relationships that are of potential ethical significance, for example with people we are in direct relationship with and also to social entities and groups with whom relationship is less immediate. Ethical dimension as relational awareness refers to which aspects of the relationship are attended to and considered. The second meaning is as a sphere of action within those fields and the extent to which our actions may affect those we are in relationship with. The third meaning is a dimension of ethical thought. This latter meaning points to ethical principles or philosophy to inform our actions. The fourth contribution is to consider specifically the four particular ethical dimensions: the relationship to others, the social and cultural, the ecological and the relationship to self. The choice to delineate these dimensions is informed by a consideration of the ethical issues mathematics educators face and ethical sources that have influenced responses to these.

In the next section, I further outline my approach to ethics. I then offer two vignettes to ground the discussion, drawn from my practice as a mathematics educator. The vignettes exemplify ways that mathematics education involves issues of value and value laden choices. The vignettes are intended as recognisable and illustrative of ethical ambiguity. They remind us that ethics is complex, simple principles will not suffice and this points to the need to consider different ethical dimensions which

are then discussed. Later, I use the notion of ethical dimension to revisit the vignettes introduced earlier in the paper and conclude by discussing some implications of thinking in terms of ethical dimensions.

Ethical stances

In taking a stance on ethics, it is not possible here to fully recapitulate long-standing debates in ethics and metaethics. Rather, I identify some relevant ethical sources that have the potential to support mathematics educators in addressing situations and choices we face.

Metaethics—the study of ethical systems—recognises different ways of distinguishing between ethical approaches, often identifying a division between utilitarian (outcome based) and deontological (principle based) ethics (Atweh, 2014). However, the primary distinction I consider here is one between universalist moral discourse and ethics based on a situated and sensitive exercise of practical reason rooted in the ethical understanding of a community (Benhabib, 1992). An example of the former can be found in Habermasian discourse ethics or Rawlsian theories of distributive justice. Habermas considers agreements that rational agents in a discourse community might make based on their common interests (Habermas, 1990).

An alternative is an ethics based on the exercise of judgement. The notion of praxis, discussed by Aristotle, continues to be invoked and developed in relation to issues of value in education (Kemmis & Smith, 2008). Aristotelian praxis is centred on individual action but when this is extended to collective action it can become social praxis (Kemmis, 2010). Such a notion gives the possibility of engagement in praxis that allows "human nature [to be] expressed through intentional, reflexive, meaningful activity situated within dynamic historical and cultural contexts that shape and set limits on that activity" (Glass, 2001, p.16). Within those ethical stances that emphasise situation and judgement, a further important distinction is the extent to which ethical judgement should be focused on future outcomes or on the immediate situation. In critical pedagogy often the emphasis is on the pedagogy as an instrument for achieving liberation or justice (Strhan, 2012), an alternative is to consider the judgement and choice in relation to existing situation and relationships rather than measured against a desired endpoint.

The ethical stance I take draws on relational postmodern ethics. Bauman (1993) contends that humans are morally ambivalent and actions are not essentially good or bad. Ethical phenomena and situations are non-rational, they are not regular and predictable and morality is not universalizable. A similar argument is made by Foucault against the moral standpoint advocated by Habermas (Brown & McNamara, 2011). This entails rejecting utilitarian and rule-based ethics. Actors are not free floating (Bauman, 1993) persons existing outside of social situations, as supposed by Habermasian ethics, but exist in concrete situations (Bakhtin, 1993). Because the ethical self is an embodied historical entity, a unitary ethics of mathematics education that fits all situations and circumstances is not possible. Bauman (1993) argues that this need not lead to moral relativism, if this is understood as a comparison between different ethical codes that are culturally applicable. However, others writing from a postmodern perspective are more comfortable with embracing a qualified relativism (Shildrick, 1997). An alternative, and the position I take here, is to respect an ethical pluralism (Anton, 2001) that is entailed not so much by different cultural norms or contexts

as by the uniqueness of the ethical actor in each concrete situation (Anton, 2001; Bakhtin, 1993), an actor that is social and culturally embedded.

Bauman's ethical approach draws on Levinas (1982, 1998), which in turn informs my discussion of the dimension of relationship to the others below. The overarching metaethical position I take is that different ethical approaches are more or less appropriate when considering different ethical dimensions and situations. However, I believe that it is possible to extend the principle of alterity proposed by Levinas. Developing this argument fully is outside the scope of this paper but rests upon an expansion of our understanding of what constitutes the ethical other. Levinas contends that ethical responsibility arises from our face to face encounters. This restricts ethical relationships to humans. Davy (2007) challenges the importance of the notion of "face" and argues for an extension of Levinian ethics to animals and the natural world more generally. Standish (2008) goes further and suggests that the other in Levinas can be extended to objects of the study. This opens the possibility that our relationship to mathematics too may be marked by responsibility in an ethical sense.

For Levinas (1998), a concern with justice arises out of being in proximal relationships with multiple others who demand " justice, justification and ultimately weighing up, calculating, judging how I take up the responsibilities I have for all the others" (Strhan, 2012, p. 149). An alternative concept of relationality is found in Bakhtin's stress on the act of speaking and answering and so on dialogue and the voice (Erdinast-Vulcan, 2008). There are many parallels between Levinas and Bakhtin's ethical philosophy (see Erdinast-Vulcan, 2008; Roth, 2013). Central to Bakhtin's view of language is that "each word tastes of the context and contexts in which it has lived its socially charged life; all words and forms are populated by intentions" (Bakhtin, 1981, p. 293). Understanding the ethical encounter as dialogical entails that our relationship and so ethical responsibility is marked by responsibility for a historically situated other.

The enmeshment of value in mathematics education

In this section, I offer two vignettes to inform later reflection on issues of value in mathematics education. In the subsequent section, I argue that they imply ethical choices. The first of these vignettes addresses curriculum issues—of what we should teach in mathematics. It is drawn from my practice as a mathematics educator when working in a university teaching undergraduate mathematics.

> *A group of second year undergraduates, studying to be high school mathematics teachers, are in a teaching session of their undergraduate degree – Mathematics with Education and Qualified Teacher Status. The session focuses on exploring different activities that might be used in the classroom. The content of the activities includes knots, commercial logic puzzles, geometric visualisations as well as more usual classroom activities. The students engage in the activities before discussing the mathematics involved and reflecting on whether or not they would use these in a school classroom and, if so, with whom.*
>
> *One of the activities models intensive farming of chickens. It models of the conditions that battery farmed chickens live in (Shan & Bailey, 1991, p. 208–209). Most students argue that the activity is not suitable to use with children as it is too political. Other more*

overtly 'political' activities, for example on migration flows or that address issues of multiculturalism, are less resisted, though some also argue that these too are political and mathematics should be 'neutral'.

This vignette raises an issue that is extensively discussed in sociopolitical literature that the curriculum content in mathematics is not neutral or value free. Some of the activities appear to be "political" and others not. If political or socially relevant mathematical contexts are excluded from the classroom, then this too is a political choice and has implications for social justice. Further, the choice in immediate and specific situations as to what curriculum content to include, or not to include, is an ethical choice not only for considerations of social justice but also because of how content may alienate or include learners.

The second vignette raises the question of pedagogy—of how we should teach mathematics. I have used the scenario as the basis for a discussion by beginning mathematics teachers to prompt reflection on different needs in the classroom (Boylan, 2009).

A group of 11–12 years olds from the same UK mathematics class have been asked about their views of teacher questioning.

Nikita's family arrived recently from an Eastern European country. She wants questioning episodes to be completed quickly so she can begin individual work. She says that the teacher should pick people rather than people putting hands up.

Susan, from a white British background, wants to avoid answering publicly and would prefer if answers were written down individually. A second preference is for forms of unison response.

Lee, from Afro-Caribbean heritage, would like to be part of a 'team'.

John, a white British student, has two conflicting views. Firstly, he wants people to be chosen 'fairly' in rotation and to answer without putting hands up but he also wants opportunities for discussion.

Jenny, from an Afro-Caribbean background, wants short closed questions to which there is a straightforward right or wrong answer. Forms of response are not a particular concern for her.

Seera, a British Asian student, does not want to speak publicly and would prefer no verbal questioning. If questions are asked she would prefer to discuss first before answering.

The pedagogical choices of the teacher will impact on who participates (or does not participate), how they participate and how that participation is experienced, including emotionally. Given the different orientations towards teacher questioning of what is only a sub-set of the class, it is apparent that there is not a single unambiguously suitable pedagogy for the class. Further, from a sociocultural perspective, the forms of participation in turn construct what mathematics is for the participants and their experience of it.

Ethical ambiguity

The vignettes remind us that the actions teachers take (or choices not to act) may support the flourishing and well-being of learners and others or impact negatively on them. Thus, mathematics education involves issues of ethical concern. The vignettes entail ethical choices that are ambiguous; they cannot be resolved through applying a principle or a set of rules. They involve choices with contradictory consequences; actions may have both desirable and undesirable outcomes. Thus, they are morally ambiguous and ambivalent: "virtually every moral impulse, if acted upon in full, leads to immoral consequences" (Bauman, 1993, p. 11). For example, qualifications in mathematics affect learners' life chances. Mathematics qualifications act as a gateway to future study and better paid employment. Supporting those who are currently disadvantaged to pass this gateway may support changes to patterns of socioeconomic and cultural disadvantage, because differences in mathematical attainment reflect and reinforce these. Therefore, a desire to promote equity supports actions to maximise student attainment outcomes. However, doing this may inculcate in students a focus on learning for results, entailing alienation, self-abnegation, distress and restrictions on identities (Reay & Williams, 1999).

Learning for attainment and learning in ways that promote more creative and agentic identities need not be in opposition. However, attainment outcomes are currently the key measure of socially legitimated educational worth and are constructed in relation to a wider performativity culture. Promoting equity by focusing on student attainment may serve to support and preserve this. There are alternatives that appear ethically preferable, for example, a pedagogy that involves a slower relationship to learning mathematics which emphasises what Jardine (2012) describes, using a play on words, as the "whileness" that makes something worthwhile. However, these may, in turn, entail negative ethical implications given the currency of mathematics qualifications that are rewarded, in part, for speed and curriculum coverage.

There is not a "right" or universal answer to these conflicting ethical considerations. Further, this ambiguity deepens given the unpredictability of the consequences of our actions (Bauman, 1993). In mathematics education research, accounts of adults reflecting on their experience of learning mathematics indicate how mathematical experiences have long-term impact on individuals' relationships to themselves (see, for example Boaler, 2005; Boylan & Povey, 2009).

Ethical dimensions

Recognising ethics as ambiguous challenges reliance on ethical codes and the belief in principles or rules that are universally applicable. The ethical commitments that are relevant to a specific issue are situated. One cannot know in advance which principles will be relevant to a particular situation. To recognise that mathematics education is ethically ambiguous entails that there is no single desirable pedagogy or curriculum.

This shifts the focus to relationship, practice and action as sites for ethical reflection. As Bakhtin (1981) contends the world must be answered. However, it is not enough to look only to practice and action and then to find an ethical choice in any given situation. Without a language to frame our reflections on ethical practice, we are required to consider each situation afresh and it inhibits

dialogue about ethical choices with others. One way to address this ambiguity and to consider appropriate action is through the concept of ethical dimension.

Often the term "dimension" is used in connection with ethics to refer to the ethical aspect of an issue or field as a whole in contrast to other aspects. Here, I am using the word differently; each ethical dimension points to a different field of relationships. Considering the two vignettes above, the narratives suggest different ethical arenas that are relevant. The first foregrounds the content of activities and their relationship to sociopolitical and ecological issues. The second vignette focuses attention on the ways in which different types of mathematics pedagogy impact on learners' relationships to themselves and others and the construction of self through mathematical practices. Our relationships in all four dimensions are mediated through mathematics and so our relationship with mathematics itself is an ethical relationship.

I intend for the notion of ethical dimension to convey three meanings, each of which can support ethical reflection. The first of these is awareness of the ethics of a situation. The concept of a dimension of awareness echoes Spinoza's concept of planes (Spinoza, 2000; Walshaw & Brown, 2012). Existing, as we do, in webs of relationality, it appears impossible to hold in our awareness the complexity of all the different patterns of relationship "that cannot in principle be fitted into the bounds of a single consciousness" (Bakhtin, 1984). Yet, these types of relationships are not of the same sort. Our ethical awareness can shift focus on to different forms of relationships. Awareness expands and contracts either involuntarily or through conscious focus. The second meaning is that dimensions are arenas for action. Ethical action involves paying attention to the quality of effects of actions in each of the dimensions and in the interrelationships between dimensions. Considering the different dimensions as spheres of awareness and action encourages an examination of multiple sources in the philosophy of ethics and so entails a third aspect of the meaning of dimension. In summary, an ethical dimension refers to awareness, action and sources of ethical thought.

Others, the societal and cultural, the ecological and the self

The ethical dimensions considered here are relationships with others, the societal and cultural, the ecological and the self. These relate to previous discussions by others concerned with value in mathematics education, perhaps because they constitute phenomenologically significant forms of human relationship. They denote recognisable areas that are implicated in mathematics education and in our relationship with mathematics, even if the boundaries between them may be blurred and the dimensions are enmeshed in each other and so are not separate. Nevertheless, the categorisation acts as a heuristic and a tool for reflection. In this section, I illustrate the ambit of the four dimensions, point to relevant ethical philosophy and highlight important issues in mathematics education related to them. The aim is to illustrate ways and directions that ethical discussion in mathematics education has been or could be developed.

Being with others

As stated earlier, the ethical thought of Levinas has been influential in the development of relational ethics (Bauman, 1993) and in the call for ethics to be explicitly considered within mathematics education (Atweh, 2013; Atweh & Brady, 2009; Ernest, 2013; Neyland, 2004; Roth 2013). Neyland (2004) invokes the philosophy of Levinas when reviewing the neo-liberal agenda in mathematics education to argue that ethical responsibility should be the starting point for engagement with

others. This is a perspective developed by Atweh and Brady (2009), who propose a socially "response-able" (Puka, 2005) mathematics education. This responsibility does not arise from exchange and is not dependent on reciprocity; it arises as part of subjectivity within encounters that are "face to face". The relationship to others is, or should be, it is argued, the original ethical form from which societal and institutional relationships are developed.

Roth (2013) applies concepts of encounter and dialogue to provide a close reading of a pedagogical episode in a mathematics context. He highlights the exposure of both teacher and learner to each other and the role of affect—including not only care and positive regard but also frustration and exasperation. In addition, he locates the source of ethical responsibility in answerability and the dialogical nature of learning relationships.

Various implications for practice in mathematics education of an ethics that takes relationship with the other as primary have been proposed. Neyland (2004) proposes a "re-enchantment" of mathematics education, to develop or restore a sense of purpose and spontaneity and encourages surprise and joy. Roth (2013) stresses the importance of fostering dialogue and dialogic relationships.

The societal and cultural dimension

Over the last 20 years, there has been an increasing discussion of values in mathematics education focused on its political dimensions and on issues of social justice. The sociopolitical turn (Gutiérrez, 2013) has involved a number of currents and traditions within mathematics education, such as the critical mathematics education tradition in Europe (see Alrø, Ravn, & Valero, 2010; Skovsmose, 1994), the radical mathematics and mathematics for social justice current in the USA (Gutstein, 2006) and ethnomathematics, initially developed in the majority world (Gerdes, 1996; Powell & Frankenstein, 1997). Less radically, the term "equity" is used as means to refer to a concern closing perceived achievement gaps in outcomes (Gutiérrez, 2008).

Those who highlight the sociopolitical often emphasise social justice and democracy as providing an imperative for action. However, ethical discourse is found infrequently (Atweh & Brady, 2009). To address this, one approach would be to interrogate the sociopolitical current in mathematics education with arguments made in general discussions of social justice in education. Such accounts may provide useful tools for reflection on critical mathematics education. Particularly, those that draw on both distributive and relational theories of social justice and in doing so emphasise the importance of recognition and respect for diversity (Fraser, 1997; Fraser & Honneth, 2003; Griffiths, 2003; North, 2006, 2008) and participative justice (Fraser, 2008).

Viewing mathematics as a social and cultural practice points to the temporal aspect of the social and cultural dimension. Mathematics is a cultural product of our ancestors and positions humans as "participants in the great, age-old human conversation that sustains and extends our common knowledge and cultural heritage"; such a recognition entails "acknowledging that the conversation is greater than yourself" (Ernest, 2013, p. 11). This suggests a responsibility to mathematics itself.

The ecological dimension

D'Ambrosio (2010) extends concerns with social and cultural issues and relationships to consider the global situation. He critiques an unreflective, rationalist and technicist mathematics education that does not contribute to the most universal problem facing humanity: survival with dignity. One aspect

of the ecological dimension is the role mathematics plays in the current environmental crisis and in responses to it.

Richard Barwell (2013) examines the mathematical formatting (Skovsmose, 1994) of climate change, noting how the descriptive, predictive and communicative aspects of climate science involve the use of mathematics and mathematical literacy. The idea of climate change is a "realised abstraction" (Barwell, 2013, p. 10) that, through mathematics, formats the world, but excludes the human narratives of changing weather or the anguish of the disruption of people's lives.

A significant capitalist response to the environmental crisis has been to enlist mathematics in the search for market solutions. Under the banner of green capitalism, mathematics is being used as a means to extend the commodification of natural resources in new ways (Sullivan, 2009, 2010). The value and worth of the natural world and our relationship to it are transmuted into valorisation; everything—water, trees, clean air, biodiversity and ecosystems—can be given a price (Sullivan, 2010, p. 117).

Rolston (2007) suggests that we are at a turning point where the technosphere, previously constructed within the biosphere, could become the realm in which natural history is located. In which case, in the terms Skovsmose (1994) uses, the mathematical and technologically formatted second nature would be not a "second nature" but would come to be what "nature" is, representing the final triumph of a disembodied rationality in which mathematics and mathematical processes take primacy over and interrupt visceral relationships with the world.

A more ecologically rooted mathematics education offers the possibility of disrupting the role of mathematics in this process of abstraction, commodification and formatting. Jardine (1994) calls for a mathematics that does not take human existence and mathematics as prior to encounter with the world, but as embedded in it and an aid to appreciation of being:

Mathematics is not something we have to look up to. It is right in front of us, at our fingertips, caught in the whorl patterns of the skin, in the symmetries of the hands, and in the rhythms of blood and breath (p. 112).

Understanding mathematics as part of the fabric of the natural world, the mathematics of kinship (Jardine, 1994) can enhance our relationship with the natural world and imbue this relationship with generativity and life. This contrasts with the algorithms that, through a process of valorisation, suck value from the world leaving empty cyphers standing for complex webs of relationship (Sullivan, 2010). D'Ambrosio proposes a primordial ethics that "recognizes the fundamental necessity of the mutual relation between the individual, the other and nature" (2010, p. 59) marked by a quality of reciprocity which is necessary for both individual and species survival. An ecological ethics implies the need for an environmentally informed critical mathematics education but also for a critique of the social construction of mathematics itself as separate and disconnected from nature.

The self

Subjectivity in mathematics education has been the focus of much analysis, particularly from a poststructuralist perspective (see, for example Brown & McNamara, 2011; Walshaw, 2004). These analyses provide accounts of the regulated and restricted subjects often produced through the

practices of mathematics education. Implicit in such accounts is an ethical critique of the consequence of such practices.

Each ethical actor is unique and so cannot be replaced by another human. The assertion that humans are not identical entails that each has a non-transferable responsibility (Levinas, 1982; Erdinast-Vulcan, 2008). At the same time, each is "a once-occurrent participation in being" (Bakhtin, 1993, p. 58) which is an expression of the totality of relationships in the universe. The construction of the subject that prevails in mathematics education, of the sort of selves that are possible or permitted, is disconnected from such an expanded notion of the self.

Here, I point to two possible ethically preferable alternatives: passion and pleasure and ethical self-care. In relation to both these areas, the work of Foucault is significant. Foucault's approach is, arguably, a postmodern reworking of Aristotelian ethics and so focused on an instrumentalist end point of self-mastery and as much freedom from oppression as possible in the context of discursive regimes. Such a possibility has been critiqued from a Lacanian perspective as an impossible goal given that the attempt to understand oneself in relation to the world is unending (Brown & England, 2004; Brown & McNamara, 2011).

However, an alternative relational re-interpretation of Foucault's ethics of the self is possible, understood as the work of the self as an unfolding participation in being aware of itself (Bakhtin, 1993). Mathematics and mathematical experience is one mediator of the relationship to self. For many, this experience currently is one that is implicated in alienation (Boylan & Povey, 2009). Alternatively, Foucault offers an ethics based on passion and pleasure. He seeks to reclaim passion from its rejection, in "civilized" discourses, in part because of its association with the body (Foucault, 1988; Zembylas, 2007). Foucault sees in passion and affective intensity the possibility of the disruption of the regulated and normalised self (Zembylas, 2007).

Embracing Foucault's standpoint suggests making space for passion and pleasure in mathematics education. This moves beyond the desire to counter or avoid negative affect. An example aligned with this sentiment is Heather Mendick's (2006) examination of the gendered experience of mathematics which draws on queer theory to propose the queering of mathematics with the aim of disturbing and provoking pleasure. Pleasure here includes the enjoyment of challenge and intellectual effort. The practices of mathematics education that produce regulated and restricted forms of subjectivity are instances of, and embedded in, prevailing practice regimes. Part of Foucault's response to this condition is to promote the practice of freedom through ethical self-care (Foucault, 1994a) that resists social forces that otherwise would define subjectivity.

One important aspect of such action is to pay attention to how to create, instigate or foster spaces in which learners of mathematics can also develop as ethical actors in relation to each ethical dimension. Two aspects of this are important. The first is the development of critical faculties (Infinito, 2003). The starting point for critique is to recognise the limits of our situation. Once we have a sense of who we are and what is, as it were, constructing us, there creates the "possibility of no longer being doing, or thinking what we are, do or think" (Foucault 1994b, p. 311). Within mathematics education, the critical mathematics and ethnomathematics traditions, discussed earlier, identify practices that support the development of critical faculties and examine mathematics as the product and producer of social constructions. This creates the possibility of understanding ways in which subjectivity is fashioned, in part, by and through mathematical practices.

The second aspect of resistance is engaging in the practice of self-construction. The concept of self that Foucault employs is at variance with that proposed by Levinas or Bakhtin who, whilst recognising the importance of the uniqueness of the individual subjectivity, ground their epistemology and ethics in relationship to others. Foucault emphasises care of the self over the care of others. However, in the practices of self-care, the importance of the role each has in others' self-construction is recognised. Infinito (2003) proposes that in education this necessitates the need for appropriate spaces:

> where individuals can participate in the on-going production of themselves with and in front of others where they can be both witness to and resources for the experiments of other selves (p. 168).

This reading of Foucault arguably avoids the potential charge that Foucault's concept of self-care is less ethical and more self-centred. Further, such spaces support the development of the self as equipped to fulfil ethical responsibility for others. This moves the ethical enquiry from "how should I live?" to "how should we live?"

Hand (2012), in a study of the practices of teachers, engaged in "equitable mathematics instruction" drew on teachers' descriptions of their practices to identify the concept of "taking up space". Taking up space refers both to space in the classroom through participation, but also to taking up space beyond the classroom. She quotes one teacher talking about the connection between space in the classroom and their aspirations for their students to take up space that is closed off due to socio-economic and cultural factors. Here, we hear echoes of Foucault:

> It's like, being able to have the tools to say, 'If I could do this, I will become anything, I will get out there and take up my space' p. 238

Here, also, I contend, we see how the different dimensions of mathematics are enmeshed. Supporting the development of autonomous actors in the mathematics is not opposed to addressing the sociopolitical and other ethical dimensions but intimately connected to it.

Mathematics classrooms in which there is only one or a limited number of ways to participate in learning mathematics deny the possibility of such spaces. One way of creating alternative possibilities is for teachers to allow themselves to be seen by students as "purposefully incomplete" (Infinito, 2003, p.170). In the mathematics classroom, this supports the practice of de-centering mathematical authority and for teachers and students to work collaboratively together at times on problems which neither students nor the teacher know the answers to.

Navigating dimensions

The vignettes presented above point to the existence of different and competing ethical commitments. I have proposed the concept of dimension as one way to conceptualise this. There are two ways that ethical dimensions are relevant to the navigation of ethical issues: firstly, when considering different commitments in relation to a single dimension and, secondly, when considering tensions between commitments related to different dimensions.

The first vignette focused on choices about the curriculum content on a mathematics teacher education degree, and so the content modelled as suitable for the school mathematics classroom. Considering the social and cultural dimension, tensions are apparent. Mathematical tools are needed for people to engage in understanding the societal choices we make including in relation to industrial food production. However, using the material on industrial farming is provocative and may alienate students from the main purpose, to develop criticality about the nature of school mathematics and so support the long-term project of changing school mathematics practices. The idea of using this activity may be far outside their current beliefs of what is appropriate, so they are unlikely to use it and this suggests considering alternative content that might still challenge but be more readily taken up.

Similarly, in the second vignette, the democratic classroom is an ideal that supports the project of mathematics contributing to the development of engaged citizens. However, this is dependent on the extent to which learners want to and can involve themselves in such a setting. The social and cultural capital needed to engage with this form of pedagogy is not evenly distributed in terms of gender, ethnicity and social class. Thus, promoting what appear to be democratic practices may favour those students who are advantaged and so help reproduce inequity. In the second vignette, we see also how there is no simple answer to enacting a pedagogy that supports the flourishing of all students in any class. Indeed, attempting to meet some learners' expressed desires may serve to foster the entrenchment of regulated subjects.

Examining choices in terms of different dimensions highlights a second form of dilemma—the way in which considering one dimension may point in the direction of a particular action but considering other dimensions may suggest alternatives. For example, we live in a world in which intensive meat production is implicated in climate change. Industrial meat production is also implicated in inequitable distribution of food that leads to hunger and malnutrition for many—an example of the primacy given to the commodification of the natural world. Given the ecological, social and cultural ethical imperatives to address this, arguably, this should be included in the curriculum, not least to nourish independent and critical thinking. Yet, individuals in the group are disturbed and discomforted by encountering these materials. My ethical responsibility to students implies I should be mindful of their well-being and the emotional states I may catalyse. Further, the general intention of this module and the underlying ethos of the course were to support a re-enchantment (Neyland, 2004) with mathematics. Provoking discomfort may be at variance with enacting a pleasurable mathematics curriculum. Thus, ethical choice here is ambiguous.

Moreover, there are instances where the same ethical principles may manifest in different dimensions in ways that are in tension. So, in the second vignette, a concern for enabling students to influence the pedagogical practices of the classroom is intrinsic to a democratic classroom, as is attending to the individual needs of students. A democratic classroom has potential benefits for the participants. It can allow for individuals to participate in autonomous ways and to develop their mathematical authority. The ethical principle that supports this is a commitment to participative justice (Fraser, 2008). Engaging with such principles is one way to address the impossibility of meeting the students' varied expressed desires. Yet, attending to those freedoms may be counter posed to the possibility of reproducing socioeconomic relationships that are inimical to participation. A teacher's commitment to freedom and autonomy of students in the here and now points in the direction of maximising their opportunities to choose what and how they study. A commitment to

the future freedom of students may lead to restricting what and how they study, in order to maximise their opportunities to gain qualifications that may lead to greater economic freedom.

Conclusion

To support the argument that ethics is important in mathematics education, I considered a variety of ethical choices that occur in classrooms, using the notion of dimension as means to simplify the "infinitely complex condition of the moral self" (Bauman, 1993, p.14). The need to consider different dimensions arises from ethical ambiguity as illustrated by the vignettes which are illustrative of the myriad ethical choices mathematics educators make. I have discussed four sources of ambiguity: firstly, that the same action may both serve to realise an ethical commitment and to hinder it; secondly, the unknowability of the effects of action; thirdly, tensions between different commitments; and, fourthly, the situated nature of the relevance of different commitments including the relative importance ascribed to different dimensions in particular situations. This suggests the need for an ethical sensibility that is fluid and situated, one in which both the commitments and the relationship between them is not fixed in advance.

Informed by the previous discussion and research in mathematics education concerned with value, I have introduced the concept of ethical dimension and proposed four dimensions as important—the other, the social and cultural, the ecological and the self. Thinking in terms of different ethical dimensions suggests a range of sources for mathematics education ethics. Clearly, there are tensions between these sources. This in turn is a reflection of the different ontological and epistemological qualities of the dimensions.

The concept of dimension potentially allows different axiological positions in mathematics education to be, as it were, brought into conversation with each other. It invites an ethical pluralism that extends Bakhtin's polyphonic epistemology into ethics. This epistemology proposes that truth arises momentarily. It cannot be expressed in a single statement from an individual bearer of a singular truth, but only through dialogue between position holders, through simultaneous and even contradictory statements (Sidorkin, 2002). This potentially allows for a further form of navigation, to find a path between an ethical relativism that proposes that choices and stances are inherently individual and subjective and an ethical absolutism.

Mapping ethical dimensions supports an ethical praxis that can help to navigate the type of ambiguities discussed earlier by distinguishing different relationships and responsibilities. The ambiguity and ambivalence of action and the distance between action and outcomes mean that praxis involves continual adjustment and change. Mathematics education that is informed by a postmodern ethical sensibility will involve less the implementation of a programme for social justice or equity, but more a dance between and with different ethical demands. This approach resonates with Foucault's (1994a) emphasis on ethics as practice or those who contend that social justice is not a state of affairs to arrive at but rather a verb, an action and a process (Griffiths, 2003; Roth, 2013).

Ethical action is always provisional. The best we can do is move step by step, and as we do this our actions change the world. As action is dialogical, each step taken means that our awareness increases of the situation, our role in it and the effects of our actions; responsibility requires experimentation and embrace of uncertainty (Derrida, 1992). The concept of ethical dimension is a

way of supporting reflection and dialogue about the ethical choices we face. It supports the development of a shared language to discuss our ethical choices and a praxis that is based on principles of flexibility and a dialogical relationship to the world and practice. This in turn can inform a collective enterprise of developing an ethical mathematics education.

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References

Alrø, H., Ravn, O., & Valero, P. (2010). *Critical mathematics education: past, present and future. Festschrift for Ole Skovsmose*. Rotterdam: Sense Publishers.

Anton, C. (2001). Beyond theoretical ethics: Bakhtinian anti-theoreticism. *Human Studies, 24*, 211–225.

Atweh, B. (2013). Is the good a desire or an obligation? The possibility of ethics for mathematics education. *Philosophy of Mathematics Education Journal, 27*. Retrieved from http://people.exeter.ac.uk/PErnest/pome27/index.html.

Atweh, B. (2014). Mathematics education and democratic participation between the critical and the ethical: a socially response-able approach. In O. Skovsmose & B. Greer (Eds.), *Opening the cage: critique and politics of mathematics education* (pp. 325–342). Rotterdam: Sense Publishers.

Atweh, B., & Brady, K. (2009). Socially response-able mathematics education: implications of an ethical approach. *Eurasia Journal of Mathematics Science and Technology Education, 5*(3), 267–276.

Bakhtin, M. (1981). *M.M. Bakhtin the dialogic imagination: Four essays*. Austin: University of Texas Press.

Bakhtin, M. (1984). *Problems of Dostoevsky's poetics*. Minneapolis: University of Minnesota Press.

Bakhtin, M. (1993). *Towards a philosophy of the act*. Austin: University of Texas Press.

Barwell, R. (2013). The mathematical formatting of climate change: Critical mathematics education and post-normal science. *Research in Mathematics Education, 15*(1), 1–16.

Bauman, Z. (1993). *Postmodern ethics*. Oxford: Blackwell.

Benhabib, S. (1992). *Situating the self: Gender, community, postmodernism in contemporary ethics*. Cambridge: Polity Press.

Boaler, J. (2005). The 'psychological prisons' from which they never escaped: the role of ability grouping in reproducing social class inequalities. *Forum, 47*(2&3), 125–134.

Boylan, M. (2009). Engaging with issues of emotionality in mathematics teacher education for social justice. *Journal of Mathematics Teacher Education, 12*(6), 427–443.

Boylan, M., & Povey, H. (2009). Telling stories about mathematics. In L. Black, H. Mendick, & Y. Solomon (Eds.), *Mathematical relationships: Identities and participation* (pp. 45–57). London: Routledge.

Brown, T., & England, J. (2004). *British Journal of Sociology of Education, 25*(1), 67–79.

Brown, T., & McNamara, O. (2011). *New Teacher identity and regulative government: The discursive formation of primary mathematics teacher education*. New York: Springer.

D'Ambrosio, U. (2010). Mathematics education and survival with dignity. In H. Alrø, O. Ravn, & P. Valero (Eds.), *Critical mathematics education: past, present and future* (pp. 51–63). Rotterdam: Sense Publishers.

Davy, B. J. (2007). Another face of ethics in Levinas. *Ethics and the environment, 12*(1), 39–65.

Derrida, J. (1992). *The other heading: reflections on today's Europe* (P. Brault & M. Naas, Trans.). Bloomington: Indiana University Press.

Erdinast-Vulcan, D. (2008). Between the face and the voice: Bakhtin meets Levinas. *Continental Philosophy Review, 41*, 43–58.

Ernest, P. (2013). What is 'first philosophy' in mathematics education? *The Philosophy of Mathematics Education Journal, 27*. Retreived from http://people.exeter.ac.uk/PErnest/pome27/index.html.

Foucault, M. (1988). *Madness and civilization*. New York: Vintage.

Foucault, M. (1994a). The ethics of the concern for self as a practice of freedom. In P. Rabinow (Ed.), *Michel Foucault: Ethics—subjectivity and truth* (pp. 281–302). London: Allen Lane.

Foucault, M. (1994b). What is enlightenment? In P. Rabinow (Ed.), *Michel Foucault: Ethics—subjectivity and truth* (pp. 303–320). London: Allen Lane.

Fraser, N. (1997). *Justice interruptus: Critical reflections on the "postsocialist" condition*. New York: Routledge.

Fraser, N. (2008). *Scales of justice, reimagining political space in a globalizing world*. Cambridge: Polity Press.

Fraser, N., & Honneth, A. (2003). *Redistribution or recognition?: A political-philosophical exchange*. New York: Verso.

Gerdes, P. (1996). Ethnomathematics and mathematics education. In A. J. Bishop, M. K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International Handbook of Mathematics Education* (pp. 909–943). Dordrecht: Kluwer.

Glass, R. (2001). On Paulo Freire's philosophy of praxis and the foundations of liberation education. *Educational Researcher, 30*(2), 15–25.

Griffiths, M. (2003). *Action for social justice in education*. Maidenhead: OUP.

Gutiérrez, R. (2008). A "gap-gazing" fetish in Mathematics Education? Problematizing research on the achievement gap. *Journal of Research in Mathematics Education, 39*(4), 357–364.

Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal of Research in Mathematics Education, 44*(1), 37

Gutstein, E. (2006). *Reading and writing the world with mathematics*. New York: Routledge.

Habermas, J. (1990). *Moral consciousness and communicative action*. Cambridge: Polity.

Hand, V. (2012). Seeing culture and power in mathematical learning: Toward a model of equitable instruction. *Educational Studies in Mathematics, 80*, 233–247.

Infinito, J. (2003). Ethical self-formation: A look at the later Foucault. *Educational Theory, 53*(2), 155–171.

Jardine, D. (1994). On the ecologies of mathematical language and the rhythms of the earth. In P. Ernest (Ed.), *Mathematics, education and philosophy: An international perspective* (pp. 109–123). London: Falmer.

Jardine, D. (2012). *Pedagogy left in peace: Cultivating free spaces in teaching and learning*. London: Continuum.

Kemmis, S. (2010). Research for praxis: Knowing doing. *Pedagogy Culture and Society, 18*(1), 9–27.

Kemmis, S., & Smith, T. (2008). *Enabling praxis: Challenges for education*. Rotterdam: Sense Publishers.

Levinas, E. (1982). *Ethics and infinity: Conversations with Phillipe Nemo*. Pittsburgh: Duquansne University Press.

Levinas, E. (1998). *Otherwise than being: Or beyond essence*. Pittsburgh: Duquesne University Press.

Mendick, H. (2006). *Masculinities in mathematics*. Buckingham: Oxford University Press.

Neyland, J. (2004). Toward a postmodern ethics of mathematics education. In M. Walshaw (Ed.), *Mathematics education within the postmodern* (pp. 55–73). Greenwich: Information Age Publishing.

North, C. (2006). More than words? Delving into the substantive meaning(s) of "social justice" in education. *Review of Educational Research, 76*(4), 507–535.

North, C. (2008). What's all this talk about "Social Justice"? Mapping the terrain of education's latest catch phrase. *Teachers College Record, 110*(6), 1182–1206.

Powell, A., & Frankenstein, M. (Eds.). (1997). *Ethnomathematics: Challenging Eurocentrism in Mathematics Education*. New York: SUNY.

Puka, B. (2005). Teaching ethical excellence: Artful response-ability, creative integrity, character opus. *Liberal Education, 91*(3/4), 22–25.

Reay, D., & Williams, D. (1999). I'll be a nothings: Structure, agency and the construction of identity through assessment. *British Educational Research Journal, 25*(3), 343–354.

Rolston, H. (2007). The future of environmental ethics. *Teaching Ethics, 1*, 1–27.

Roth, W.-M. (2013). Toward a post-constructivist ethics in/of teaching and learning. *Pedagogies An International Journal, 8*(2), 103–125.

Shan, S., & Bailey, P. (1991). *Multiple factors: Classroom mathematics for equality and justice*. Stoke on Trent: Trentham Books.

Shildrick, M. (1997). *Leaky bodies and boundaries: Feminism, postmodernism and (bio)ethics*. London: Routledge.

Sidorkin, A. (2002). Lyotard and Bakhtin: Engaged diversity in education. *Interchange, 33*(1), 85–97.

Skovsmose, O. (1994). *Towards a philosophy of critical mathematics education*. Dordrecht: Kluwer.

Spinoza, B. (2000). *Spinoza: ethics*. New York: Oxford University Press.

Standish, P. (2008). Levinas and language of the curriculum. In D. Egéa-Kuehne (Ed.), *Levinas and education: at the intersection of faith and reason* (pp. 56–66). New York: Routlege.

Strhan, A. (2012). *Levinas, subjectivity, education: Towards an ethics of radical responsibility*. Chichester: Willey-Blackwell.

Sullivan, S. (2009). Green capitalism, and the cultural poverty of constructing nature as service-provider. *Radical Anthropology, 3*, 18–27.

Sullivan, S. (2010). ‘Ecosystem service commodities’—a new imperial ecology? Implications for animist immanent ecologies, with Deleuze and Guattari. *New Formations a Journal of Culture/Theory/Politics, 69*, 111–128.

Walshaw, M. (2004). The pedagogical relation in postmodern times. In M. Walshaw (Ed.), *Mathematics education within the postmodern* (pp. 121–139). Greenwich: Information Age Publishing.

Walshaw, M. (2013). Poststructuralism and ethical practical action: Issues of identity and power. *Journal of Research in Mathematics Education, 44*(1), 100–118.

Walshaw, M., & Brown, T. (2012). Affective productions of mathematical experience. *Educational Studies in Mathematics, 80*, 185–199.

Zembylas, M. (2007). A politics of passion in education: The Foucauldian legacy. *Educational Philosophy and Theory, 39*(2), 135–149.