

For whom is mathematical success compatible with ‘physical’ masculinity?

Social class, ethnicity, and imagined futures

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There is a problematic but widespread perception that we do mathematics with our minds, and sport and Physical Education (PE) with our bodies. Strong identification with sport and PE could therefore pose a barrier to mathematics learning. I explore this troubling possibility using data from a mixed-methods study of 450 Year Nine students (age 13-14) in three New Zealand schools. The most socially privileged students often described mathematical and sporting success as entirely compatible, although most described mathematics as valuable for their working futures and sport as enjoyable but inconsequential. In contrast, working-class and ethnic minority boys often identified strongly with ‘physical’ masculinity and viewed physical strength and sporting prowess as pathways to paid work. Such students tended not to identify as mathematically capable. This mechanism for exclusion from mathematical success is particularly concerning in nations such as New Zealand where sport is so dominant in school-age boys’ imagined futures.

Keywords: mathematics; social class; masculinity; ethnicity; body; discourse

Introduction

Mathematics is widely viewed as a discipline best suited to people with highly functioning brains (Walkerdine 1988; Moreau, Mendick, and Epstein 2010; de Freitas and Sinclair 2014). According to Walkerdine, “mathematics has, for centuries, held this position as queen of the sciences” (1988, 187) – logical, esoteric, and open only to those with high ‘intelligence’. Research emphasizing post-structural modes of interpretation has used the concept of *discourse* to argue that mathematics has discursive associations with white, middle-class masculinity (Walkerdine 1988; Jaremus et al. 2020; Mendick 2006). In this article I argue that the relationship masculinity and mathematics performance has distinctive characteristics in a post-colonial context such as New Zealand, with especially worrying implications for

socially disadvantaged and ethnic minority boys. A key aspect of this argument is a comparison between mathematics and Physical Education (PE) in terms of students' attitudes and learning experiences.

The article is structured in three sections. Firstly, it introduces and briefly explains the key theoretical concepts used in the article, namely *discourse*, *capital*, and *field*. Secondly, there is a selective review of literature relating to social identity and school mathematics, particularly in relation to scholarship that critically explores the mind/body dichotomy. In this second section I argue that in New Zealand and other post-colonial nations, indigenous men occupy a contradictory position in relation to the mind/body binary. The third section describes an empirical, mixed-methods study of Year Nine (age 13-14) students in New Zealand and argues that students' orientations towards mathematics on the one hand, and PE and sport on the other, are mediated by social class, ethnicity, and gender. I argue that Māori (indigenous), Pacific, and working-class boys can have a particularly problematic social identity in relation to mathematics.

Key theoretical concepts

This article draws on post-structural discourses analysis (Mendick 2006) and Bourdieu's (1986) concepts of capital and field, as both were helpful in the process of interpreting and narrating a large corpus of mainly qualitative data. I have previously discussed the use of *theoretical reflexivity* (Pomeroy 2017) to work with these two approaches in tandem.

Post-structural discourse analysis

I use the term *discourse* in this article, in the post-structural tradition, to denote a representation or truth-claim, implicit or explicit, about the way things are. For example, I argue that there are powerful or dominant discourses about the discipline of mathematics which represent mathematics as cognitive rather than emotional or physical. This

representation is not universally accepted, and there may be other representations of mathematics – *counter-discourses* – that portray the discipline differently. Post-structural lenses are attuned to questions of power and vested interests; where intellectual work is valued more than physical, mathematicians have much to gain by being positioned as ‘intellectual’. The concept of discourse also enables the naming and, sometimes, the challenging or *discursive binaries* or dichotomies, such as the mind/body binary. Again, the idea that the mind and the body are coherent and distinct elements of a human being is a truth-claim or representation of the ‘nature’ of humans. My use of post-structuralism, and the concept of discourse in particular, draws mainly on the work of scholars who have deployed Foucaultian concepts in their own analyses of mathematics education (Mendick 2006; Moreau, Mendick, and Epstein 2010; Walkerdine 1988; Alderton and Gifford 2018). For a rigorous and accessible introduction to the use of post-structural discourse analysis in mathematics education see Mendick (2006, 7-24).

Capital and Field

Bourdieu (1986) and many researchers who have drawn on his scholarship have used the term *capital* to refer to tangible and intangible things, characteristics, and credentials that have social or economic value and can be exchanged for other types of capital, sometimes across generations. The value of capital is not universal, but relative to the *field* in which valuation occurs, and may change over time. Pertinent aspects of *field* in the current article include a mathematics curriculum based on the international canon of school mathematics topics (for example, arithmetic, linear algebra, angle geometry); representations of mathematics, sport, and race in sports media and film; and gender double-standards about the desirability of physical strength and aggression. A full typology of ‘types of capitals’ can be found in Bourdieu (1986), however this article refers primarily to two forms of embodied

cultural capital which I call *physical capital* and *academic capital*. I use physical capital (Shilling 1991) to denote the development of bodily strength and skill, mainly through PE and sport. I use academic capital to refer to ‘desk’ learning, mainly in mathematics, that can become converted into symbolic capital through formal assessments. The use of term capital highlights what young people gain from engagement in different school activities, and the value that they anticipate such engagement might provide in the fields that they imagine themselves entering in the future (Horne et al. 2011).

The mind, the body, and mathematics

The distinction or ‘Cartesian binary’ between mind and body is problematic (de Freitas and Sinclair 2014; Marquis 2018), but my aim here is neither to make a case for the real existence of such a binary nor to subject the binary to critique. Rather, I hope to show that the discourse or ‘collective story’ (Mendick 2006) of the mind/body binary is gendered and racialised in New Zealand for reasons related to our colonial history. The analysis presented here is complementary to, but differs in emphasis, from sociological analyses of the mind, body, and mathematics (Solomon, Radovic, and Black 2015; Mendick 2006) which emphasise the ‘identity work’ involved in maintaining a mathematical femininity.

Male minds, female bodies

Walkerdine’s (1998) extensive scholarship on girls learning mathematics draws critically on the Cartesian mind/body dichotomy. Walkerdine traced the historical construction of women as emotional and incapable of reason through the ‘enlightenment’ discourse of rationality. She argued that the same discourses that represent mathematics as ‘queen of the sciences’, or the ultimate expression of a rational mind, render rationality masculine. The perceived abstract and general nature of mathematics renders it powerful and obscure, existing in a plane beyond the empirical specificities of the physical world. In contrast, according to

Walkerdine “the fact that women’s nature was located in their bodies immediately made them naturally external to a capacity for reason” (Walkerdine 1998, 35). This masculinity of reason appeared to be reflected in teachers’ attributions of high-attaining boys’ success to ‘talent’ and high-attaining girls’ success to ‘hard work’. Conversely, low-attaining boys were not achieving their potential, whereas low-attaining girls lacked potential. This points towards a curriculum discourse in which gender mediates who can be seen, and see themselves, as rational and therefore mathematically able.

Mendick and colleagues have extended Walkerdine’s analysis of mathematics as masculine, drawing in particular on images of mathematicians in popular culture. A series of studies (Mendick 2006; Moreau, Mendick, and Epstein 2010) involving in-depth interviews with secondary and university mathematics students in England suggested that the enlightenment image of the mathematician as a ‘rational man’ remained prevalent two decades after Walkerdine’s research. Mendick (2006, 62) argued that “within popular culture, the dominant image of the mathematician depicts them as boring, obsessed with the irrelevant, socially incompetent, male, and unsuccessfully heterosexual”. Not surprisingly, this was an image that most students wanted to keep at arm’s length. Students *not* identifying as ‘good at maths’ were quick to distance themselves from those they perceived as ‘good at maths’, with one student commenting “I’d rather be like medium stage in maths, and have social skills” (p. 63). Mendick and colleagues are cautious not to overplay the impact of such images on identification with/against mathematics, explaining that some university mathematics students deployed the images positively, enjoying being perceived as ‘brainy’ and ‘eccentric’. However, despite their critical awareness, students with positive mathematical identities still had to work to resist the ‘nerd’ image, going to great lengths to assure the interviewers and their friends that mathematicians are ‘just normal people after all’.

More recently, research with teachers of advanced, post-compulsory secondary mathematics in Australia (Jaremus et al. 2020) indicated that discourses of male ‘talent’ and female ‘dedication’ remain alive and well. However, there was also evidence that the positioning of “giftedness as a ‘mindset’ rather than a naturalised ‘fact’” challenged notions of innate ‘talent’ (Jaremus et al. 2020, 228). Another recent analysis of Australian Year 4 (age 9-10) students’ images of scientists (Scholes and Stahl 2020) indicated that there may be some reduction in the explicit male gendering of imagined scientists. However the images deployed by these students still largely conformed to the stereotype of a lab-based scientist doing difficult, dangerous work with specialised equipment. The authors argue that ‘cleverness’ was still associated with stereotypes of being a scientist, evident in references to “hard tests, pressure, workload and the need to achieve good grades in science” (Scholes and Stahl 2020, 10).

A Foucaultian discourse analysis of images of mathematicians in junior secondary Mexican textbooks (Sánchez Aguilar and Castaneda 2020) showed that mathematicians portrayed in these widely distributed textbooks were nearly all European men, often from antiquity. The authors argue that such a portrayal contributes to a ‘dividing practice’ that positions mathematical agency as ‘other’ from female, indigenous, or indeed any Mexican students. Of the 158 representations of mathematicians, one was female, and none were Mexican or from “regional ethnic groups that have been prominent in the application and development of mathematics, such as the Maya for instance” (Sánchez Aguilar and Castaneda 2020, 763). Such analysis of the intersections of gender and race emphasise that that discursive masculinity of mathematics is mediated by race in ways that privilege white masculinities and exclude indigenous masculinities.

European minds, indigenous bodies

There was a widely held belief amongst European settlers in New Zealand for much of the colonising era that Māori – especially Māori men – were physically gifted but intellectually inferior to Europeans (King 2003; Hokowhitu 2004). Hokowhitu (2004) has traced the way discourses of Māori male physicality have changed since Europeans first began to describe Māori. The early pre-colonial encounters of the eighteenth and nineteenth centuries led to European accounts of Māori as ‘savage’ – physically powerful and aggressive but not naturally rational thinkers. This racist discourse of cognitive inferiority fitted well with the idea that Europeans were the most ‘evolved’ race. During the colonial era, when European settlers and their descendants sought agricultural and industrial labourers, Māori physicality was seen as suiting Māori ‘by nature’ to labouring employment. In the twenty-first century, a dominant image of Māori men is the sports star, most notably in rugby union and rugby league, and best exemplified by the haka – a Māori tradition, in the Māori language – performed by the All Blacks at the start of rugby matches. Such images of masculinity are still ‘physical’, but seemingly more positive or even celebratory. However, Hokowhitu (2004) argues that the celebration of Māori men’s sporting success is a form of “positive racism” that makes it harder for Māori boys to enact academically successful masculinities. Such stereotypes manifest in many ways, for example, rugby commentators are especially likely to comment on the strength, speed, and aggression of Māori and Pacific rugby players and the tactical thinking or ‘clever’ plays of Pākehā (NZ European) sportsmen (Fitzpatrick 2011).

New Zealand Pacific peoples are frequently subject to a very similar discursive positioning as Māori: physically gifted (especially the boys, especially at rugby) but not intellectual (Grainger 2009; Fitzpatrick 2011). Since the second world war, Pacific people and urban Māori people have tended to occupy similar positions in the labour force and live in the same suburbs (King 2003), and many young New Zealanders now have both Māori and

Pacific heritage. Much of the research which addresses Māori and Pacific peoples' positioning in relation to the mind/body binary comes from sport and PE literature. For example, McDonald (2014) documents how in an elite Australian boys' school rugby union team, Pacific boys are portrayed in absentia as big, strong, and fast, but undisciplined. McDonald (2014, 5) writes of the Australian setting that "there can be little doubt that the most visible space for Pacific Island men in Australia is in sport, especially in professional rugby league and rugby union". There is evidence that this is also the case in New Zealand (Grainger 2009).

A recurring theme in scholarship on Māori and Pacific physicality is a biologically essentialist form of racism coupled with Cartesian dualism, a combination that renders intellectual achievements hardly worth pursuing. Subservient positions in the labour structure coupled with historically racist economic and education policies (King 2003) have excluded many Māori and Pacific students from educational success in dominant terms. McDonald's analysis of an encounter he had with a spectator, as a white rugby player in Australia, illustrates poignantly the deeply ingrained racialisation of the mind/body binary:

I started playing rugby after I finished high school at a club with a strong affiliation to New Zealand and that draws the majority of its players from Māori, Cook Island and Samoan backgrounds. I always remember my first senior game in 1993. I was playing 5-eight (the position considered to be the central decision-making position on the field), and we had just had a big win against a major rival. One of the club's (white) supporters shook my hand after the game and as a way of encouragement said, 'Good to see you at number 10, we need a white guy to keep all these coconuts under control'. This statement represents the simplistic articulation of bio-racism and its related Cartesian binary logic, but for the supporter, the comment was neither here nor there. Simply, the players around me were potentially brilliant but erratic, prone to poor decision-making and impulsive. My 'white' character would provide a perfect balance to their 'black' talents. (McDonald 2014, 7)

It is not difficult to extrapolate the implications of such stereotypes of 'white' character and

‘black’ talents into mathematics classrooms. ‘White’ character portrayed like this possesses the intellectual capacity for abstract thought and the discipline to develop habits of excellence. Conversely, ‘black’ talents, when stereotyped in this way, do not include the ‘cleverness’ or focus purportedly required in mathematics.

Fitzpatrick (2011) explored critically the presence of ‘physical’ discourses in relation to both race and the school curriculum in her ethnography of New Zealand Year 12 and 13 (age 16-18) PE students. Fitzpatrick argues that Māori and Pacific students viewed themselves and the subject of PE as ‘physical’. Students were able to describe PE as ‘easy’ and derive pleasure and academic credentials from studying it. The irony she highlights is that New Zealand’s senior PE curriculum contains much academic, scientific content such as exercise physiology, and a lot of time spent at desks in classrooms. Even so, students contrasted PE with science, with one student commenting that “science doesn’t come easily to our minds” (Fitzpatrick 2011, 136). Here we see the power of racialised discourses to interact with curriculum discourses (PE as ‘physical’) and draw students towards some areas of the school curriculum and away from others.

Contradictory positions

Scholarship highlighting enlightenment discourses of ‘rational man’ tends to emphasise the tension between being feminine and being mathematical. However, another line of scholarship in post-colonial contexts has documented an alternative ‘opposite’ to the ‘thinking’ white man: the ‘physical’ indigenous man. On first inspection, these two bodies of research could be interpreted as positioning indigenous boys and men in a contradictory position in relation to the mind/body binary – aligned with the mind by masculinity and with the body by indigeneity. However, in an intersectional analysis, these literatures need not be seen as in conflict. In both cases, ‘rational’ thought has discursive associations with white,

educated men. The empirical section that follows uses a multiple case study approach to explore orientations to mathematics, PE, and sport of a small but diverse group of New Zealand Year 9 students.

The study

The empirical part of this report draws on a mixed methods study of social class, ethnic, and gender inequalities in New Zealand Year 9 (age 13-14) students' learning experiences and attainment in mathematics (Pomeroy 2016). Three co-educational state secondary schools participated in the study: Queens, Robinson, and St Edmunds Colleges. The schools were selected so as to maximise socio-economic and ethnic diversity. Socio-economically, Queens sits within the top 20 percent of New Zealand schools, Robinson is about average, and St Edmunds is in the lowest 20 percent. Eighteen Year 9 classes and their 16 teachers participated in the study.

Schools provided nationally age-normed mathematics test data collected near the beginning of Year 9. Students ($n=425$ after data-cleaning) completed a pen-and-paper questionnaire, which asked them about attitudes to mathematics and other school subjects including PE. The questionnaire included a short form of the Attitudes Toward Mathematics Inventory (short-ATMI, Lim and Chapman 2013) which has three subscales: *enjoyment* of mathematics, *self-confidence* in mathematics, and *perceived value* of mathematics. The questionnaire also asked students about their gender, ethnicity, and a range of socio-economic indicators. New Zealand schools do not hold individual-level socio-economic data, not even crude proxies such as Free School Meal eligibility in the UK. Therefore, I used student self-report data regarding of parental education and occupation to generate a quantitative indicator of family SES for each student against the New Zealand Socio-Economic Index (NZSEI-06, Milne, Byun, and Lee 2013). I conducted semi-structured interviews with a sub-sample of 40

students, using friendship pairs where possible to help students feel more comfortable and to enable peer discussion. The interviews included discussion of students' impressions of different school subjects along the dimensions *interesting/boring*, *easy/difficult*, and *important/not important*. To stimulate discussion about the relationship between home life and school, I asked students in later interviews to draw a picture of themselves doing their homework and then explain the picture to myself and a peer. The study received ethical approval through the University of Cambridge Faculty of Education and adhered to New Zealand and UK ethical guidelines for educational research (NZARE 2010; BERA 2018). School, teacher, and student names are pseudonyms.

'Well-rounded' students and strategic mind-body balance

Ella is a white, middle-class girl in Mr McAlister's top stream class at Queens College. She likes mathematics, rates mathematics as very important for her future, and achieves very high mathematics test results. In the following interview extract, Ella is explaining why she rated PE as the easiest school subject.

Ella: it's just, I don't really stress about [PE], it's easy for me because you don't have to do well in it

David: what are the subjects you do have to do well in?

E: maths and English

D: maths and English, why is that?

E: cos they are like the two basic learning things, so yeah without them, you're pretty much screwed

This conversation is consistent with Ella's questionnaire responses, in which she rates both mathematics and PE as interesting, but rates mathematics as 'very important' and PE as 'not important' for achieving her goals in life. Ella's perception of mathematics as important seems to be located within the curriculum discourse of 'core' school subjects rather than relating directly to its status as a pre-requisite to a specific career goal. Although in her

questionnaire she writes *accountant* ??? (question marks in original) as her preferred job – the same job as her father – in the interview she is less specific, indicating that she wants to do “something to do with maths or writing”. After further discussion, it becomes clear that the main thing she is sure about is that she wants to make a lot of money.

Ella: I just like maths. I like most parts of it, like, I mostly like the financial literacy part of it, yeah.

David: why do you like the financial literacy, what's the interest there?

Ella: I like money.

Later Ella reiterates “I like buying stuff”, and expects that in Year Thirteen she will definitely study mathematics and English, and possibly economics.

The data do not enable me to say definitively where Ella’s perceptions of the relative importance of different subjects in the school curriculum come from. However, her clearly tentative career aspiration – “accountant???” – is telling; given that she does not seem to have specific work goals, the job she suggested on the day of the questionnaire was a professional job discursively linked to mathematics and also to making good money. Ella’s narrative of the importance of different subjects positions mathematics as crucially important to achieving the well-paid, professional future she imagines for herself, with PE and sport as enjoyable but ultimately dispensable sideshows.

Anna is a Pacific-heritage, working-class girl, also in a top stream, interviewed together with Detroit, a Māori, working-class boy from her class. Anna participates in gymnastics, softball, and netball. Discussing whether PE is important, Anna and Detroit have this exchange:

Anna: I wouldn't say PE's important unless you want to be Usain Bolt

Detroit: oh, well it's important to me

Anna: well it's important to me too but it's not like my job. Cos I do competitive gymnastics. I want to do that 'til I'm like twenty or whatever, but I don't wanna be a PE teacher, I don't

Detroit: you don't want it to be your only

Anna: yeah I want to have like a job

The amount of time that Anna devotes to sport and her espoused enjoyment of PE indicate that sport and PE are, in a sense, important to her. However, she is emphatic that sport and PE are not important for her future working life. Anna and Detroit are ambivalent about the importance of mathematics, aware of its high status and presumed importance, but suspicious that its usefulness is overstated.

Anna: everyone says that maths is really important but

Detroit: but then we always question him [the teacher], we're like 'when are we actually going to use this?' But then Mr McAlister says we're going to use it

Anna: my Mum works in a bank and she says she never uses the stuff she learnt in school that much. And she works in a bank, that's like the maths [cut off by Detroit]

Despite her scepticism, Anna plans to continue with mathematics in Years 12 and 13, when it is optional. Her justification voices powerful messages about mathematics' place in the curriculum hierarchy.

Anna: yeah, I think I'll keep [doing mathematics in Year 12]

Detroit: I'd probably keep it for Year 12

David: so it's kind of been drilled into you those are the most important skills?

Anna: yeah, because it's like maths, it's like maths, it's not like, option

Anna later refers to mathematics as "one of those life skills", echoing a recurring theme that mathematics is a powerful, transferrable skill, even if individual techniques are unlikely to be useful in later life. For Bourdieu (1986), a defining feature of capital is its convertibility into other forms of capital, so despite a strong commitment to sport and enjoyment of PE, it would be difficult to argue that Ella and Anna view these physical activities as capital accumulation.

Such views are likely influenced to some extent by the gender pay gap in sport. For example, even in rugby-mad New Zealand, members of the national women's rugby team the Black Ferns struggle to make a living from rugby, despite having won more World Cup victories than their highly professionalised male counterparts the All Blacks (RNZ 2018). Linear modelling of the questionnaire data confirmed that girls were much less likely than boys to list professional sport of any kind as a career aspiration ($t=4.4, p<.001$), and much less likely to describe PE as important to achieving their goals in life ($t=43.5, p<.001$).

Ella and Anna are in a top set mathematics class and claim to enjoy mathematics most of the time. Both acknowledge (albeit Anna more critically than Ella) the importance of mathematics and English for entering a good job, which for both of them means a highly paid profession requiring university education. Furthermore, both girls enjoy PE and participate in a range of sports. Yet they position PE as peripheral from learning and closely linked to physical recreation, often slipping freely between the curriculum subject of PE and extracurricular sport. If we take mathematics to be a 'mind' activity and PE and sport to be 'body' activities, then for these students the mind/body binary splits PE off from mathematics and other 'academic' subjects, positioning PE as extracurricular. For these students, the mind/body binary does not seem to function in any mutually exclusive way – there is no evidence that these students are 'balancing' sport and academic achievement or that being both 'sporty' and 'academic' requires identity work. So far, this is good news for positive mathematical identities in a nation with very high participation in sport.

The students discussed in this section, those with 'smart minds' and 'active bodies', will be doubly admired within the school community, *not only* academically successful but 'well rounded'. Those active in sport are somehow deemed tougher, more resilient, more suited to leadership, including professional leadership (Horne et al. 2011; McDonald 2014) – in fact a prestigious New Zealand independent school has started to feature the phrase *All-*

round Man in its marketing. Institutional practices that support this characterisation are academic and sports prizegiving ceremonies, with the prestige attached to the titles ‘dux’, ‘first in mathematics’, or ‘sportsman of the year’. Whilst other activities such as drama, choir, and Māori cultural performances receive institutional recognition when they are acknowledged in school assemblies, such activities do not have the institutionally embedded special status accorded to sport.

‘Academic’ students: invested in the mind

There was a small but significant group of students who played little or no sport and tended not to enjoy PE or to rate PE as important. I first noticed this resistance to the norm of playing sport and liking PE in the narratives of Maraia and Hannah.

Maraia, a middle-class Māori girl, expressed most clearly her active rejection of an investment in physical capital:

My family is really, really sporty, and so I've always done and been surrounded by sport and – but this year I've put my foot down and been like, I don't actually enjoy this, I don't want to do this anymore, yeah, cos, uh, I don't like sport at all [laughs]

Maraia rated PE as ‘not important’ in her questionnaire and told me “I’m going to drop [PE] as soon as I can”. Like many students who do not invest in physical capital, Maraia imagines herself in a well-respected professional job – she plans to become a doctor and already has a particular medical school in mind. Maraia spends much of her spare time reading, and a dominant feature of her bedroom in a picture that she draws during the interview is her bookcase. It is noteworthy that of her three older siblings, all of whom have left school, only her brother has continued with competitive sport. This is consistent with the point, developed further later in this article, that Māori masculinities are tied up with sport and physical strength in a way that leaves Māori girls freer than Māori boys to break away from the

‘physical beings’ stereotype (Hokowhita 2003).

Whereas Maraia was from a ‘sporty’ family and had previously played a lot of sport, Hannah’s lack of interest in physical activity seemed more passive. Hannah did not enjoy PE and found it difficult “mostly because I’m just not very athletic so, just cause I’m not good at it”. Andrew, a South Asian boy, and Talia, a South Asian/Pacific girl were both matter-of-fact about not wanting to participate in sports. Asian students as a group stood out for their particularly low scores on interest in PE, a relationship that Pang has explored in the context of Chinese heritage students in similarly sports-mad Australia (Pang and Macdonald 2015). A pronounced trend amongst the students mentioned was that they aspired to professional jobs such as nursing, medicine, and accountancy.

The students described in this section miss out on the previously mentioned symbolic and status rewards that accrue to students who are successful in sports. There was some evidence that rejecting the norm of playing sport had a higher emotional cost for students whose families place great value on sporting achievements. However, there was no sign that such students saw disengagement from sport and PE as a risk to their future professional success. Furthermore, such students may have other activities such as reading that could be said to occupy the same position – extracurricular, recreational – as sport does in the lives of ‘well-rounded’ students.

Risky investments in physical capital

Callum is a working-class Māori boy in a middle-set class at Robinson. During my observations he had been moved to an isolated seat at the front of the classroom for disruptive behaviour. He plays rugby and basketball, does martial arts, listens to rasta, hiphop, and dubstep music, and follows rugby on TV. He finds mathematics boring and difficult. In his questionnaire he listed his favourite subjects as PE and Outdoor Education, and his least

favourite as mathematics and science. When I asked Callum in an interview to rank a range of subjects from easy to difficult, he said:

I'm not really good at, I'm one of those people that's not really good at all, like, that like, that subjects aren't easy and stuff. So that probably the easiest one for me would probably have to be PE, because I enjoy it and just like give it one hundred percent every time. And difficult and hard, probably maths and science.

The stilted and halting expression in the first sentence of this quote suggests that it is difficult for Callum to articulate what he is trying to say about himself. There is some evidence that for Callum difficult emotions are associated with his identifying as “one of those people” for whom “subjects” – which seem not to include PE – aren't easy. PE then becomes a source of redemption and pride in an otherwise problematic relationship with the school curriculum. He expects he will be nervous when he gets to his first high-stakes mathematics exam in Year Eleven. The main feelings that he says he associates with mathematics lessons are frustration and feeling stupid.

David: Why do you feel frustrated?

Callum: just, I just don't really know what to do and sometimes when I just like – like cos I think last time I did get put up the front [of the classroom] again for talking a bit, but so, but when there was really no one around I did get a bit frustrated cos I had nothing to do, didn't understand the work really well

And earlier in the interview:

I wish I could learn to be better at maths. As I said, like, sometimes I get a bit jealous because I can see a lot of people in my maths class know how to do it easy, and I sort of struggle with it.

Callum's difficulty with mathematics positions him in opposition to the successful student, both academically and morally. He explains the behaviour that leads to the humiliation of being isolated from other students and near the teacher as deriving from his lack of

mathematical ability.

I've probably been a bit of a trouble-maker in maths, but probably because, again, I probably get bored because I don't know what to do, even if I ask the teacher for help I don't know what to do, so I just start doing random stuff, talking and stuff.

Callum is undecided as to whether he will continue to take mathematics once it is no longer compulsory; the only subject that he is sure he wants to continue with is PE. He imagines the decision over whether to continue with mathematics depending on his future attainment:

It depends, like if I still suck at maths, oh like, you know, if I still am the same as I am now at maths I'll probably just drop it, I probably won't see the point of doing maths, but if I'm pretty good at maths, getting the hang of it and then I'll probably keep continuing doing maths.

Given Callum's troubling experiences in the mathematics classroom and his low perception of his own ability, it is hardly surprising that he has begun to imagine a future for himself which does not rely on success in mathematics. Callum plans to join the army, a plan which he explains using a violent and patriotic cliché: "I like New Zealand and one day I'd like to fight for it". This career aim to some extent justifies Callum's focus on PE, because a physical fitness assessment is one of the entry requirements for army training. Callum's wish to 'fight for his country' alongside participation in rugby and karate speak of identification with a tough and physically aggressive masculinity (Connell 2008). As previously mentioned, rugby is a high-status sport in New Zealand and has traditionally been a forum in which Māori men have gained admiration in wider society (Hokowhitu 2003; King 2003). On the subject of karate, Callum explains "I haven't really had to pull it out in a situation, but I had a few friends ask 'can you show me a few moves?', and I showed a few of them the moves, you know." Karate provides one source of strongly embodied capital which yields recognition amongst peers, if not more widely.

There is a similarity and a difference between Callum's demonstration of karate moves to his friends and, for example, Ella helping her friends with mathematics problems. Both have the potential to accrue symbolic capital in the form of recognition within a field of peers. However, Ella's mathematics knowledge has high exchange value within the institution of the school, whereas if Callum used karate at school his behaviour would be considered deviant and he would most likely incur official sanctions. The capitals that these two students are accumulating are different, but not equal.

Callum's interview was an especially poignant example of a student disaffected with academic success and strongly invested in the accumulation of physical capital, however, it was not unique. Michael and Joshua, two Pacific-heritage boys from St Edmunds, displayed a similar level of identification with physical rather than academic capital. Both boys were in the top class at St Edmunds and had mathematics attainment around the national average for their age. Neither boy reported the level of difficulty with mathematics expressed by Callum, yet they did talk of always being blamed when other students were noisy, and both listed PE as their favourite subject. Michael's least favourite was mathematics and Joshua's least favourites were English and Religious Education. Both rated PE as very important and wrote on their questionnaires that they wanted to be professional rugby players. Both boys followed a range of sports on TV, including rugby league and Ultimate Fighting Championship (UFC) mixed martial arts, both of which are highly professionalised at the top end. The top end, however, was a long way away for Michael and Joshua. The school rugby team that they both played in had suffered a series of defeats by huge margins, until by the end of the season a full team was not turning up to games. It seems that whilst sports media brings images of the

highly tough, violent world of working-class¹ male professional sport very close (Azzarito 2009; Connell 2008) the means of entry into professional sport are very far away from students like Michael and Joshua (Shilling 1991).

When I interviewed Michael and Joshua, they did not mention wanting to be sports players.

Michael: I just know that I want to do something physical

Joshua: Yeah, I want to do something to do with sports

M: Not like sitting in an office

J: Yeah

D: Why is that? What would it be like if you got a job in an office that you wouldn't like that?

M: It would be boring. I want to do something that's – that's cool – that I don't want to get stressed and that

Michael later suggested that he might like to be a builder like his cousins, and Joshua explains the attraction of teaching PE:

David: Do you know any people where you see their jobs and you think that looks kind of cool?

Joshua: Mr [PE teacher], he said he didn't do really well in school but he went to university and became a PE teacher.

For both boys, there was an explicit emphasis in the way they narrated their imagined futures on doing something 'physical' and that didn't require high academic achievement. However, they were unclear about the details of their strategies for entering the paid workforce. Both said that they wanted to go to university, but neither was familiar with the entry requirements.

¹ National surveys (e.g., Q&A Research 2014) and my own questionnaire data suggest that rugby

league and combat sports are predominantly watched and played by Māori, Pacific, and low-SES white males.

For Michael, university seems an unusual and financially costly precursor to entering a construction trade. And although Joshua's PE teacher may well not have achieved highly in school, Joshua will need to gain entry to the selective Bachelor of Physical Education degree in order to progress towards training as a PE teacher, most likely a serious challenge due to the difficulty he claimed to have with school science.

My argument is not that there is anything wrong with the 'physical' jobs that Michael and Joshua imagine for themselves, or with their evident enjoyment of sport and PE. What troubles me is that they are coming to see themselves as on the margins of academic schooling even though they are attaining reasonably good results. Each lists a core 'academic' subject as their least favourite, and they rule out 'office jobs' despite (or because of?) not knowing anyone who has one. Nor am I arguing that disengagement with mathematics is an inevitable consequence of finding value in physical activity for low-SES, Māori, and Pacific boys. Yet there is at least provisional evidence in the questionnaires and interviews of a cycle in which identifying with physical masculinity makes the academic (school) and professional (employment) trajectory seem undesirable, as in the case of Michael. Similarly, struggling to succeed in mathematics can make 'physical' sources of value, which are often gendered (Azzarito 2009; Connell 2008), all the more important, as demonstrated in Callum's narrative. Overall, the interviews suggested that low-SES, Māori, and Pacific boys were frequently invested in the performance of a highly physical masculinity that was at odds with the 'cerebral' and 'brainy' discursive positioning of mathematics.

Conclusion

This article has traced the relationship of the mind/body binary to gender and race in the post-colonial context of New Zealand and explored the implications of this relationship for

identification with school mathematics. Based on a mixed-methods analysis of how students' social class, ethnicity, and gender relate to their perceptions of mathematics, sport, and PE, I have proposed a loose typology of students:

1. 'Well rounded' students who see mathematics as important for achieving the well-paid, professional futures that they hope for, and who also enjoy sport and PE, but who describe sport and PE as recreational. Such students were disproportionately socio-economically advantaged white and Asian girls and boys.
2. 'Academic' students who shared the 'well rounded' students' views about mathematics, but who did not enjoy PE or participate in sport. Such students were disproportionately socio-economically advantaged white girls, and Asian girls and boys.
3. Students who did not see mathematics as a pathway to the 'physical' working futures that they imagined for themselves – often in sporting, military, or trade jobs – and saw effort in PE and sport as an investment in future employability. Such students were disproportionately Māori, Pacific and socio-economically disadvantaged white boys.

This analysis supports the suggestion that, for some students at least, there is a tension between mathematics learning and a commitment to sport and 'physical' achievement. In particular, I have sought to illustrate a problematic tension between mathematics and the strongly 'physical' masculinities most often enacted by ethnic minority and working-class boys (Connell 2008).

My argument is not that these boys lack mathematical capability or potential. Rather I suggest that it is difficult for them to occupy the subject position of the 'smart' or 'brainy' student within discourses of academic and specifically mathematical ability. By the time they reach Year Nine, many of these students have received years of low or average test results and seen other students put in 'extension' groups or 'gifted and talented' programmes. Such

students, largely positioned outside institutional definitions of academic success, can find a sort of refuge in PE and sport. Success in these arenas still brings recognition from schools, although generally to a lesser degree than academic success. Furthermore, the physical capital that such students accumulate may be highly valued by their families and peers in a way that is cross-cut by social class, ethnicity, and gender. The futures that these students imagine often involve reconversion of physical capital into economic and symbolic capital in ways that are either highly risky or lead to poorly rewarded and insecure positions in the employment structure. My critique is therefore not of involvement in sport and physical activity *per se*. What I wish to suggest is that some students are discursively positioned as more suited to sporting and ‘physical’ achievement than academic or ‘mind’ achievement, making it hard to ‘see themselves’ in mathematics. Furthermore, these two types of achievement accrue very unequal material rewards and recognition, making the relationship between mathematical identity and ‘physical’ masculinity a social justice issue.

The tension between mathematical identity and ‘physical’ masculinity is a complex challenge with a long history, and it implicates those within and outside of formal education. Outside of institutional education, producers of sport, news, and film media can resist discourses that position mathematicians as a cognitive function of intellectually gifted white men, and those that perpetuate Māori and Pacific men as gifted primarily with physical strength and skill. At the education system level, teachers need support to challenge the ‘white space’ (Milne 2016) of a curriculum in which indigenous mathematics and mathematicians are invisible, for example by connecting to Māori and Pacific funds of knowledge (Hunter and Sawatzki 2019). At the school level and in the context of ethnic and socio-economic achievement disparities, more awareness is needed of the messages that students internalise about themselves through ‘ability’ grouping (Francis, Taylor, and Tereshchenko 2020), and how such messages can reinforce harmful racialised discourses

about 'ability' that are present in wider society . I hope that the analysis in this article can inform these ongoing projects of supporting school mathematics to be more accessible and vibrant.

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