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DEBATES IN MATHEMATICS EDUCATION

Edited by Dawn Leslie and Heather Mendick

SCHOOL MATHEMATICS AS SOCIAL CLASSIFICATION

Peter Gates and Andy Noyes

We Need to Talk About... 'Class'

Imagine... you meet up with your teacher friends one evening and start discussing your most challenging group, and some of your most challenging students. How would you describe them?

Probably in doing that, you will have classified students according to some criteria, comparing some students against others. Classifying students is something that teachers and schools engage in all of the time; ranking, grouping, setting, allowing some onto courses, keeping others out, and so on. Classification is not only a fundamental process of mathematical activity, but also is fundamental to mathematics education itself. Yet there is a particular type of classification that is of interest to us in this chapter – sorting students by their social and economic backgrounds. So we begin by asking the following questions:

- How do young people become classified through mathematics education?
- How do our professional practices (our pedagogy, curriculum, assessment, etc.) contribute to this?

- How might we respond in light of this awareness of our collusion in such classificatory processes?

Why is this tendency toward classification such an issue for mathematics teachers that we need a chapter on it? Paul Connolly's (2006) study of GCSE performance highlights that student socioeconomic background (rather than gender or ethnicity) is the greatest predictor of learning outcomes. This is not to say that these three social characteristics should be seen as unconnected; all three can be difficult to pin down sometimes and we know that gendered and ethnic identities are complex and can, for some young people at least, be problematic.

Social class is a complex, shifting and contested notion and often goes unrecognised which makes its influence hard to see and to measure. In a recent study drawing on three large datasets in the UK, Alissa Goodman and Paul Gregg (2010) reported that 'only 21% of the poorest fifth (measured by parental socioeconomic status - SES) manage to gain five good GCSEs (grades A*–C, including English and mathematics), compared to 75% of the top Quintile' (p.7).

The term 'socioeconomic' oversimplifies things somewhat and we find the idea of '*capital*' helpful. Capital is usually thought of as financial resources or *economic capital*, but this was extended by Pierre Bourdieu, a French sociologist, into *cultural capital* (buying into particular, 'cultured' ways of living) and *social capital* (having connections and knowing people with relevant influence).

Think about a diverse collection of young people (think of your students if you're working in a school). What can you 'see' as the different forms and levels of economic, cultural and social capital they have?

Identifying 'Class'

There are an estimated 3.5 million children living in poverty in the UK and this figure is expected to soar by 400,000 in the coming years. A lack of jobs, stagnating wages, increased living costs and spending cuts are placing enormous pressure on families up and down the UK. Children's experiences of poverty and the recession are often overlooked. (Whitham, 2012)

It is quite difficult to provide a simplistic definition or measurement of someone's social class and we generally use some form of 'proxy indicator'. We could use 'occupational indicators'. If we use the terms 'working class' or 'middle class', we could classify by the parental occupation and income if we knew them. These two measures will be closely related but not uniquely so. Some 50 years ago this terminology would not have been too problematic – yet as the economy has become more segmented, fragmented and dynamic, such occupational measures become more difficult to depend on.

We might alternatively use some 'economic indicators' and use the terms 'poor', 'deprived' or 'disadvantaged' to indicate some sense of being denied some opportunities or economic resources. This too is difficult to measure, but one approximation to being poor is being eligible for free school meals so this is often used as a proxy. This is not fool-proof as students can easily move in and out of such categories.

A third approach is to use ‘*aggregated geographical measures*’ which are based upon postcodes and census output areas. An example of this is the UK government’s *Income Deprivation Affecting Children Index* (IDACI). This measures the proportion of children under the age of 16 that live in low income households in a particular area and is used when comparing school contextual achievement.

Finally you can use data on ‘*consumer spending habits*’ or ‘*geodemographic segmentation*’. The system called MOSAIC has been developed by Experian in the UK and creates 155 person types aggregated into 67 household types. As with the IDACI this assumes we are like the people we live near; which to some extent we all are.

Making Judgements

UK Governments use a number of these proxy measures in their analyses of student progress – and other countries will undoubtedly use similar measures. The weakness of these sorts of measures is that they rely heavily on economic capital and on spatial aggregation and ignore the equally important dimensions of cultural and social capital. So, although there are certain allocation problems for some students (transgender, dual heritage etc.), analysing educational outcomes by gender and ethnicity are relatively straightforward. However, statistical analyses and classifications made on the basis of socioeconomic status are fraught with problems. Research in the US shows that the mathematics achievement gap related to *socioeconomic status* (SES) is roughly *10 times* the size of the gender gap (Lubienski, 2002, p.105). However, although socioeconomic status is arguably the most important dimension of educational achievement, it is the one most often systematically overlooked. It is tricky to separate out the effect sizes of

class, ethnicity and gender and to understand the intersection of these: being a white working-class boy makes you as complex as a Chinese middle-class girl.

Having argued that social class is a problematic and contested construct, it is the case that we all classify on the basis of some measure of socioeconomic status. Indeed, as we have said, everyone is engaged in classifying, at a more or less conscious level, all of the time. Our categories and strategies for doing this are themselves a product of our own social backgrounds and upbringing. Part of the way teachers classify their students is through the assessment of mathematical skills but another part is through implicit and often subconscious judgements of the students' cultural capital, even in the form of their names (Noyes, 2003). Do we picture a Kylie or a Dwayne in the same way as a Katherine or a David? There is never a truly fresh start at school!

Think of the time you met one of your classes for the first time, try and become aware of what you noticed about the students. What judgements were you forming and how? Write down some notes, reflect on them prepare yourself to be surprised by a) your skills as an amateur sociologist and b) your prejudices. Then consider the implications of those initial judgements for your future interactions with these students.

So, whether we like it or not, we are all involved in classificatory practices, and these are probably not fair; they tend to benefit certain kinds of people like ourselves. To talk about 'class' then is to organise the world around us, whether we do this organising and classifying in school or in society more generally. A key sociological idea is that schools are one of the key sites of social reproduction; hence the use of class as an

organising principle in school and society is not at all accidental. Neither is the fact that it remains largely hidden, or at best misrepresented in various ways.

Attainment and Class

In an earlier study of GCSE mathematics attainment across the Midlands of England by Andy (Noyes, 2009, p.177) the relationship between the level of income deprivation and attainment became clear (Table 2.1).

INSERT TABLE 2.1 NEAR HERE

Students from the households in the lowest quintile of IDACI scores (i.e. the least deprived areas) were over twice as likely to achieve a grade C in GCSE than those in the most deprived fifth of households. This grade C is critical for accessing many education, employment and life opportunities. Students from the least deprived homes were over *five* times as likely to get A*/A grade than those in the most deprived households. These grades are the desired prerequisite in most schools/colleges for progression to Advanced level mathematics (see the later chapter by Cathy Smith).

When this attainment pattern is combined with the fact that low levels of numeracy have been shown to be the strongest predictor of unemployment (Bynner and Parsons, 1997), and that those who complete an A-level in mathematics are likely to earn more in the future (Wolf, 2002; Adkins and Noyes, 2016), there is a convincing argument that the rankings and classifications undertaken through school mathematics have a great

influence on organising social classifications for the future – possibly more so than all school subjects. Pierre Bourdieu puts it quite starkly:

Often with a psychological brutality that nothing can attenuate, the school institution lays down its final judgements and its verdicts, from which there is no appeal, ranking all students in a unique hierarchy of all forms of excellence, nowadays dominated by a single discipline, mathematics. (Bourdieu, 1998, p.28)

In the light of all this, it is really important that teachers of mathematics think about their own roles, and the role of the education system in social classification. So, who gets what in school mathematics in your school, and in your classes?

Virtual Schoolbags

In a study of disadvantaged young people in Adelaide, Pat Thomson (2002) talked about the ‘*virtual school bag*’ to explore how schooling interacts with the *stuff* – the ‘*baggage*’ that young people bring to school. Rarely do teachers of mathematics get to look into these school bags. If we ignore the different contents of these virtual bags and treat all students equally we give *de facto* support to those who arrive at school with the right kinds of *kit* that is necessary for success in schools. This kit does not just include a pencil, ruler and pen, it also includes ways of thinking, speaking and writing that are common in schools but not common in all kinds of homes.

If you are working in a school, identify two contrasting students in your classes and find out as much as you can about them. If you have access to their postcode use the Department for Education (DfE) site to identify their IDACI measure.

In a study of two very different children (Caitlin and Cory) attending the same school (Jorgensen, Gates and Roper, 2014), differing learning trajectories in mathematics have resulted from the influences of family culture and linguistic capital as well as the ability group that they were taught in; Caitlin was in the top ability group, Cory in the lowest. Analysis and experience in schools suggests it is very unlikely that either of them will change ability group even at an early stage of their secondary education, as this grouping seems in many ways to be a product of much more than mathematical knowledge.

In your experience, how often do setting decisions get changed and students move between sets? What are the implications for students and teacher?

Both students lived with their mothers. Caitlin lived in an affluent area; she used similar language and had similar values to her teachers. Her parents have endowed their daughter with much social, cultural and linguistic capital. In the educational field, she has distinct advantages; her capital earns her an enhanced reputation, a comfortable position in the highest ability set and high attainment.

Cory's progression was not so smooth and he did not achieve the same degree of academic success as Caitlin. Cory and the school system did not fit together as naturally as Caitlin and school seem to. Cory's view of education was narrower than Caitlin's; for

him the purpose of school is purely functional and looks at individual skills and knowledge as opposed to the value of an all-round education. This agrees with Andy's findings that 'the economically and culturally more well-endowed make the most of moving school' (Noyes, 2006, p.43)

How are students' backgrounds and prior experience integrated into curricular and pedagogic decisions in classrooms where you have taught and learned maths?

One of the ways in which 'class' works in schools is through language, and a number of researchers have explored how language helps in the classificatory and discriminatory practices of school mathematics. Robyn Zevenbergen (2001) highlights the fact that school language is middle class and therefore presents an obstacle to working-class children who may not have the dispositions tacitly required by schools. This means that those children without the same language competence are disadvantaged in the classroom.

How We Organise Learners

Consider the issue of ability grouping (part of the 'ability thinking' discussed by Mark Boylan and Hilary Povey in the previous chapter). It is taken as a given in the UK that for mathematics we must place students in ability groups. Indeed, it is difficult to find schools in which this has not been the accepted practice for years. By contrast, such an approach is uncommon across Scandinavia. Indeed, it is illegal to set by ability in Finland, Denmark and Norway to name but three countries. The PISA (Programme for International Student Assessment) data highlights how countries with a less

differentiated attainment range do better in those tests (OECD, 2010). In addition, setting by ability is recognised as discriminatory:

Early student selection has a negative impact on students assigned to lower tracks, without raising the performance of the whole student population. In addition, selection exacerbates inequities since students from disadvantaged backgrounds are more likely to be placed in the least academically oriented tracks or groups. (OECD, 2012, p.56)

So why is ability grouping illegal in Finland, Norway, Denmark and other countries? If ability grouping is so good that it is just impossible for most UK mathematics teachers to even conceptualise what teaching would be like without it, why does Finland come top in international comparisons (OECD, 2004). In Finland, low attainers did better than their compatriots in the UK and the gap between lower and higher attainers was lower than elsewhere.

The challenge is to try and engage young people more effectively with mathematics rather than focus on structural organisational principles. However, it is not just a professional matter, it is a deeply political and ideological one (Gates, 2006). It is also dependent upon the value that young people place on the mathematics that they encounter.

Karen Pellino (2007) argues ‘the social world of school operates by different rules or norms than the social world these children live in’ by drawing our attention to some of the characteristics of children in poverty. She found they experience: high-mobility, hunger, repeated failure, low expectations, undeveloped language, clinical depression,

poor health, emotional insecurity, low self-esteem, poor relationships, difficult home environment, a focus on survival.

Socioeconomic disadvantage may have a direct influence on children's development, for example through limited material resources and an increased risk of a range of health and developmental problems, and an indirect influence through parental education, expectations and aspirations. Schools favour middle-class attitudes and expectations – which is why working-class students often get into trouble. Working-class students are too often defined by what they are not or do not have: they have no motivation, have low ability, low aspirations, parents who are not interested.

How Will You Teach?

The thing about social classification is that it goes on all around us all of the time - quietly and powerfully - and we are both the subjects of, and agents of, this classificatory social world.

Since we wrote the first edition of this chapter in 2013 the world has changed; populism is on the rise and concerns abound regarding 'fake news'; the UK has voted to leave the European Union, in part because of incorrect views about immigrations and globalisation; and Donald Trump has been elected President of the USA amid varied claims of misogyny, denial of climate change, and so on. In Brazil the right-wing Jair Bolsano, a vocal opponent of same-sex marriage and homosexuality, abortion, affirmative action, and drug liberalization was elected President. More generally Nationalism and Neo-fascism is on the rise across Europe. These discourses frame the

worlds of the young people in our classrooms and so the ability to think critically about the often hidden social forces in our societies that we wrote about back in 2013 (about social class) are now more urgent than ever before.

However, taking action to ameliorate the experience of working-class learners and communities is not an act of charity; it is a political act. When teachers endeavour to enhance the achievement of pupils brought up in disadvantaged communities, they must, of necessity, ask difficult questions about how those who have benefitted from an education system that tends to reproduce social privilege then influence that society and its education system. Education is essentially political as reflected in the following two excerpts.

Consider the “research report” seductively titled “*The achievement-wellbeing trade-off in education*” (Sahlgren, 2018) by the Centre for Education Economics (we leave the reader to investigate the political position and associations of CfEE¹). The message of this report is that educationalists (termed “progressives” by Sahlgren) have for years been working under the presumption that we should care for young people’s well-being.

The idea that pupil well-being and effective learning go hand in hand is an important tenet of progressive educational theory. Since genuine learning is

¹ The Centre for Education Economics (CfEE) rebranded itself from “*The Centre for the Study of Market Reform of Education (CMRE)*” an organisation that lobbied for profit-making schools, and greater private sector involvement in education. It has a 'collaborative relationship' with the Institute of Economic Affairs, and The Adam Smith Institute

supposed to be experienced as enjoyable and energising, education that does not deliver this experience tends to be seen as inadequate. Progressive theory has therefore come to highlight the relationship between pupil-led learning, enjoyment, and performance as a virtuous circle. Yet little rigorous evidence has been presented in favour of this assumption. Indeed, the paper presents evidence showing to the contrary that effective learning is often not enjoyable. Rather, several interventions and strategies – such as homework, school competition, and traditional teaching methods – involve an achievement-happiness trade-off. (Sahlgren, 2018, p. 1)

In contrast to notions of competition and extra homework (which has been shown to benefit the middle classes who have the social and cultural resources to make the most of schooling outside of school), the OECD report on “*Equity in Education: Breaking Down Barriers to Social Mobility*” sets out a more inclusive vision for

...developing teachers’ capacity to identify students’ needs and to manage diversity in classrooms, to build strong links with parents, and to encourage parents to be more involved in their child’s education. Teachers can also foster students’ well-being and create a positive learning environment for all students by emphasising the importance of persistence, investing effort and using appropriate learning strategies, and by encouraging students to support each other, such as through peer-mentoring programmes. Clearly, the most impressive outcome of world-class school systems is that they deliver high-quality education across the entire school system so that every student benefits from excellent teaching. Achieving greater equity in education is not only a social-justice imperative, it is also a way to use resources more efficiently, and to increase the supply of knowledge and skills that fuel economic growth and promote social cohesion. Not least, how we treat the most vulnerable students shows who we are as a society. (OECD, 2018, p. 3)

You will need to investigate these positions further, and reflect on why it is that one of these positions resonates more than the other.

The challenge we want to give you is to recognise the part that you play, often unwittingly, and to consider what might be done in response. So, in this final section we invite those of you who are teachers or student teachers to think of the school in which you are teaching in or aspire to teach in. What it is like? How similar or dissimilar is it than the school(s) you yourself went to? Andy's study of student teachers' decisions about their first teaching posts (Noyes, 2008) highlights the tendency for teachers to take up their first post in a school similar to the one that they themselves attended. Who then will teach in the schools in more deprived areas? It appears the answer to that question is, whoever the school can get. With increasing shortages of mathematics teachers, schools are forced to take drastic action, which results in those pupils who this chapter has been focusing on, often getting taught by the less experienced and mathematically qualified teachers:

This deployment of more experienced teachers at Key Stage 5, while understandable, means that the shortage of maths teachers is being felt most keenly at Key Stage 3 (and to some degree Key Stage 4). At this age, young people's attitudes to subjects and future study are crystallising. If maths teaching and learning is not as engaging or tuned to individual needs as might be desired there are significant risks of adverse effects on pupil outcomes and progression in those schools struggling to allocate specialist or experienced teachers for younger year groups. (Allen & Simms, 2018, p 5)

So how might we make maths teaching and learning as “*engaging or tuned to individual needs as might be desired*”? Especially for those young people who lead difficult and challenging lives? Our experience over many years of teaching mathematics in schools, and of reading and researching around the subject (see Perry and Francis, 2010),

suggests the following might be a good place to start to raise the attainment of those more economically and culturally disadvantaged young people:

- Encourage working-class young people to feel engaged in the mathematics curriculum and to feel it has a purpose.
- Find something out about vocational transition routes and pay attention to alternatives in your examples.
- Focus on what students know and can do rather than on what they don't know and cannot do.
- Engender positive, respectful social and pedagogic relationships to explicitly foster self-esteem and resilience in working with mathematics.
- Treat low SES students to the same high expectations, with a demanding and rigorous mathematics curriculum that expects all students to succeed and understand.
- Create and use meaningful tasks involving inquiry and cooperative learning, where low SES learners have some control and responsibility.
- Recognise and embrace the diversity in the student body, valuing the talents and abilities of low SES learners, encompassing a respect for different life worlds and their contributions to mathematics.

- Get to know the families, and provide differentiated support.

Those final two points have been stressed by the Organisation for European Cooperation and Development, (OECD, 2012, p. 142), one of whose recommendation for improving equity in education is “*prioritise linking schools with parents and communities*”. They provide five pages of guidance on how this might be achieved which recognise the responsibility of the school in establishing meaningful mutually respectful two-way channels of communication. School mathematics department have a particular responsibility here, given the importance of parental attitudes towards mathematics.

Perhaps the greatest challenge for all of us is to see the ways in which school tends to reinforce social *class* differences. More specifically, as mathematics teachers, this is to recognise the influence that SES and poverty has on all aspects of teaching and learning mathematics. Engaging explicitly with class and social differences in learning has been shown to have the potential to open up greater opportunities for higher order thinking (Jorgensen, Sullivan, *et al.*, 2011), and for raising the intellectual quality of student cognition (Kitchen, DePree, *et al.*, 2007). *Class*, in some guise or another, is always a latent variable whose invisibility obscures possibilities for action. We need to not only talk about, but do something about, class.

Studies have shown that poverty has a stronger influence on achievement than instructional quality, leading to a policy imperative that if we want all pupils to do well “minimizing social inequities must be a fundamental component of education policy”. (Georges, 2009)

Further Reading

Boaler, J. (2009) *The Elephant in the Classroom*. London: Souvenir Press: In this book Jo Boaler talks about some of the more enduring problems of mathematics teaching and how to acknowledge and use support from home to make mathematics more exciting.

Noyes, A. (2007) 'Mathematical Marginalisation and Meritocracy: inequity in an English classroom', in B. Sriraman (ed), *International Perspectives on Social Justice in Mathematics Education*. Missoula MT: University of Montana Press: This book chapter presents a detailed account of how two 11-year-olds (Stacey and Edward) experience mathematics together in the same class when they are socially very distant from one another. Their mathematical trajectories are about to diverge quite dramatically and the roots of this divergence can be traced to their social backgrounds and the values and dispositions that have been acquired there.

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GCSE Mathematics Grade	IDACI quintile				
	1 (least deprived)	2	3	4	5 (most deprived)
A*	5.7%	3.8	2.8	1.7	0.8
A or above	18.9	14.1	10.5	6.6	3.8
B or above	42.5	34.3	27.7	19.7	13.2
C or above	68.6	60.3	52.2	41.6	31.8
D or above	83.5	77.1	69.9	59.1	48.6
E or above	92.9	89.5	84.9	76.7	67.9
F or above	97.3	95.6	93.6	89.1	83.3
G or above	98.4	97.7	96.8	94.7	91.9

Table 1: GCSE Mathematics Grade and Income Deprivation (cumulative percentages)

Source: Noyes 2009; National Pupil Database