Journal of Philosophy of Education
The Journal of Philosophy of Education Society of Great Britain
pesgb

Journal of Philosophy of Education, Vol. 54, No. 3, 2020

Whose Ethics? Toward Clarifying *Ethics* in Mathematics Education Research

CHRISTOPHER DUBBS

The philosophical branch of ethics is foundationally concerned with the question of right or wrong, benevolent or harmful, and ultimately what is proper conduct. The present inquiry addresses two related questions: (1) How have theories of ethics been applied to mathematics education research? and (2) What alternatives have not been considered? What might the implications be if these alternative formulations were considered? To answer the first question, I offer a review of the philosophy of mathematics education literature, considering those articles which discuss ethics and mathematics education together. The ethical perspectives adopted within the literature span normative and non-normative, modern and postmodern orientations towards ethics. To answer the second question, I explored philosophy literature to identify which philosophical perspectives of ethics have (not) been adopted by philosophers of mathematics education research. The structure of this paper parallels these two questions: the first part considers the philosophy of mathematics education research and how researchers have defined ethics while the second part discusses additional philosophical approaches to ethics and puts those approaches into conversation with those identified in part one. I conclude by intertwining these two strands into my central thesis: ethics per se *is construed too narrowly in the philosophy of mathematics education literature and considering additional ethical perspectives from philosophy can be generative of new ideas.*

INTRODUCTION

> Can mathematics education have a first philosophy? Is there a branch of philosophy that is a *sine qua non* for mathematics education research and possibly its practice as well? Are there philosophical assumptions that cannot be avoided in pursuing any inquiries whatsoever in our field? (Ernest, 2012, p. 8).

In 'What is our First Philosophy in Mathematics Education?' Paul Ernest sought the 'first philosophy' of mathematics education research, or that

Published by John Wiley & Sons Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

without which (*sine qua non*) there would be no proper philosophical basis for mathematics education research. In other words, a *first philosophy* of mathematics education research would be a philosophy that is a defining or central characteristic of all mathematics education research. Ernest evaluated the suitability of *ontology* or being, *epistemology* or knowing, and *ethics* or proper conduct, among others, as a first philosophy of mathematics education research before proclaiming ethics as *the* first philosophy of mathematics education research. As mathematical absolutists might argue that formal, deductive logic is the *sine qua non* of mathematics (Ernest, 1991)—that is, a central, defining characteristic of mathematics—Ernest argued that our ethical responsibility of educating students is that which holds the project of mathematics education research together.

The philosophical branch of ethics is foundationally concerned with the question of right or wrong, benevolent or harmful (Mill, 2001), and ultimately what is proper conduct (Levinas, 1982, 1985). The epistemic violence (Fasheh, 2012), racialised and gendered privileging (Battey, 2013; Mendick, 2006), and 'negative impacts on the confidence and self-esteem of groups of students' (Ernest, 2016, p. 18) inherent to Western mathematics education challenges this very same claim of an ethical first philosophy; that is, this violence and these negative impacts seem counter to what might conventionally be understood as *good*.

Research into ethics as a foundational philosophy of mathematics education both precedes and succeeds Ernest's (2012) contribution (see Figure 1 in the next section to view the range of relevant literature). I continue Ernest's argument that ethics, as a multifaceted branch of philosophy, can serve as *a* first philosophy of mathematics education research while simultaneously challenging and expanding the perspectives adopted in the literature. Ethics should not be considered a monolithic concept but rather a diversity of perspectives that spans from normative virtue, duty, and utilitarian ethics to postmodern ethics (Dell'Olio and Simon, 2010; Levinas, 1985; Mill, 2001; Pojman and Tramel, 2009). The present inquiry addresses two related questions:

1) How have theories of ethics been applied to mathematics education research? and
2) What alternatives have not been considered? What might the implications be if these alternative formulations were considered?

To answer the first question, I offer a review of the philosophy of mathematics education literature, considering those articles which discuss ethics and mathematics education together. This search identified a nexus of research which has (1) explicitly drawn upon philosophical literature to elaborate a theory of ethics, and (2) has used that theory as a justification for or defining characteristic of mathematics education research. The ethical perspectives adopted within the literature span normative and non-normative, modern and postmodern orientations towards ethics.

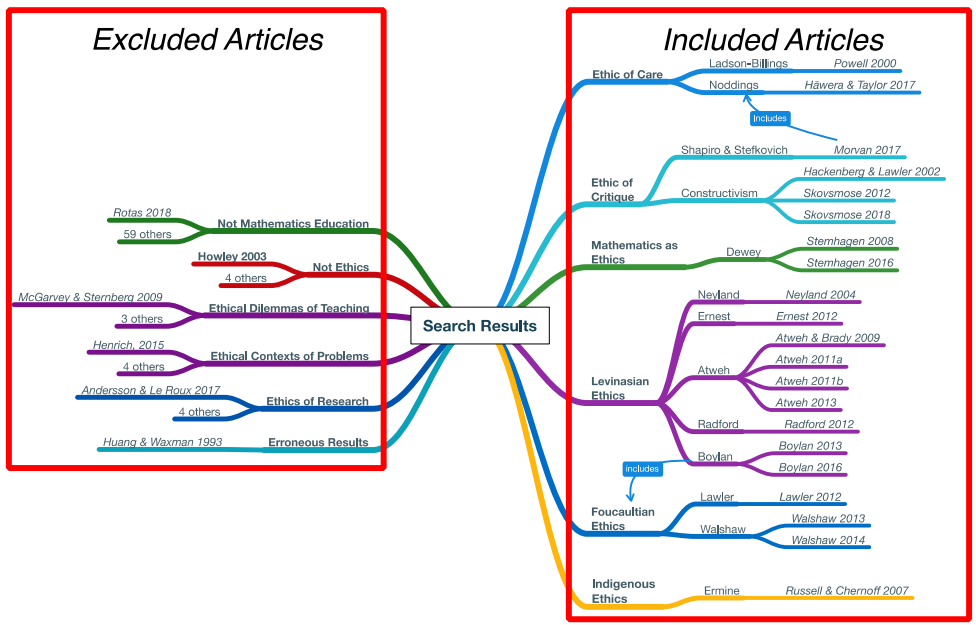

Figure 1: Visual overview of the literature search, the excluded (left) and included articles (right), and their philosophical allegiances. [Color figure can be viewed at wileyonlinelibrary.com] [Colour figure can be viewed at wileyonlinelibrary.com]

To answer the second question, I explored philosophy literature myself to identify which philosophical perspectives of ethics have (not) been adopted by philosophers of mathematics education research. The structure of this paper parallels these two questions: the first part considers the philosophy of mathematics education research and how researchers have defined ethics, while the second part discusses additional philosophical approaches to ethics and puts those approaches into conversation with those identified in part one. I conclude by intertwining these two strands into my central thesis: ethics *per se* is construed too narrowly in the philosophy of mathematics education literature and considering additional ethical perspectives from philosophy can be generative of new ideas.

CARTOGRAPHY OF PHILOSOPHY OF MATHEMATICS EDUCATION LITERATURE

I begin here by presenting a review of the relevant philosophy of mathematics education research. Paul Ernest, author of *The Philosophy of Mathematics Education* (1991; Review in *JOPE*: Davis, 1992) and editor of the *Philosophy of Mathematics Education Journal*, is a name often associated with the philosophy of mathematics education. For this reason, I position his *for the learning of mathematics* article 'What is our First Philosophy in Mathematics Education?' as my focal article and as my point of departure from the current philosophy of mathematics education literature. Before I consider Ernest's argument in detail, I introduce other research which has considered ethics and mathematics education together. My review of this literature will show that Emmanuel Levinas' ethical perspective (1951, 1969, 1982, 1984, 1985) is widely adopted within this philosophy of mathematics education literature.

My positioning of Ernest's argument for ethics as mathematics education's first philosophy is how I have chosen to begin this inquiry, but this need not be the case. For example, Boylan's (2013) dimensions of ethics—ecological, social and cultural, other, self—would likewise provide a salient framework from which to analyse the mathematics education literature. By centering Ernest's argument, I proceed *from* philosophy *to* mathematics education research, tracing the uptake of ethical theories within mathematics education research, whereas if I had adopted Boylan's argument, I would have begun with the uptake of D'Ambrosio, Gutiérrez, Gutstein, Levinas and Foucault within mathematics education research and might have chosen to connect those to philosophical literature. Similarly, beginning with Shapiro and Stefkovich's Multiple Ethical Paradigm (2016; as applied to mathematics education research by Morvan, 2017) would have used ethics of justice, of critique, of care, and of the teaching profession as a point of departure before exploring the roots of those ethics within the philosophical literature. I do *not* argue that my current approach is better, but rather *different*: this approach enabled me to emphasise that proceeding *from* philosophy research *to* mathematics education research can reveal what ethical formulations are included, excluded and misconstrued.

Search criteria: identifying the relevant mathematics education literature

To identify the philosophy of mathematics education literature, I searched ERIC for all articles including 'ethics' and 'mathematics education.' This search yielded 101 results which I then screened by title, abstract, and keywords for explicit mention of mathematics and ethics. This screening process split the results into 21 included articles and 80 excluded articles (see Figure 1). Those excluded articles were excluded for one of six different reasons. First, articles which were about ethics but not about mathematics education were excluded. Most of these articles were erroneously included because they were published in journals with mathematics as part of the journal title (e.g. *Canadian Journal of Science, Mathematics, and Technology Education*; *EURASIA Journal of Mathematics, Science, and Technology Education*; or *Journal of Computers in Mathematics and Science Teaching*) but were about science, technology or engineering (e.g. Rotas, 2018). Second, articles which were about mathematics education but were not about ethics were excluded (e.g. Howley, 2003). Third, articles that focused on the ethical dilemmas of teaching (e.g. McGarvey and Sterenberg, 2009) were excluded. Fourth, articles on the use of ethical contexts in mathematics problems (e.g. Henrich, 2015) were excluded. Fifth, articles on the ethics of research itself (e.g. Andersson and le Roux, 2017) were excluded. Lastly, one search result was identified due to a typographic error (ethic instead of eth**n**ic) and was, therefore, excluded.

Since my goal is to examine which philosophical theories of ethics *have been* operationalised in mathematics education research, to consider what else *might be* and *can be*, the 21 included articles are elaborated and unpacked next. My goal is not, however, to discredit the value of research and work in those six excluded areas. Rather, these articles merely fall outside my focus on the philosophical discussion of ethics in the context of mathematics education. To distinguish it from the above excluded areas, I will refer to the nexus of relevant literature as the *philosophy of mathematics education* literature. As a philosopher of mathematics education, my goal is to bring the project of mathematics education research into question and I situate this present work within this nexus of similar research. A visual summary of the included and excluded articles is included in Figure 1.

Literature review: considering ethics and mathematics education together

In this subsection, I discuss those 21 included articles listed on the righthand side of Figure 1. Within these 21 articles there are two broad foci: (1) establishing the need to think ethics and mathematics education together, and (2) if thinking ethics and mathematics education research together, how should ethics be defined. The former focus constitutes 8 of the included articles while the latter constitutes the remaining 13.

Neyland's seminal 'Toward a Postmodern Ethics of Mathematics Education' (2004) introduced Emmanuel Levinas into the philosophy of

mathematics education literature. In this piece, Neyland was primarily concerned with a 'postmodern re-enchantment' (p. 60) of mathematics education research. Modernism assumed the Cartesian dualistic subject, that the mind and the body were *essentially* different: the so-called Cartesian split between rationality and instinct, between thought and the body itself. Rationality, modern thinkers hoped, would lead to prescriptive ethical codes that would guarantee an ethical life, the so-called Modern dream (Neyland, 2004). Neyland argued that just as prescriptive ethical codes reduce human experience to rule-following, particular policy calls for equality and standardisation reduces education to a project of rule-following and the reduction of students to stereotypes. Just as Levinas's postmodern approach re-enchants ethics, by opening space for the individual to exist and act freely, Neyland argued that adopting this Levinasian ethical perspective towards students, towards their uniqueness and irreducibility, would yield a project of mathematics education that is ethically sound.

Atweh's (2011a, 2011b, 2013; Atweh and Brady, 2009) conception of ethics together with mathematics education was one of response-ability. Atweh and Brady argued that the relationship between teacher and student should be considered one of ethical responsibility (Levinas, 1969), in which the teacher is responsible for the needs of the other, of their students. This ethical responsibility meant addressing the unique individual and not addressing them in a stereotypical fashion. Atweh continued this discussion of unique individual needs versus stereotypical relations (Atweh and Brady, 2009) in an interrogation of quality and equity (2011a), social justice, race, ethnicity and identity (2011b), and the *good* (2013), in which each was not considered a monolithic response to stereotypical understandings of inequality for particular groups of people (e.g. stereotypical assumptions of women, queers, etc.; see Conrad, 2014 for more on the reclaimed usage of *queers*) but each must be concerned with the particular needs of *particular* individuals to be of ethical value, to be ethically good. Acting ethically, according to Atweh (2013), is not a desire but an obligation for mathematics education researchers: it is our ethical responsibility to interrogate the implicit ethical assumptions within/of mathematics education research.

In a related vein, Stemhagen (2008, 2016) argued that there is an inseparable mathematics-ethics connection. Instead of adopting a Levinasian perspective, however, Stemhagen begins by reviving a Deweyan philosophy of mathematics: 'mathematics comes about as we engage in inquiries in order to live better in the world, it follows that ethics is never far from mathematics' (2008, p. 63). Coupled with this philosophy of mathematics, Stemhagen deploys Deweyan democratic education to conceive of a *democratic mathematics education* (2016) that holds the empiricist nature of mathematics, and the result that philosophy will have on human behaviour in the world as it is, and as it can be, as the ethical justification for mathematics education.

Similar to Stemhagen's approach, beginning with a philosophy of mathematics education to elaborate a connection to ethics, Hackenberg

and Lawler (2002) and Skovsmose (2012, 2018) both begin from a radical constructivist assumption about mathematics education. According to Hackenberg and Lawler:

> because each person actively builds knowledge to organize her experiential reality, interactions with others are guided by [a liberatory ethics] . . . Educators with this ethics orchestrate learning environments that will support students in developing self-awareness and the ability to decenter that are necessary for active citizens of a democracy (2002, p. 12).

Further emphasising the compatibility of this approach with Stemhagen's approach, Hackenberg and Lawler likewise draw on Deweyan principles of democratic education to elaborate their *ethics of liberation* (2002). Central to their conception is critique. Their understanding of critique is the same as Skovsmose's *critical constructivism* (2018), an understanding where constructed understandings must be open to interrogation and reconfiguration. Skovsmose extends this critical constructivism to ethics itself: constructed meanings of ethics likewise are open to reconfiguration, in particular, Skovsmose argues that critical mathematics education, and social justice in particular, be open to a reflexive critique (2012, 2018). Radford (2012), by joining Foucault's critique of individualist notions of emancipation to this ethic of critique, proceeds to refigure emancipation in critical-ethical terms. That is, Radford (2012), independently applies Skovsmose's critical constructivism to the project of emancipation, one goal of democratic education, within mathematics education.

Another justification for the thinking of ethics and mathematics education research together is that of an ethic of care. With roots in the work of Nel Noddings (1988), Hāwera and Taylor (2017) and Morvan (2017) argue that 'students are at the heart of every education system and they should be nurtured and encouraged' (Morvan, 2017, p. 37). However, 'an ethic of care is not just about being kind to students. It involves caring about student achievement and enacting strategies to support that' (Hāwera and Taylor, 2017). Together, then, these authors suggest that since caring about the success of every student—individual humans with their own trajectories, interests, and goals—is central to the mathematics education project, ethics and mathematics education are inseparable. Indeed, Powell continues this argument, and elaborates further: 'a caring ethic is essential for African American students who face the same problems in the mathematics classroom as other students, but with more exaggerated effects because of racism in this country' (Powell, 2000). Powell's ethic of care, instead of drawing from the intellectual heritage of Noddings, draws on the critical race work by Gloria Ladson-Billings (1994) on the successful teaching of African American students. In all three cases, however, the authors argue that caring is a central characteristic of an ethical relationship between teachers and all of their students.

In contrast to the above literature which sought to justify thinking ethics and mathematics education, Boylan (2013, 2016) begins from *the*

assumption that an ethical perspective on the project of mathematics education is necessary (drawing on both Atweh and Neyland's arguments). He departs, however, by arguing that a singular perspective, particularly the Levinasian perspective of Atweh and Neyland, is unnecessarily narrow. Boylan argued that Levinasian ethics merely addressed the ethical dimension of the *Other*, yet left the ecological (D'Ambrosio, 1985; Fasheh, 2012; Skovsmose, 1985) and social and cultural[1] (Gutiérrez, 2013; Gutstein, 2006) dimensions of ethics, as well as ethical dimensions of the self (Foucault, 1994), unaddressed. These four perspectives together, Boylan asserted, constituted a complex understanding of the ethical dimension of mathematics education research.

Three of Boylan's dimensions (2013) still constituted perspectives on the Other, whether it be their environment, social and cultural experiences, or a responsibility towards them. Boylan's inclusion of Foucault (1994), however, considered the ways in which people care for themselves to maintain recognition as certain types of ethical beings. In other words, Boylan would consider not only how teachers must respond to the needs of their students but also how teachers present themselves to be recognised as ethical teachers in their school and cultural context. Foucault's ethics as care of the self has likewise been adopted by both Walshaw (2013, 2014) and Lawler (2012), both interrogating *who* can know mathematics and how particular people achieve recognition as doers of mathematics.

In addition to these predominantly Western perspectives, and related to the work of Gutierrez and Gutstein (both connected to the critique elaborated by other authors such as Skovsmose), one author in this philosophy of mathematics education literature has considered Indigenous notions of ethicality together with mathematics education (Russell and Chernoff, 2013). These authors draw on the Indigenous concept of ethical spaces (Ermine, 2007), the space where two knowledge systems meet, to consider the ways in which particular ways of knowing, here Western and Indigenous, interact with, complement and contradict one another. For Ermine, harm occurs when one's Indigenous ways of knowing are subjugated to dominant Western ways of knowing. This harm constitutes Ermine's unethical; in contrast, an ethical space is one in which the difference between different groups is affirmed and contrasted in non-judgmental ways (2007). Since the Levinasian perspective of ethics is the most elaborated within mathematics education research and the perspective adopted by Ernest, I unpack this perspective next before turning to Ernest's argument.

Face of the Other*: Levinas' ethical formulation*

> Every man's (sic) responsibility [is] towards all others, a responsibility which has nothing to do with any acts one may have really committed. Prior to any act, I am concerned with the Other, and I can never be absolved from this responsibility (Levinas, 1982, p. 290).

> Ethics, in this bare, stripped down sense, is the first philosophy of mathematics education [research]. Following Levinas' arguments, ethics

> trumps the other candidates for first philosophy for mathematics education (Ernest, 2012, p. 13).

Levinasian ethics (1951, 1969, 1982, 1984, 1985) is not an absolute ethical code that must be followed; to assert such codes would presume a human experience reducible to totalised categories (Neyland, 2004). The presupposition of interpersonal encounters, Levinas argues, occurs prior to both ontology and epistemology (1982); that is, the supposition of an inevitable encounter with the *Other* precedes both the embodiment of the encounter (ontology, or being) and the reflection on practices which lead to the formation of personal creeds (epistemology, or knowing). In part, Levinas argues, that since *being* is reducible to *knowing*, and *knowing* is not only violent and negating but also *insufficient*, there must be something which pre-exists both being and knowing, both ontology and epistemology.

For Levinas, the ontological relationship between individuals—that is the *being*ness of individuals exposed to one another—is one which is reducible to understanding. In other words, Levinas (1951) argued, the ontological relationship is one in which one affirms the *be*ing of another through *understanding* their otherness; through reducing their humanity to a reference to the universal (e.g. instead of seeing the Other as a complex human, one might understand them as a Black queer woman; reducing the totality of their experience to the comprehensible intersection of three universal categories). This reduction of Otherness to knowing—or the reduction of ontology to epistemology, and epistemology to knowing—and the violence and negation (Levinas, 1951) inherent in this knowing of an *Other*, is the problem which induced Levinas's departure from ontology and epistemology, towards what he defines as an ethics, what he outlines as ethical conduct.

Levinas asserted: 'we are responsible beyond our intentions . . . our consciousness and our mastery of reality through consciousness do not exhaust our relation with reality' (Levinas, 1951, p. 4). By this, Levinas suggests that 'in doing that which I wanted to do, I have done so many things I did not want' (Levinas, 1951, p. 4.). In other words, Levinas argued that the *entirety* of our bodily exposure to Others in the world is not captured by our *conscious* interaction with Others (though surely *some* is): there is also the accidental and the unconscious. Proper conduct for Levinas, constitutes the suspension of *knowing* the Other, respecting their unknowable complexity (Butler, 2005), and acknowledging one's responsibility towards the preservation of that same Other, since it is from the *Other* that the *I* is bestowed recognition (Levinas, 1982, 1984).

It is this pre-reflective exposure, this bodily exposure in front of the face of the other which precedes our comprehension of the *Other*, and the suspension of the grasp of understanding, that constitutes an ethical relationship to the other. It is also this exposure which constitutes the ethical responsibility of Levinas (1982) and the 'bare, stripped down sense' characterisation of ethics named by Ernest (2012). The presupposition of this encounter is a result of our unchosen cohabitation of the earth with others, our responsibility to our neighbours, regardless of whether or not they are kin, given their

equal right to inhabit the earth (Butler, 2015; Levinas, 1982). This Levinasian ethics, a pre-ontological and pre-epistemological responsibility for the Other, is the perspective adopted in a majority of the literature outlined above (namely, Atweh, 2011a, 2011b, 2013; Atweh and Brady, 2009; Boylan, 2013, 2016; Neyland, 2004). Levinasian ethics, however, is only one of a number of ethical formulations; after elaborating Ernest's argument for Levinasian ethics as the first philosophy of mathematics education, I transition to alternative ethical approaches.

ERNEST'S ARGUMENT FOR ETHICS AS THE FIRST PHILOSOPHY OF MATHEMATICS EDUCATION RESEARCH

Ernest (2012) sought to establish ethics as *the* first philosophy of mathematics education research, to establish ethics as a central and defining characteristic of all mathematics education research. Through replicating Levinas' argument against ontology and epistemology (1951, 1984), Ernest concluded that ethics is the first philosophy of mathematics education research, the philosophy central to all mathematics education research endeavours. While I agree with Ernest that ethics can indeed serve as *an* acceptable first philosophy of mathematics education research, I diverge in his endorsement of Levinasian ethics as *the* ethics which is mathematics education research's first philosophy. Instead of adopting Boylan's argument that Levinasian ethics is only concerned with the *Other*, and that mathematics education researchers must additionally consider the self, social, cultural and ecological (2016), I argue here that ethic *per se* is construed too narrowly in the philosophy of mathematic education literature and suggest that additional ethical perspectives from philosophy might be considered and might be generative of new ideas.

Ernest, nearing the crescendo of his argument (2012, p. 13), established several of his positions explicitly: (1) Ernest accepted Levinas' argument for ethics as first philosophy writ large, (2) Ernest found Levinas's conceptions of ethics to be adequate/acceptable, and (3) Levinasian ethics is the appropriate first philosophy of mathematics education research. In this section, I analyse Ernest's replication of Levinas' argumentation. In particular, I outline Ernest's description, and subsequent disqualification, of critical theory, philosophy of mathematics, ontology and epistemology as first philosophies for mathematics education research.

The choice of critical theory, philosophy of mathematics, epistemology, ontology and ethics as candidate first philosophies was Ernest's choice and may seem arbitrary. Ernest justified his inclusion, however, of epistemology, ontology and ethics by paralleling the philosophical progression from Descartes to Heidegger to Levinas, from epistemology to ontology to ethics as first philosophy. Critical theory was included because of the context of the sociopolitical turn in mathematics education research (e.g. Gutiérrez, 2013) which has questioned the foundations of mathematics education research itself. Further, philosophy of mathematics was included given the intimate connection between the social institution of mathematics education research and the body of knowledge named mathematics.

Critical Theory. Critical theory in mathematics education research (e.g. D'Ambrosio, 1985; Fasheh, 2012; Pais, 2011; Skovsmose, 1985) can be understood as a values-based judgement of the intersection of mathematics education research with some social practice (Ernest, 2012). Ernest argued that there is ethical, philosophical or epistemological research which does not presume a critical orientation (e.g. 'what does it mean to know mathematics?' versus 'who can know what mathematics?'), therefore critical theory is insufficient as a first philosophy for mathematics education research. Further, Ernest asserted that this dependency of critical theory on ethical framing—the basis for any value-judgements—positions critical theory as a so-called *last philosophy*, a philosophy which succeeds other philosophies rather than precedes them.

Philosophy of Mathematic. Philosophy of mathematics asks 'What is mathematics, and how can we account for its nature? What philosophies of mathematics have been developed? Whose?' (Ernest, 1991, p. xii). One's particular beliefs about the nature of mathematics (e.g. mathematics as absolute vs. mathematics as fallible; Lakatos, 1976), one's beliefs about the ontological nature of mathematical objects (e.g. the Platonic discussion of a 'Real' object of mathematics, to be discovered) do not have a deterministic impact on the nature of that same person's teaching and classroom (Ernest, 1995, 2008, 2012). For this reason, together with the number of mathematics education research concerns that are beyond the scope of a philosophy of *mathematics* (e.g. a cognitive study of learning may not necessarily be dependent upon a philosophy of mathematics), Ernest declared philosophy of mathematics insufficient as the first philosophy of mathematics education research.

Epistemology. While epistemology, centrally concerned with questions of *what is knowledge? What does it means to know?* (Ernest, 1991), seems appropriate for mathematics education research, an endeavour directed towards the teaching and learning of mathematics, there is much excluded. By many accounts, however, 'mathematics education [research] is an interdisciplinary field situated at the confluence of mathematics, the social sciences, and the humanities' (Ernest, 2012, p. 10); as such, knowledge and knowing fails to account for all the psychological, social and discursive processes simultaneous with epistemological processes.

Ontology. Ernest suggested that ontology, or the study of being, the interrogation of what objects are taken for-granted to exist in the world and their nature as objects, might prove generative as a first philosophy of mathematics education research. Different ontologies would hold different accounts of the nature of and existence of humans and the objects we interact with in the world (e.g. calculators as objects versus calculators as extensions of cognition; Greeno and MMAP, 1998). Ernest suggested that this investigation of the nature of human and object *being*ness within the context of mathematics education research could prove to be quite fruitful, going so far as to recommend a Heideggerian ontological framework.

Nonetheless, Ernest disqualified ontology as the first philosophy since these ontological theories had not yet been elaborated in mathematics education research (see de Freitas and Sinclair, 2013, for seminal work in this

area). Since Ernest's task in identifying the first philosophy of mathematics education research was *nominal* rather than normative, *descriptive* rather than prescriptive—though his use of *the* may betray this—he chose not to name something that was undeveloped at the time as the first philosophy. Levinas, however, disqualified ontology as a first philosophy writ large when he argued that *ethics precedes ontology* (1951, 1984).

Ethics. Ethics is foundationally concerned with the question of proper conduct and is considered from a number of perspectives: as naming and engaging in virtuous behaviour (Hursthouse and Pettigrove, 2016; Noddings, 1988), as prescribing one's duty (Alexander and Moore, 2016), as mandating conduct which maximises happiness and minimises harm (Sinnott-Armstrong, 2015), and even as a radical concern for the *Other* which exceeds one's concern for one's self (Levinas, 1982). Levinas established ethics, or properly his particular concept of ethics (Levinas, 1951, 1982, 1984, 1985), as a first philosophy writ large, that is, as a foundational philosophy that underlines and guides all human experience and interaction. In other words, according to Levinas, our capacity to be responsible for others, even more than our responsibility for our own selves, is the defining characteristic of humanity.

Ernest argued that since (a) Levinas established ethics as a first philosophy writ large, and (b) he could not disqualify Levinasian ethics as a first philosophy for mathematics education research, Levinasian ethics was *the* first philosophy of mathematics education research.

I refer to Ernest's conclusion as 'Levinasian ethics' instead of *ethics* as Ernest does to emphasise the Levinasian assumption implicit in Ernest's assertion of 'ethics as *the* first philosophy of mathematics education research'. For Ernest, ethics is synonymous with Levinasian ethics so that Ernest's conclusion is more properly formulated as: Levinasian ethics as the first philosophy of mathematics education research.

MORAL PHILOSOPHY: A CONSTELLATION OF PERSPECTIVES

While Ernest was diligent to consider several branches of philosophy—ontology, epistemology and ethics—he treated ethics as a singular endeavour, one with which Levinasian ethics was synonymous. My purpose here is to argue that even though Levinas' ethics *is* the most widely adopted in the philosophy of mathematics education literature, there is no reason to assume this *ought* to be the case.[2] This section proceeds through the introduction of three distinct approaches to moral philosophy: virtue ethics, deontology or duty ethics, and utilitarian ethics. These three ethical perspectives provide an overview of the normative approaches to ethics (Mastin, 2008).

While these branches of ethics are not necessarily compatible with each other, indeed Levinas explicitly excludes these approaches from the *ethical* on the basis of their prescriptiveness, I suggest that considering each as a first philosophy of mathematics education research will be generative in framing *ethical* mathematics education research. Though I present one perspective as representative of each branch, these branches are not monolithic: within each of the following branches of moral philosophy are numerous conceptions

which are neither necessarily complementary nor compatible. The breadth of each branch is an additional way in which the joining of the philosophical study of ethics to mathematics education research can be generative.

Normative Ethics. While there are numerous divisions that I could make between the various branches of ethics, I have chosen two for particular rhetorical purposes: normative vs. non-normative and modern vs. postmodern. The first division enables me to contrast virtue, duty and utilitarian ethics with non-prescriptive ethics. These normative ethics have had little explicit uptake within mathematics education research, but that is not to say that the questions these perspectives raise have not been addressed. Instead, I argue here that when relevant work has occurred, it has started with mathematics education research, pointed to anticipated beneficial consequences, and then has accepted that as a justification for that work.

The second division invites a critique of the majority of the literature reviewed to this point. By looking to the philosophy literature, an alternative reading of Levinas (Batnitzky, 2004) which establishes him as a modern thinker—*contra* the prevalent association of Levinas with postmodernism in the mathematics education research literature—suggests that Neyland's (2004) central argument for a postmodern re-enchantment may not be realised though his, and others', adoption of Levinas. Indeed, adopting a postmodern perspective and bringing Batnitzky's reading to Ernest's work suggests a critical limitation within the philosophy of mathematics education research: with the exception of Walshaw and Lawler, philosophers of mathematics education continue to draw upon modern ethical formulations, Modern formulations that reduce human experience to rule following. This Modern reading of Levinas, likewise, reenchants Neyland's (2004) argument and echoes the call for a postmodern reenchantment of mathematics education research.

Virtue ethics. Virtue ethics is the first of three normative approaches to ethics, approaches to ethics which are prescriptive of a proper behaviour determined by some set of virtues, consequences or rules. Virtue ethics can be traced to Aristotle (Hursthouse and Pettigrove, 2016) and is concerned with *good people*, people whose very nature is cultivated to be virtuous (e.g. a virtuous person is one who is temperate, courageous, modest, etc.; Aristotle, 1955). Virtue ethicists, however, have not been restricted to antiquity. For example, Nel Noddings (1988), feminist ethicist, has introduced an ethic of caring, in which care for others is offered as a feminist virtue. As is typical of second-wave feminism, Noddings' virtue of caring is problematically uncritical of the association of caring with feminine, an association that is neither natural nor necessary but culturally and historically constructed (Butler, 1990). Nonetheless, Noddings did seek to address the unequal valuation of feminist and non-feminist perspectives.

Unlike Levinas' perspective, which need not presume a stable and fixed identity, virtue ethics would invite questioning the ethical *nature* or core, the degree of ethicality of mathematics education research itself. Such questions might consider: how do mathematics education researchers argue that mathematics education is itself virtuous? What are the virtues by which an ethical mathematics education might be measured? Does it empower

students (e.g. teaching mathematics for social justice) and, presumably, having agency and the potential to effect change are virtuous? Perhaps teaching is a virtue? Is possessing mathematical knowledge itself is a virtue?

Duty ethics. Duty ethics, or deontology, is second of three normative approaches to ethics. Duty ethics, of which there are three distinct sub-branches (Alexander and Moore, 2016; Rohlf, 2015), restricts proper conduct (a) to honouring one's duty, (b) to respecting another's rights, or (c) to upholding the contractual requirement of consent. Kant described his categorical imperative, or one's proper duty, is to act in such a way that one would will all others to act in the same way, in accordance with what might constitute a universal law (Kant, 1993). From this perspective, for example, one would not will for all to act in their own egoistic self-interest: stealing money from someone might benefit me, but I would not reasonably will another to steal my own money.

For mathematics education research, a deontological perspective invites questioning if and how mathematics education has been constructed as a duty, a right, or a contractual obligation: is it the duty of those who know mathematics to ensure that the body of mathematical knowledge is passed from one generation to another? Is it dutiful to teach mathematics because of ways in which it empowers students to use mathematics in understanding and making their world? Is it the right of all children to learn mathematics, therefore teaching mathematics is justified? Do mathematics educators owe all students a mathematics education because of the power and status afforded by it?

Utilitarian Ethics. Utilitarianism is the last of the three normative approaches to ethics and can be traced to Jeremy Bentham and John Stuart Mill (Bentham, 1907; Mill, 2001). Utilitarianism evaluates the *consequences* of actions and holds that 'an act is morally right if and only if that act maximises the good, that is, if and only if the total amount of good for all minus the total amount of bad for all is greater than this net amount for any [alternative] act available' (Sinnott-Armstrong, 2015). Utilitarianism necessitates, prior to any action, calculating the total of all happiness and all harm effected by an act; only acts in which total happiness exceeds total harm are ethically justified (with those acts which achieve maximal happiness and minimal harm being optimal).

Like the previous approaches to normative ethics, utilitarianism is not singular: there are competing conceptions (see Sinnott-Armstrong, 2015 for a summary of each formulation). While some utilitarian formulations prioritise minimising total harm (*negative utilitarianism*: every action should monotonically reduce harm), others demand the optimal decision be made at each step with little advice on how to approach such a calculation (*act utilitarianism*). In contrast to both, some utilitarian formulations provide general rules under which harm is expected to be minimised and happiness is expected to be maximised, *on average* (*rule utilitarianism*). In some instances, the happiness of and harm to everyone is treated equally; other times, mitigating harm to those most hurt is prioritised over mitigating the harm of others less hurt.

From these utilitarian perspectives, many questions of mathematics education come to the surface, a few include: is mathematics education justified because of a calculus establishing more happiness than harm? In other words, does the overall benefit of mathematics education outweigh the harm it inflicts (e.g. Fasheh, 2012)? Is mathematics education justified as a rule since *on average* it yields more happiness than harm? Is mathematics justified since it seeks to educate all, or since those most vulnerable can benefit from learning mathematics (e.g. Gutstein, 2003)?

Non-Normative Ethics. Levinas does not offer any normative prescription to be followed that will guarantee ethical engagement with Others (Critchley, 1996). Instead, Levinas argued that due to the complexity of our responsibility for the Other, proper conduct cannot be reduced to prescriptive virtues, norms, nor calculi. Explicitly, Levinas himself would have considered virtue, duty and utilitarian forms of ethics insufficient for engaging in a 'nonsubsumptive relation with the other' (Critchley, 1996). Undoubtedly, Levinas' ethics is markedly non-normative but it is not necessarily postmodern. While Neyland, Ernest and the others each identify Levinas with postmodernism, a modern reading of Levinas, borrowed from philosophy and discussed next, challenges this classification.

A POSTMODERN RELATION TO ETHICS

> Levinas' philosophical project is not to overcome assertions about the modern subject but to reassert the truth of such a construction . . . Far from presenting a postmodern retreat from the subject, Levinas affirms Descartes's modern subject for ethical purposes (Batnitzky, 2004, pp. 19–21).

While Atweh, Boylan, Ernest and Neyland each associate Levinas with postmodern thinking, Batnitzky (2004) provides an alternative reading of Levinas which proposes that Levinas can be read as a Modern thinker. In particular, Batnitzky argues that the subject, the 'I' of Levinas, is essentially the Cartesian dualistic subject. This is not to say that Levinas' subject is equivalent to the Cartesian *cogito ergo sum* (I think, therefore I am); indeed, Levinas argued that the ethical occurs prior to both the *cogito* and the *sum*, epistemology and ontology (in a way, I am ethically responsible *ergo cogito et sum*).

Descartes affirmed the split between rationality and animalistic senses, subjugating the 'unthought' to the rational thinking of the mind. Levinas (1951, 1969, 1982, 1984, 1985), in his attempt to establish the precedence of ethics over ontology and epistemology reifies this division. Levinas' insistence that there is some part of human experience, in front of the face of the other, which not only precedes but also exceeds epistemology hints towards his dualistic assumptions. If I am in some ways my thoughts and in some ways my body, and one precedes the other—regardless of which does the preceding— Levinas' sequential exposure is irreconcilable with an embodied, postmodern or materialist account.

Postmodern theories which reject this dualism (e.g. Butler, 2001) argue explicitly against this Cartesian mind-body split. While detailing Butler's ethical perspective (2005, 2015) is beyond the scope of this paper, in brief, Butler's ethical perspective argues that neither are we as humans reducible to the language with which we refer to our bodies nor are we bodies which transcend language, instead, we are simultaneously constituted by language and constituting ourselves through bodily performances. Butler's formulation diverges from Levinas by arguing that the ethical occurs concurrently with being, not prior to: the ethical, the ontological and the epistemological are inextricable (i.e. I am ethically responsible *et cogito et sum*). Butler (2001) likewise departs from the singularity of Levinas' Other that bestows recognition: Butler's ethical project occurring during the performance of identity for and bid for recognition from many Others.

Interrogating mathematics education research from a Butlerian perspective might ask: How might we reimagine an equality between a teacher and their multiple students? How does mathematics education research respect the precarious humanity of those engaged in mathematics education (as students, teachers, researchers, etc.) at threat of both discursive and ontological erasure? How does language constrain and constitute the mathematical subject? What bodily performances are recognised as mathematical? These questions, together with those raised by considering virtue, duty and utilitarian ethics as introduced above, demonstrate how philosophical inquiry into mathematics education research is generative. If alternative ethical configurations are considered, what other questions might be raised?

MOVING WITH/BEYOND LEVINAS: LIMITATIONS OF CURRENT CONCEPTIONS

I am indebted to Levinas for his 'reintroduction of the discourse of ethics into social science discourse' (see Atweh, 2013, for this attribution). While I have framed the Levinasian perspective included in mathematics education research as problematic—in part because of its prevalence and in part because of its allegiance to the Modern, Cartesian subject—it is also only on the condition of its presence that I am able to diverge and introduce new conceptions of ethics for consideration. The Levinasian perspective presented by Ernest, presented as synonymous with ethics, unnecessarily limits what can be understood as an ethical mathematics education research, yet it is the very condition by which alternatives can arise.

To reiterate, the philosophy of mathematics education literature has largely considered the ethical perspective of Emmanuel Levinas with some additional consideration of critical, feminist, Indigenous and postmodern perspectives. Since my aim is not normative, and my interest is not in prescribing a singular first philosophy nor a singular ethical formulation, I have included both normative and non-normative alternatives to ethics as possible points of departure. By introducing the philosophical study of ethics, I identified at least three additional branches of ethics which might be considered as first philosophies of mathematics education research. Furthermore, I showed how philosophy literature offers additional readings of the

ethical formulations that have become taken for granted within mathematics education research (namely, Batzinsky's modern reading of Levinas), challenging the so-called postmodern re-enchantment of mathematics education research. Explicitly adopting an ethical perspective is generative of new ways to interrogate and understand mathematics education research though philosophical problem posing. As philosophers of mathematics education, when we invoke *ethics*, to whose ethics are we referring?

Correspondence: Christopher Dubbs, Program in Mathematics Education, Michigan State University, 354 Farm Lane Rd, North Kedzie, Room 332, Michigan State University, East Lansing, MI 48824, USA.
Email: dubbschr@msu.edu

NOTES

1. I would like to emphasise that I do not disagree with Boylan and, indeed, agree that the social and cultural aspects of mathematics education is central to its ethicality. The work of Bob Moses, 1989, for example, who argues for mathematical knowledge as a civil right is not included here since he does not situate himself within the philosophical tradition of ethics, but rather within the political activism of Ella Baker and her role in the Civil Rights Movement. These two traditions have distinct foundational assumptions and while I do not hold one above the other, this does focus on the former at the exclusion of the latter.
2. Hume, 1739, is explicit in distinguishing propositions of what *is* and what *ought* to be. By way of this *is-ought* distinction, Hume directly countered the naturalistic fallacy: the state of things is not justification for what ought to be. Hence, that Levinas' perspective *is* most widely adopted by mathematics education researchers is not sufficient to establish that it *ought* to be that way—a separate *ought*-argument is necessary.

REFERENCES

Alexander, L. and Moore, M. (2016) Deontological Ethics, in: Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Available online at: https://plato.stanford.edu/archives/win2016/entries/ethics-deontological/.

Andersson, A. and le Roux, K. (2017) Toward an Ethical Attitude in Mathematics Education Research Writing. *Journal of Urban Mathematics Education*, 10.1, pp. 74–94.

Aristotle (1955) *The Ethics of Aristotle: The Nichomachaen Ethics* (rev. ed.) trans. J. K. Thomson, (New York, Viking).

Atweh, B. (2011a) Reflections on Social Justice, Race, Ethnicity and Identity from an Ethical Perspective. *Cultural Studies of Science Education*, 6, pp. 33–47.

Atweh, B. (2011b) Quality and Equity in Mathematics Education as Ethical Issues, in: *Mapping Equity and Quality in Mathematics Education* (Dordrecht, Springer), pp. 63–75.

Atweh, B. (2013) Is the Good a Desire or an Obligation? The Possibility of Ethics for Mathematics Education. *Philosophy of Mathematics Education Journal*, 27, pp. 1–11.

Atweh, B. and Brady, K. (2009) Socially Response-Able Mathematics Education: Implications of an Ethical Approach. *Eurasia Journal of Mathematics, Science & Technology Education*, 5.3, pp. 135–143.

Batnitzky, L. (2004) Encountering the Modern Subject in Levinas. *Yale French Studies*, 104, pp. 6–21.

Battey, D. (2013) Access to Mathematics: 'A Possessive Investment in Whiteness'. *Curriculum Inquiry*, 43.3, pp. 332–359.

Bentham, J. (1907) *Introduction to the Principles of Morals and Legislation*. (Oxford, Clarendon Press).

Boylan, M. (2013) Mathematics Education and Relational Ethics: Dimensions and Sources. Paper presented at the Third Mathematics Education and Contemporary Theory Conference (Manchester, MECTC). Available online at: http://www.esri.mmu.ac.uk/mect2/papers_13/boylan.pdf.

Boylan, M. (2016) Ethical Dimensions of Mathematics Education. *Educational Studies in Mathematics*, 92.3, pp. 395–409.

Butler, J. (1990) *Gender Trouble: Feminism and the Subversion of Identity* (New York, Routledge).

Butler, J. (2001) How Can I Deny That These Hands and This Body Are Mine? In: T. Cohen, B. Cohen, J. H. Miller and A. Warminksi (eds), *Material Events: Paul de Man and the Afterlife of Theory* (Minneapolis, MN, University of Minnesota Press).

Butler, J. (2005) *Giving an Account of Oneself* (Oxford, Oxford University Press).

Butler, J. (2015) *Notes Toward a Performative Theory of Assembly* (Cambridge, MA, Harvard University Press).

Conrad, R. (2014) *Against Equality: Queer Revolution Not Mere Inclusion* (Oakland, CA, AK Press.)

Critchley, S. (1996) Introduction to 'Is Ontology Fundamental?' In: A. Peperzak, S. Critchley and R. Bernasconi (eds), *Emmanuel Levinas: Basic Philosophical Writings* (Bloomington, IN, Indiana University Press).

D'Ambrosio, U. (1985) Ethnomathematics and Its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, 5, pp. 44–48.

Davis, A. (1992) Review of *Philosophy of Mathematics Education*. *Journal of Philosophy of Education*, 26.1, pp. 121–126.

de Freitas, E. and Sinclair, N. (2013) New Materialist Ontologies in Mathematics Education: The Body in/of Mathematics. *Educational Studies in Mathematics*, 83.3, pp. 453–470.

Dell'Olio, A. and Simon, C. J. (eds) (2010) *Introduction to Ethics: A Reader* (Lanham, MD, Rowman & Littlefield Publishers).

Ermine, W. (2007) The Ethical Space of Engagement. *Indigenous Law Journal*, 6.1, pp. 193–203.

Ernest, P. (1991) *The Philosophy of Mathematics Education* (New York, Routledge).

Ernest, P. (1995) Values, Gender and Images of Mathematics: A Philosophical Perspective. *International Journal of Mathematical Education in Science and Technology*, 26.3, pp. 449–462.

Ernest, P. (2008) Epistemology Plus Values Equals Classroom Image of Mathematics. *Philosophy of Mathematics Education Journal*, 23, pp. 1–12.

Ernest, P. (2012) What is our First Philosophy in Mathematics Education?*For the Learning of Mathematics*, 32.3, pp. 8–14.

Ernest, P. (2016) The Collateral Damage of Learning Mathematics. *Philosophy of Mathematics Education Journal*, 31, pp. 1–24.

Fasheh, M. J. (2012) The Role of Mathematics in the Destruction of Communities, and What We Can Do to Reverse This Process, Including Using Mathematics, in: O. Skovsmose and B. Greer (eds) *Opening the Cage: Critique and Politics of Mathematics Education* (Rotterdam, Sense Publishers), pp. 93–105.

Foucault, M. (1994) The Ethics of the Concern for Self as a Practice of Freedom, in: P. Rabinow (ed.). *Michel Foucault: Ethics - Subjectivity and Truth* (London, Allen Lane), pp. 281–302.

Greeno, J. G. and MMAP. (1998) The Situativity of Knowing, Learning, and Research. *American Psychologist*, 53.1, p. 5.

Gutiérrez, R. (2013) The Sociopolitical Turn in Mathematics Education. *Journal for Research in Mathematics Education*, 44.1, pp. 37–68.

Gutstein, E. (2003) Teaching and Learning Mathematics for Social Justice in an Urban, Latino School. *Journal for Research in Mathematics Education*, 34, pp. 37–73.

Gutstein, E. (2006) *Reading and Writing the World with Mathematics: Toward a Pedagogy for Social Justice* (New York, Routledge).

Hackenberg, A. J. and Lawler, B. R. (2002) An Ethics of Liberation Emerging from a Radical Constructivist Foundation. Paper presented at the Biennial International Conference on Mathematics Education and Society (Denmark, MES). Available online at: https://files.eric.ed.gov/fulltext/ED468200.pdf.

Hāwera, N. and Taylor, M. (2017) 'I Learned Quite a Lot of the Maths Stuff Now That I Think of It': Māori Medium Students Reflecting on their Initial Teacher Education. *Australian Journal of Teacher Education*, 42.5, pp. 87–100.

Henrich, D. (2015) Mathematical Ethics: Values, Valences and Virtue. *Philosophy of Mathematics Education Journal*, 29, pp. 1–8.

Howley, C. (2003) The Lifeworld Makes Mathematics Education Rural: Implications for Math Education Research. Paper presented at the Annual Meeting of the National Council of Teachers of Mathematics (San Antonio, NCTM).

Huang, S. Y. L. and Waxman, H. C. (1993) Comparing Asian-and Anglo-American Students' Motivation and Perceptions of the Learning Environment in Mathematics. Paper presented at the Annual Conference of the National Association for Asian and Pacific American Education (New York, NAAPAE).

Hume, D. (1739) *A Treatise of Human Nature*. Available online at: https://ebooks.adelaide.edu.au/h/hume/david/h92t/B3.1.1.html.

Hursthouse, R. and Pettigrove, G. (2016) Virtue Ethics, in: Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Available online at: https://plato.stanford.edu/archives/win2016/entries/ethics-virtue/

Kant, I. (1993) *Grounding for the Metaphysics of Morals*. trans. J. Ellington (Indianapolis, IN, Hackett Publishing Co).

Ladson-Billings, G. (2009) *The Dreamkeepers: Successful Teachers of African American Children* (San Francisco, John Wiley & Sons).

Lakatos, I. (1976) *Proofs and Refutations: The Logic of Mathematical Discovery* (Cambridge, University of Cambridge Press).

Lawler, B. R. (2012) The Fabrication of Knowledge in Mathematics Education: A Postmodern Ethic Toward Social Justice, in: Tony Cotton (ed.), *Towards an Education for Social Justice: Ethics Applied to Education* (New York, Peter Lang).

Levinas, E. (2008[1951]) Is Ontology Fundamental? In: A. Peperzak, S. Critchley and R. Bernasconi (eds), *Emmanuel Levinas: Basic Philosophical Writings* (Indianopolis, IN, Indiana University Press).

Levinas, E. (1991[1969]) *Totality and Infinity* (Dordrecht, Kluwer Academic Publishers).

Levinas, E. (1989[1982]) Ethics and Politics, in: S. Hand (ed.), *The Levinas Reader* (Oxford, Blackwell Publishers).

Levinas, E. (1989[1984]) Ethics as First Philosophy, in: S. Hand (ed.), *The Levinas Reader* (Oxford, Blackwell Publishers).

Levinas, E. (1985) *Ethics and Infinity* (Pittsburgh, PA, Duquesne University Press).

Mastin, L. (2008) Ethics, in: 'The Basics of Philosophy'. Available online at: http://www.philosophybasics.com/branch_ethics.html.

McGarvey, L. M. and Sterenberg, G. (2009) Ethical Concerns: Negotiating Truth and Trust. *For the Learning of Mathematics*, 29.1, pp. 35–39.

Mendick, H. (2006) *Masculinities in Mathematics* (New York, Open University Press).

Mill, J. S. (2001) *Utilitarianism* (Ontario, Canada, Batoche Books Limited).

Morvan, J. A. (2017) Making Visible and Acting on Issues of Racism and Racialization in School Mathematics. *Brock Education: A Journal of Educational Research and Practice*, 27.1, pp. 35–52.

Moses, R. P., Kamii, M., Swap, S. M. and Howard, J. (1989) The Algebra Project: Organizing in the Spirit of Ella. *Harvard Educational Review*, 59.4, pp. 423–443.

Neyland, J. (2004) Toward a Postmodern Ethics of Mathematics Education, in: Walshaw, M. (ed.), *Mathematics Education Within the Postmodern* (Greenwich, CN, Information Age Publishing), pp. 55–73.

Noddings, N. (1988) An Ethic of Caring and its Implications for Instructional Arrangements. *American Journal of Education*, 96.2, pp. 215–230.

Pais, A. (2011) Criticisms and Contradictions of Ethnomathematics. *Educational Studies in Mathematics*, 76, pp. 209–230.

Pojman, L. P. and Tramel, P. (eds) (2009) *Moral Philosophy: A Reader* (Indianapolis, IN, Hackett Publishing Co).

Powell, A. (2000) Reflections on Exemplary Mathematics Teachers by Two African American Students. Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, AERA).

Radford, L. (2012) Education and the Illusions of Emancipation. *Educational Studies in Mathematics*, 80.1-2, pp. 101–118.

Rohlf, M. (2016) Immanuel Kant, in: Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Available online at: https://plato.stanford.edu/archives/spr2016/entries/kant/.

Rotas, N. (2018) Debugging Robotic Machines in Transdisciplinary Spaces. *Canadian Journal of Science, Mathematics and Technology Education*, 18.3, pp. 232–241.

Russell, G. L. and Chernoff, E. J. (2013) The Marginalisation of Indigenous Students within School Mathematics and the Math Wars: Seeking Resolutions within Ethical Spaces. *Mathematics Education Research Journal*, 25.1, pp. 109–127.

Shapiro, J. P. and Stefkovich, J. A. (2016) *Ethical Leadership and Decision Making in Education: Applying Theoretical Perspectives to Complex Dilemmas* (New York, Routledge).

Sinnott-Armstrong, W. (2015) Consequentialism, in: Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Available online at: https://plato.stanford.edu/archives/win2015/entries/consequentialism/.

Skovsmose, O. (1985) Mathematical Education vs. Critical Education. *Educational Studies in Mathematics*, 16.4, pp. 337–354.

Skovsmose, O. (2012) Critical Mathematics Education: A Dialogical Journey, in: A. A. Wager and D. W. Stinson (eds), *Teaching Mathematics for Social Justice: Conversations with Educators* (Reston, VA, National Council of Teachers of Mathematics), pp. 35–47.

Skovsmose, O. (2018) Critical Constructivism: Interpreting Mathematics Education for Social Justice. *For the Learning of Mathematics*, 38.1, pp. 38–44.

Stemhagen, K. (2008) Doin' the Math: On Meaningful Mathematics-Ethics Connections. *The Mathematics Enthusiast*, 5.1, pp. 59–66.

Stemhagen, K. (2016) Deweyan Democratic Agency and School Math: Beyond Constructivism and Critique. *Educational Theory*, 66.1-2, pp. 95–109.

Walshaw, M. (2013) Post-structuralism and Ethical Practical Action: Issues of Identity and Power. *Journal for Research in Mathematics Education*, 44.1, pp. 100–118.

Walshaw, M. (2014) Who Can Know Mathematics? *For the Learning of Mathematics*, 34.2, pp. 2–6.