

Ethics, Morality, and Mathematics Education

Jude Ocean

La Trobe University

This paper explores the possible effects of gendered ethical systems or moralities on participation in mathematics education. In particular, it suggests that the prevailing morality in the classroom significantly affects the attraction, retention, and success of female students.

Introduction

This paper discusses the influence of personal ethical systems or moralities on participation in mathematics education. It is a summary of the argument underlying a current doctoral study. The intention of this study is to explore one possible aspect of the resistance of women to post-compulsory mathematics education. The consideration of morality is somewhat unusual within current mathematics education research, but, this paper will argue, it is relevant to the issue of increasing the participation of girls and women in mathematics education.

The terms "morality" and "ethics" are sometimes used differently. "Morality" brings with it a particular, usually religious resonance. It suggests a stern set of duties that require us to subordinate behaviour, particularly sexual behaviour, to a universal "moral law". "Morality" thus has come to reflect a certain set of Judaeo-Christian values, which may not be found in other ethical systems. However, while the term "morality" has acquired religious/sexual overtones in ordinary language, it is generally used within western philosophical discussion without these connotations, so that it is synonymous with personal "ethics". Further, it is the term commonly used in the feminist literature on morality. It is for these reasons that the term "morality" rather than "ethics" is generally used in this paper.

Webster's Dictionary (1981) defines morality as "principles or considerations of right and wrong action or good and bad character". This definition is based on concepts of duty, obligation, and principle. Such a construction of morality has been the basis of ethical argument since Classical Greece. Morality has been thought to have one origin, a *human* one. However, the work of Carol Gilligan has suggested that there may not be just one origin. She has identified two distinct moral perspectives, gender-related but not gender-specific. These she named Justice and Care morality- they are the moral perspectives associated with men and women respectively. The first section of this paper describes these two different moral perspectives more fully. The second part of this paper discusses the influence of personal morality on participation in mathematics education, with particular attention to the attraction and retention of female students. The second part also provides evidence to suggest that a classroom environment that embodies a Care (rather than a Justice) morality will produce more successful female mathematics students.

Part One: Morality

Gendered Morality

In 1977, Carol Gilligan identified differences in the ways in which men and women approach moral dilemmas. She reported what she called a "different voice" amongst women talking about morality. In 1982, her challenge to conventional moral theory was published. Gilligan's work provoked considerable controversy as, until this time, gender had not been considered relevant to moral theory. This is shown by the fact that all the major moral theorists (such as Piaget, 1965; Erikson, 1968; Kohlberg, 1969) had worked with all-male

samples. They had unhesitatingly presented their findings as universal. Kohlberg (1981), for instance, conducted a heavily funded study of human moral development, in which he followed the development of eighty-four males for twenty years. He did not once interview a female. This possible flaw in his methodology attracted no comment until the work of Gilligan (1977).

Kohlberg (1971) described the development of moral judgement from childhood to adulthood. On his six-stage scale of moral development, men reach the pinnacle of moral maturity, while most women tend to cluster around the halfway mark. Women's judgements generally exemplify the third stage, where morality is conceived of in personal terms and goodness is concerned with helping and pleasing others. This conception of goodness is considered to be adequate for women in so far as their lives are centred in the home. Kohlberg implied that only if women entered the traditional arena of male activity would they recognise the inadequacy of this moral perspective and progress like men to the higher stages where relationships are subordinated to rules (stage four), and rules to universal principles of justice (stages five and six). Thus, Kohlberg's theory positioned women as deficient in comparison to men.

Rather than seeing women in need of change so that they would more closely fit the theory, Gilligan (1982) considered that the theory might be in need of change so as to more closely reflect reality. Gilligan described morality as a tension between the moral perspectives of Care and Justice. Women, she said, were more likely to construct a moral problem as a failure of response, rather than in terms of whether or not "rights" were adequately addressed. Since women were more likely to conceptualise the self as interdependent with others, rather than as separate and autonomous, Care morality centred more on the maintenance of relationships, rather than on individual rights, as in Justice morality.

Justice morality is that theorised by Kohlberg (1969,1971) as "universal" morality. It is the more familiar of the two because it is the basis of western legal systems. The moral priority of Justice is fairness or equality. A morally mature person is able to make decisions independent of the opinions and values of others. Within Justice morality, violation is of personal or property rights, rules, or standards of behaviour. At first sight, Care morality is less familiar. This may be because it has been relegated to the private rather than the public domain because of its association with women, as Martin (1994) argues. The priority of Care morality is the maintenance of connection to others. A morally mature person should be able to respond to the needs and circumstances of others *in their terms*. Within Care morality violation is of connection or relationship; for instance, abandonment, exclusion, ridicule, sarcasm, silence (as in being ignored). These are acts of violence; they do harm.

It follows that detachment, the mark of mature moral judgement within Justice morality, becomes *the* moral problem within Care morality. Conversely, situational morality (attention to the needs and circumstances of individuals) is the mark of mature moral judgement within Care morality but *the* moral problem within Justice morality (Gilligan & Attanucci, 1988). In short, those with a Care perspective have, relatively speaking, more of a focus on others; those with a Justice perspective have more of a focus on themselves. Each sees the moral priority of the other as a problem.

Justice and Care moralities have been presented here as quite distinct entities for the purposes of clear explanation. It is however important to note that they are not completely separate either conceptually or in practice. For instance, while some laws protect property and personal rights, others (such as those that ensure the provision of health services) are

designed to provide care. Individuals, too, usually demonstrate a combination of Justice and Care considerations, which differs by gender. Women usually mention more Care than Justice considerations, while men usually mention more Justice than Care considerations (Gilligan & Attanucci, 1988). However, in the North American populations studied, about 30 per cent of women, but virtually no men, demonstrated a Care-only morality. Thus, if women were not present in the samples, all responses could be analysed and scored in terms of Justice. When women are included in the samples, the existence of a sizeable group whose responses cannot be coded in terms of Justice morality forces confrontation with Justice as a "universal" moral theory (Gilligan & Attanucci, 1988).

Gilligan's work is not without challenge. One major criticism is that her theory is essentialist. Using the definition of essentialism given by Martin (1994), someone who claims to have identified an essence claims to have found a feature, characteristic or trait that differentiates all possessors of it from all non-possessors of it. By this definition, any essentialist theory of gender would be able to differentiate all men from all women. However, Gilligan specifically stated that morality was gender-related, not gender-specific (Gilligan, 1977, 1982). It follows that all men cannot be differentiated from all women on the basis of Gilligan's theory. The space limit on this paper leaves no more room for a discussion of criticisms of Gilligan's work, but Kerber (1986), Gilligan (1994), and Martin (1994) provide good overviews of both valid and refuted criticisms, in particular those focussing on race, ethnicity, class, culture, romanticism and essentialism.

This section has focussed on the links between morality and gender. The focus on the next section is on morality and its links with types of reasoning, particularly in mathematics. Ideas drawn from the work of Polya (1954) and Lakatos (1976) introduce this section.

Part Two: Mathematics Education

Morality and Reasoning

Early concerns about the moral climate of the mathematics classroom were voiced by the mathematician Polya (1954) and the philosopher Lakatos (1976). For example, Lakatos commented that "it has not yet been sufficiently realised that present mathematical and scientific education is a hotbed of authoritarianism and is the worst enemy of independent and critical thought ... in mathematics this authoritarianism follows the deductivist pattern." (Lakatos, 1976, p. 142). In criticism of the deductivist pattern he says that "deductivist style presents ... proofs out of the blue in an artificial and authoritarian way. It hides the global counter examples that led to their discovery" (Lakatos, 1976, p. 144). Lakatos valued independent and critical thinking, which he viewed as incompatible with authoritarianism. If we accept that authoritarianism is a certain sort of morality, Lakatos has claimed a link between morality and reasoning. In particular, he claimed that a certain type of morality (authoritarianism) was opposed to a certain type of thought (independent and critical).

Lakatos (1976) used the technique of "conscious guessing", which he contrasted to "the deductivist style" mentioned above, to develop independent and critical thought. This technique involves conjecture about relationships among quantities and shapes. Proof eventually arises from a continuing zigzag between conjecture and counter-example. However, conjecture and counter-example "do not appear in the fully fledged deductive structure; the zigzag of discovery cannot be discerned in the end-product" (Lakatos, 1976, p 42).

Polya (1954) defined the necessary moral qualities of the mathematician as honesty and courage. For Polya, the willingness to constantly confront belief by experience was

essential to the practice of mathematics. He believed it was necessary to continually check observation (experience) against generalisation (belief). This process of reasoning, and the willingness to undertake it, Polya termed the "inductive attitude". He identified honesty and courage as the necessary personal qualities that would enable the adoption of the "inductive attitude". In summary, both Lakatos (1976) and Polya (1954) described certain kinds of reasoning they believed to be desirable in mathematics. Lakatos identified a moral climate that he believed mitigated against this; Polya identified moral qualities that he believed encouraged it.

Lakatos (1976) and Polya (1954) wrote twenty and forty years ago, but their ideas were successfully put into practice by Lampert in 1990. Lampert experimented with teaching a course designed to generate the kind of mathematical thinking valued by Polya and Lakatos. She chose problems that had the capacity to engage all the students in the class in making and testing mathematical hypotheses. The hypotheses were embedded in the answers the students gave to the problem; comparing answers elicited hypotheses and provoked discussion of their relative merits, creating the kind of zigzag between inductive observation and deductive generalisation that finally creates the proof. This type of thinking, she noted, involves risk; risk that one's assumptions are open to revision, that one's insights are limited, that one's conclusions are inappropriate. Letting other people in on one's conjectures increases personal vulnerability (Lampert, 1990). Accordingly, she created a moral climate in the classroom designed to maximise honesty and courage in her students.

The kind of mathematical thinking valued by Lakatos (1976) and Polya (1954) is echoed today in educational policy both in Australia and New Zealand. A *National Statement On Mathematics For Australian Schools (1990)* states that

"The systematic and formal way in which mathematics is often presented conveys an image of mathematics which is at odds with the way it actually develops. Mathematical discoveries, conjectures, generalisations, counter-examples, refutations, and proofs are all part of what it means to do mathematics" (p. 14).

The corresponding publication in New Zealand, *Mathematics in the New Zealand Curriculum (1992)*, also reflects this position.

This section has presented the arguments of Polya (1954) and Lakatos (1976), which were echoed by Lampert (1990), that what they value as mathematical thinking is encouraged by the presence of certain moral qualities, and discouraged by others.

The next section will focus on the links between types of thinking in mathematics and gender. It will again draw on the work of Gilligan, (1977, 1982), who identified two different styles in reasoning, each associated with one of the two moral perspectives.

Morality, Reasoning, and Gender

In 1985, Buerk investigated links between types of reasoning in mathematics and the two moral perspectives discovered by Gilligan (1977, 1982). One of Buerk's motivations for undertaking this study was that she "realised that these different perspectives on morality were relevant to (her) work with women who avoided mathematics" (1985, p. 63). In her early work on morality, Gilligan (1982) had identified two different types of moral reasoning - "separate" (found most commonly within Justice morality), and "connected" (found most commonly within Care morality). Buerk chose excerpts from Gilligan's book (1982), juxtaposing phrases that characterise "connected" reasoning with those characterising "separate" reasoning. These are shown, in part, in Table 1.

Table 1: Descriptors of "Separate" and "Connected" Reasoning (Buerk, 1985).

"Separate" Reasoning	"Connected" Reasoning
gets right to solution in a structured, algorithmic way, stripping away any context	tries to experience the problem, relate it to the personal world, clarify language, create context, remove ambiguity
uses mode of thinking that is abstract and formal	uses mode of thinking that is contextual and narrative
geared to arriving at an objectively fair or just solution upon which all rational persons can agree	geared to looking at limitations of any particular solution and describing the conflicts that remain
legal elaboration of rules and fair procedures	tolerant in attitude towards rules and more willing to make exceptions

(See *Women's Ways of Knowing* by Belenky, Goldberger, Clinchy and Tarule (1986) for an expansion of "separate" and "connected" reasoning.)

Buerk gave a group of mathematicians at Ithaca College, New York, these combined sets of phrases. The mathematicians identified the phrases characteristic of "separate" reasoning as the way that mathematics is communicated in the classroom and in textbooks. They identified "connected" reasoning as the way in which they do mathematics. They "stressed the creative side; attention to the limitations and exceptions to theories, the connections between ideas, and the search for differences among theories and patterns that appear similar" (Buerk, 1985 p. 64). In this, they concur with Polya and Lakatos. The "connected" reasoning list is similar to both Polya's "inductive attitude" and Lakatos's "conscious guessing", in which the mathematician constantly checks conjecture with experience, zigzagging towards proof.

Becker (1995) also applied the ideas of Gilligan, and their extension in the work of Belenky et al (1986), in teaching women mathematics. She argues that this zigzag between hypothesis and observation is an essential feature of "connected" knowing in mathematics. It is important for women students to see "how we start a problem, make an error, and begin our solution over again" (Becker, 1995, p. 168). The *National Statement (1990)* states that this is important for all students - "School mathematics should show the intuitive and creative nature of the process, and also the false starts and blind alleys, the erroneous conceptions and errors of reasoning which tend to be a part of mathematics" (p. 14).

Many women prefer "connected knowing" as their primary mode in approaching certain problems (Buerk, 1985, Becker, 1995), and this approach to mathematics is encouraged by the *National Statement (1990)*. However, as Lampert (1990) pointed out, "connected knowing" involves risk. Therefore it is important to provide, at the best, a moral climate that is recognised by the students as supportive, and at the very least, a moral climate that is not harmful. The next section will discuss the beneficial and harmful aspects of both moral perspectives as they might be experienced in the mathematics classroom.

Morality in the Mathematics Classroom

The differing experiences of boys and girls in the mathematics classroom have been well documented (Leder, 1992). In this section, some evidence will be presented and reinterpreted in the light of Gilligan's (1982) theory of gendered moral differences. Gilligan argues that, generally speaking, a predominantly Justice Morality is found amongst males and a predominantly Care morality amongst females. Within the Justice perspective harm

is done by infringement of rights, or violation of rules or standards. Within the Care perspective, harm arises from non-response and violation of connection or relationship; for example, isolation, ridicule, sarcasm, silence (as in being ignored, or excluded from the group). In the mathematics classroom, evidence for the presence of Care morality in females might be found in the observation that women feel anxiety about being left behind, cut off from others, as when an experienced and competent tertiary educator talks about being 'lost' in a mathematics class: 'I feel panic when a classmate who earlier didn't understand, now does' (Leder, 1995, p. 15). For women, being ignored or disconnected from others means some degree of harm; so in a typical mathematics class where females get less attention, less criticism, less frequent praise for correct answers, have work monitored less frequently, and have less contact with teachers (rephrased with the emphasis on females, Leder, 1995), they may well experience the mathematics environment negatively. Both the Justice and Care perspectives have a positive (beneficial) and negative (harmful) side that can be seen in the classroom. The positive side of Justice morality can be seen in the actions of teachers who set into place strategies to redress perceived inequities (for an example of such a programme, see Morrow and Morrow, 1995). The negative side of Justice morality is seen when Justice slides into privilege; the claiming of special treatment. When attempting to exercise privilege, students use the principles and techniques of Justice morality to serve their own interests. This may be seen in the mathematics classroom in such behaviours as students who produce a correct answer may take this as an indication that they no longer have to listen to others (Lampert, 1990); students who are bored may provoke a vote to force a move onto a new topic (Lampert, 1990). The positive side of Care morality is seen for instance in cooperative working, peer tutoring, and mathematically productive discussion, as evidenced in a university-level mathematics course taught by Rogers (1995), in which over two-thirds of the students actively participated in the group activities, and in which retention and achievement was high. The negative side of Care morality in mathematics education is seen when Care slips into patronage. Walkerdine (1989), in a study of fourth-year British maths students, found that twenty boys and eight girls were entered for O-levels despite girls outperforming boys in the school's preparatory exam. Teachers' arguments for entering girls for the less difficult Certificate of Secondary Education was that they felt they should "protect" the girls, not "push" them. In 'taking care' of the girls, the teachers were ignoring their rights to equal access to status-conferring, not to mention job-conferring qualifications.

The Effect of Classroom Morality on Attraction, Retention, and Success of Students

It seems that courses that embody a Care morality might produce more successful women mathematicians than traditional courses do. Rogers (1990) reported on the mathematics department at The State University of New York College at Potsdam. In 1983, 60.4 per cent of all Potsdam's degrees were awarded to women compared to 43.8 per cent nationally, and for five of the last seven years the highest achieving students in the entire college were female mathematics majors. Female enrolment and achievement in this course are far higher than the national average. However, this is not due to factors such as strong female role models; fourteen of the fifteen staff are male. The significant factor may be that the staff have a Care morality, as portrayed by one teacher who remarked to Rogers as they returned from a student function together "You've got the idea haven't you, I hope, that our students are more to us than just mathematical minds? ... We're really interested in people as people" (Rogers, 1990, p. 41). According to Leder (1995), Potsdam's success in attracting females to mathematics courses well beyond the compulsory level was achieved by creating a class

environment that was supportive. It may be that the women at Potsdam feel supported in tolerating the states of "risk and vulnerability" that Lampert (1990) described as being essential to mathematical practice.

Rogers, who reported on the Potsdam experience, also reported on a university-level mathematics course designed to focus on both Care morality and "connected" knowing in mathematics (Rogers, 1995). This course achieved as good results, overall, as two other university courses taught by the traditional lecturing method. However, students in this course obtained more of the highest grades overall and far fewer students failed. This course enjoys high demand, lower levels than usual of attrition and absenteeism, and higher and more consistent achievement.

Alternatively, it may be that a skilled balance of Care *and* Justice moralities provides a productive environment for women. One of the most popular teachers at Potsdam seemed to demonstrate this. Comments of his that indicate Care has not slipped into patronage are, for example, "I do not wish to be the students' 'pal' when I teach ... they (students) cannot forever remain children - some things will not be forgiven (after a certain time)" (Rogers, 1990, p. 38). Justice did not slide into privilege, either - he says "I am quite accessible" (Rogers, 1990, p. 38), and his students describe him as "kind of nurturing ... friendly about his intimidation ... like, "yes, you've made a mistake, but you haven't done anything that any of my other students haven't done" (Rogers, 1990, p. 41). This teacher's classes are always heavily subscribed.

Another possible explanation is that the morality of the teacher may not, in fact, be especially important. Perhaps the group work and discussion in the courses reported by Rogers (1990, 1995) create an opportunity for students to provide a Care environment for each other, regardless of the teacher's intentions. Group work, class interaction, and discussion, with their opportunities for connection and relationship, have the potential to provide a moral climate that appeals to girls and women far more than the traditional silent, individualistic mathematics classroom.

Conclusion

This paper attempts to provide one answer to the question of why women do not continue with mathematics at post-compulsory levels. It puts forward the argument that the answer, at least in part, depends on the "moral climate" of the classroom. It discusses the theory of Gilligan (1977, 1982) that morality is gendered in western societies, and argues that this has significant effects in mathematics education. In particular, it argues that a classroom that encourages discussion, group work and cooperation is experienced by most women as supportive: whereas, in contrast, the moral climate of the traditional, silent, rule-based classroom is experienced by most women as harmful. This accounts, at least in part, for the avoidance of traditional mathematics education by women. This paper also offers evidence that there are higher attraction, retention, and achievement rates for women in courses which allow and encourage behaviours characteristic of the gender-related morality of Care, and thus suggests that a consideration of gendered moral perspectives may be of significance in mathematics education.

References

- A National Statement on Mathematics For Australian Schools*, (1990). Curriculum Corporation, Australian Education Council.
- Belenky, M., Clinchy, B., Goldberger, N., & Tarule, J. (1986). *Women's Ways of*

- Knowing: The Development of Self, Voice, and Mind*. New York, Basic Books.
- Becker, J. R. (1995). Women's Ways of Knowing in Mathematics. In P. Rogers, & G. Kaiser (Eds). *Equity in Mathematics Education: Influences of Feminism and Culture* (pp. 163-73). The Falmer Press.
- Buerk, D. (1985). The Voices of Women Making Meaning in Mathematics. *Journal of Education*, 167, 59-70.
- Erikson, E. (1968). *Identity: Youth and Crisis*. New York: W. W. Norton
- Gilligan, C. (1977). In a Different Voice: Women's Conceptions of the Self and of Morality. *Harvard Educational Review*, 47, 481-517.
- Gilligan, C. (1982). *In a Different Voice: Psychological Theory and Women's Development*. Cambridge, MA: Harvard University Press.
- Gilligan, C. (1994). Getting Civilised. *Fordham Law Review*, 63, 17-31.
- Gilligan, C., & Attanucci, J. (1988). *Two Moral Orientations*. In C. Gilligan, J. Ward, J. Taylor (Eds), *Mapping The Moral Domain* (pp. 73-86). Harvard University Press.
- Kerber, L., Green, C.G., Maccoby, E.E., Luria, Z., Stack, B., & Gilligan, C. (1986). On *In A Different Voice: An Interdisciplinary Forum*, *Signs*, 11, 304 -33.
- Kohlberg, L. (1971). *From Is To Ought: How to Commit the Naturalistic Fallacy and Get Away With It In The Study Of Moral Development*. In T. Mischel (Ed), *Cognitive Development and Epistemology*. New York: Academic Press.
- Kohlberg, L. (1981). *The Philosophy of Moral Development*. Harper and Row, San Francisco.
- Lakatos, I. (1976). *Proofs and Refutations.*, Cambridge University Press.
- Lampert, M. (1990). When the Problem is not the Question and the Solution is not the Answer. *American Educational Research Journal*, 27, 29-63.
- Leder, G. (1992). *Mathematics and Gender: Changing Perspectives*. In D.A.Grouws (Ed), *Handbook of Research on Mathematics Learning and Teaching* (pp. 597-622). New York: Macmillan.
- Leder, G. (1995). *Equity inside the Mathematics Classroom: Fact orArtifact?* In W.G.Secada, E. Fennema, and L. Adajian (Eds), *New Directions for Equity in Mathematics Education*, (pp. 209-24). New York, Cambridge University Press.
- Martin, J. R. (1994). Methodological Essentialism; False Difference and Other Dangerous Traps. *Signs; Journal of Women in Culture and Society*, 19, 630-657.
- Mathematics In The New Zealand Curriculum, (1992). Ministry of Education, Learning Media: Wellington, New Zealand.
- Morrow, C., & Morrow, J. (1995). Connecting Women With Mathematics. In Rogers, P., & Kaiser, G. (Eds), *Equity in Mathematics Education: Influences of Feminism and Culture* (pp. 13-26). The Falmer Press.
- Piaget, J. (1932: 1965). *The Moral Judgement of The Child*. New York: The Free Press.
- Polya, G. (1954). *Induction and Analogy in Mathematics*. Princeton University.
- Rogers, P. (1990). Thoughts on Power and Pedagogy. In L. Burton, (Ed), *Gender and Mathematics: An International Experience* (pp. 38-46). London, Cassell.
- Rogers, P. (1995). Putting Theory into Practice. In P .Rogers, and G. Kaiser (Eds), *Equity in Mathematics Education: Influences of Feminism and Culture*,(pp. 175-85). The Falmer Press.
- Walkerdine, V. (1989). *Counting Girls Out*. Virago.
- Webster's Third New International Dictionary (1981). G. & C. Merriam Co.