

Can the subaltern do science? Minoritized students' struggles for intelligibility in the secondary classroom

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- Spivak (1988) *Can the subaltern speak*: the problem of 'giving voice' to the Other – can academic discourse really be an effective social justice tool?
- Exploring in the context of UK secondary science classrooms – what opens up/ closes down who can 'do' science and the conditions for 'allowing the Other to speak'?

Why science?

- Entrenched inequalities in science participation
- Archetypal, high-status (white, male, middle-class) subject area (Harding 1988)
- Our approach: Social justice (rather than 'pipeline') concern

Science classrooms

- Constituted by power relations
- Struggles for voice, authenticity and recognition – that is, who can and does have voice and authority and who is, or is not, recognised as ‘good at school science’
- Carlone et al (2014): how teachers create different conditions within their classrooms for what, and who, is valued as being ‘smart at science’ - Ms Wolf and Mr Campbell
- Our focus: how science classroom practices & performances (by schools, teachers and students) open up/ restrict who can/not speak and who can/not perform a science identity

Conceptual framework

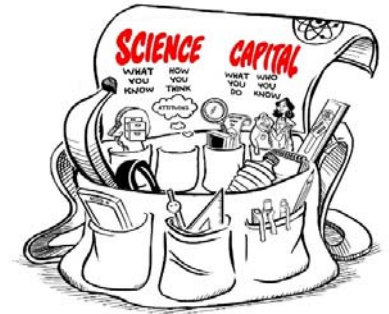
- Judith Butler (1990, 1993) - identity as 'performance' / 'intelligibility'
- Gender not as fixed, given or biological – rather bodily and discursive 'acts'
- Gender (and identity) as 'doing' (forever becoming, 'in process', Hall 1990)
- But not entirely 'free choice' or free-floating – authenticity/ recognition
- 'Intelligibility' – what is recognised, valued, 'thinkable' within dominant discourse/ cultural matrix ("certain kinds of "identities" cannot "exist", Butler 1990: 24).



Paper focus

- How classroom spaces are constituted by complex power struggles (for voice, authenticity and recognition), involving multiple layers of resistance and contestation involving the ‘institution’, teachers and students.
 - What are the celebrated identity performances in nine urban secondary science classrooms and how are these reproduced and/or contested, and by whom?
 - Which student science identity performances are (un)intelligible in these spaces? And with what implications for science engagement and participation?

Enterprising Science project



- Five year R+D project (KCL, Science Museum, BP)
- Focus on data from this year – professional development/ intervention strand
- Working with 9 secondary science teachers (6 London schools)
- ‘Science capital’ pedagogical approach (utilising a ‘funds of knowledge’ and Bourdieusian inspired ‘science capital’ approach, Archer et al., 2015) – equity orientated praxis
- 9 month ‘ethnographic’ classroom observations of 9 London classes
- Discussion groups with 59 students (13 groups)
- 2 teacher workshops and pre/post teacher interviews

The teachers

- Ms Dennis (Black British woman, Y10, bottom set, Coleville School)
- Ms Randel (South Asian woman, Y9 top set, Coleville School)
- Ms de Luca (British/ European woman, Y8 bottom set, Mareton School)
- Ms Chuckwu (Black British woman, Y10 bottom set, Mareton School)
- Mr. Okello (Black British man, Y8 middle set, Northfields School)
- Ms Arkwright (White British woman, Y9 top set, Northfields School)
- Mr Hobbes (HK Chinese man, Y7 middle set, East End school)
- Ms. Smith (White British woman, Y8 top set, St. Mark's School)
- Mr Sharma (South Asian man, Y9 bottom set, Metropolitan School)

What are the celebrated identity performances and how are these reproduced and/or contested, and by whom?

- What performances do teachers personally value?
 - *Intellectually engaged*: ‘Curious’, ‘questioning’, “thoughtful”, “open minded”, “not seeking right/wrong answers”
 - *Social and co-operative*: “Engaging in discussion”, “sharing each other’s knowledge and ideas”, “good communicators”, “team players”
 - “Creative”, “problem-solvers”, seeing science as “connected” to other subjects
 - *Self-directed learning*: “conscientious and self-motivated”
- Students largely concur – and notice the approach being trialled:
 - “Mr Hobbes is different from other teachers because some other science teacher they try to make the lessons boring .. But Mr Hobbes has a very different way of teaching” (Ali, Y7 boy)
 - “Ms Randel teaches us a lot about the subject ... but then she also sometimes goes off topic, which like keeps the lesson moving” (Sam, Y9 boy)
- But both teachers and students recognise that these get subverted in practice ...

3 dominant performances – observation, interviews and discussion groups

- ‘Tick box’ learning
- Behavioural compliance
- Science as ‘brainy’/ muscular intellect

'Tick box learning' – educational performativity

- Instrumental approaches: required, inculcated (and compliance rewarded) through the management, curriculum, structures, practices and audit/ inspection culture of their schools and wider education system
- Ball (2003): performativity is a key, common technology within current UK educational reform, aligning education with private sector
- Exemplified by 'teaching to the test' (recognised by both teachers and students)
- Mixed views: 'necessary evil'? Some student resistance to 'going off topic'
- Teachers try to resist ("I always try to fight the system", Mr Hobbes), but are also captured by the discourse
- Concerns – works against student agency, engagement & science identity:
 - “Being curious - at some point in KS4 you have to kill it’ (Ms. De Luca)
 - “KS4 has a knuckle down atmosphere – not much inquiry and not so active” (Ms Arkwright)
 - “‘Is this in the test?’ is the most annoying and hurtful thing you can hear” (Mr Hobbes)
 - “As soon as we mention exams, we kill that bit of passion” (Mr Sharma)

'Doing the right thing': *behavioural compliance*

- Symbolic performance (demanded, celebrated/ sanctioned by teachers and students) and highly prevalent (classroom time)
- 'Not shouting out' and 'putting your hand up'

Students are mostly talking and not working. A couple, like Dwayne seem to be looking at the board and trying to write answers. A boy calls out 'I done it!' Mr Hobbes highlights to the class who is 'doing the right thing' and names students who are behaving: "Dwayne is doing the right thing. Ahmed is doing the right thing" (Mr Hobbes, 14th October)
- Ball (2003): performativity requires educational managers and teachers to become 'technicians of behaviour' - required 'to produce bodies that are docile and capable' (Foucault 1979a: 294).
- Patrolled by some students:

Casey is getting upset and frustrated with everyone being noisy. He calls out loudly "shush, man!" Later in the lesson, Casey claps for quiet and shouts "stop messing about!" Another student retorts "we're not". Casey shouts again to the class "can you be quiet?!" Again, later in the lesson, Kaleem shouts loudly at the top of his voice to the class "shush, can you just shush? We are going to be late for lunch" (Mr Hobbes, 11th November)
- But is behavioural compliance the same as 'good learner'? Some order is required for student voice/ engagement – but too much (overly didactic) closes down curiosity, questioning. A pedagogy of control can negatively impact agentic & creative learning (Verelas et al 2011).

Being well behaved is not (necessarily) the same as performing scientifically?

- E.g. Dwayne, 12 year old, Black British boy
- Consistently quiet, well-behaved and attaining
- But does not see self, and not seen by others as 'scientific'
- "I don't know if Dwayne is good at science because he's always quiet, but he does the work and his book is normally full of sums" (Jana, girl)

Doing science through 'muscular intellect': 'Being right', being 'brainy – and 'being macho'

- Students identify 'science people' in their class as the 'brainiest':
 - "They're really like smart", "they're very smart", "they always get the questions right"
- Aligned with masculinity – only one group identify a girl first when asked to name science people in their class
- Performance of 'muscular intellect'
 - Shadin congratulates himself publically for getting the answer right, saying loudly (ostensibly to himself, but loudly, so others can hear), "metal chloride - genius! Yeah, I'm a genius!" (18th nov).
- ... and 'talking science' (Lemke 1990)
 - Farooq tells the rest of the class to be quiet and listen to Miss. He explains how you can calculate the power in the lightbulb using the equation (Ms Dennis, 9th December)
- But – while recognised as authentic ways of 'doing' science, they also close it down for most students – reinforcing the 'mystique' of science and silencing others

Silencing others

Qadir calls out aggressively over other boys to answer // Qadir is invited to answer, says "iron and oxygen make rust". He continues to call out the answers loudly beyond his 'turn' (when other students are invited to answer the next questions). // Qadir gets up and goes over to bellow the answer at another boy (Mr Hobbes, Y7, 12th Jan)

Sharifa: ... They say all these big words, you know.

Leonor: They need to show off.

Sharifa: Yeah, well, they show off too much, there's a limit, isn't it? //

Leonor: Yeah, you have to show off to someone, so if you don't show off, then people will just think that, oh, you're quiet, like this girl, she's //

Sharifa: [They shouldn't] show off too much and then people, they feel bad about themselves, 'cos they think that like, well, they're trying to like say that you're dumb [...] They act like, they're like superior and high bred and all this better than anyone else (*Mr Okello, Y8 girls discussion group*)

Policing and derision of those who get it 'wrong'

- Girls are more likely to be reticent and 'shy' compared to boys

"You feel like everybody is staring at you, waiting for you to talk and then you feel, like, I don't know, pressure wise" (*Shona, Y9 girl*)

Eddie: Boys, yeah, they are much more loud

Kai: The women are much quieter and sit at the back, so they don't get chosen most of the time" (*Ms Randel, boys discussion group*)

“If I’m dumb, how can I speak?” The (attempted) silencing of girls

- Spivak (1990: 104): ‘the subaltern as female cannot be heard or read’.
- Silencing and ‘unintelligibility’ of girls, especially in classes where ‘outnumbered’ (e.g. Mr Hobbes, Ms Chuckwu, Mr Okello, Ms Dennis, Ms. De Luca, Mr Sharma)
 - “The boys are so loud, they're like... they don't let you speak” (Sharifa, Y8 girl, Mr Okello’s class)
- Small group of dominant boys - constant, loud, public bids for recognition (shouting out, bullying and silencing others) - disruptive students who took up more physical and discursive space than girls. E.g.
 - Cayden does something which sounded like a fart and the students around him laugh and shout. Tommy at the back gets up to stretch and starts dancing // The boys at the back (Cayden and Tommy and Chris) are play fighting quite loudly and roughly. (Ms Dennis, 9th Dec).

Silencing girls through performances of masculinity: (i) hetero-sexualised 'banter'

- Qadir teases Ayesha that one of the boys likes her. He shouts at Salma, "Salma are you cheating on Ahmed?! You slag!" // Mubid is still calling across to the girls and trying to tease them, about who is cheating with who// Qadir is trying to get attention and distract others. Salma gestures to him to be quiet// (**18th nov**)
- A boy at the front is asked to explain the answer to the class. Casey waves his hand trying to answer. Mr Hobbes says "you need to write down the official word for this which is 'attracts'". Qadir and the boys laugh and say "oh yes, Salma *attracts!*" (Dec)
- Mr Hobbes calls on Fateen (quiet girl in headscarf) to answer. As he does so, Youssef makes fun of her name, saying 'fat mumma'. He continues to heckle her "Hey, I've got a new nickname for Fateen, fat mumma! Let fat mumma talk! // Youssef keeps calling "shut up fat momma" to Fateen // Youssef is shouting "fat momma" at the girls again. Qadir jokes with him, "oh so she's your momma now?" Qadir shouts over at the girls "he isn't your son, he's your husband! Your wedding night!" // Youssef is still calling out rude things to Ayesha and Qadir, saying "She's like stinky momma and I'm like shorty daddy. I like the punan-ana!" (9th Feb)

Interpretation of boys' performances

- Girls' views:
 - We're the only girls in the class, I suppose they all get bored of each other and we don't like socialise with them in the lesson, like they get bored of each other, so they think, oh, let's go and wind them up (Tanisha)
- But – boys' performances disrupt girls' (and Other boys') access to learning and reinforce dominance of hetero-masculinity within class (and science) space

Silencing girls through performances of masculinity: (ii) muscular intellect & talking science

Mr Hobbes asks, “Why are wires made out of copper and not gold?” Mariam replies “Cos gold is very expensive and takes a long time to make?” Salma adds “Cos electricity doesn't flow through it so well?”. But Salma says it quietly and the class are talking over her. Mr Hobbes asks her to repeat her answer. Salma becomes embarrassed and says “oh, I forgot what I was going to say ... oh, I remember –“ then repeats her answer. But Qadir shouts ‘elections!’ at her aggressively, as if telling her off for not giving the ‘correct’ scientific terminology in her answer. Mr Hobbes ignores Qadir and follows up with Salma, “OK, so you mean gold is a good conductor”. (18th Nov)

Jana is called on to answer a question, but most of class are not listening and a boy imitates her voice in a mocking way, making other boys laugh. (Mr Hobbes, 12th Jan)

The girls are trying to ask Mr Hobbes questions about electricity but the boys keep interrupting their discussion with him and are trying to get his attention instead (Mr Hobbes, 9th Feb).

Silencing girls through performances of masculinity (iii) Muslim hetero-masculinity

- Particularly noticeable in Mr Hobbes' class (predominantly Muslim students from Bangladesh, mostly boys)
- Interpret as performances of power by boys, to assert themselves in relation to girls

Salma gets out of her seat and walks round to talk to Ayesha. Qadir and Mubid are calling back to Salma, saying her name is a Muslim name//

Shadin says something about a burger that makes Qadir and Mubid laugh. They keep talking about Salma, calling to her “you are Mus-lin” [a play on her name and ‘Muslim’]. Qadir calls out in Bengali or Arabic //

Qadir and Mubid and Shadin are talking and mucking about trying to get Salma’s attention, asking her again if she is a Muslim. Salma replies indignantly “of course I am!” //

Shadin is being cheeky to Salma, talking in Bengali and Arabic, and calling out “Inshallah”. Qadir copies him. They are imitating being strict Muslim men (in the tone they are using) and are trying to make their voices deeper, to sound like they are telling her off. Kaleem tells them to shush. Qadir shouts at Salma: “Muslim! How much does beef cost?” He and Salma shout at each other. Qadir is shouting at Salma in Bengali or Arabic. They are saying something about chicken, beef to which Qadir exclaims “she's Indian!” //

Qadir and Mubid are relentlessly talking at and about Salma. Qadir taunts her “Muslim! What would you do?” //

Qadir calls to Salma, “Muslim, Muslim its your turn to do a proverb”. The boys say it is a dare. Salma argues back “but I didn't say truth..” (truth/dare game?) Girls are reading notes thrown by the boys. Qadir shouts at the girls about having a husband and six children //

Qadir is shouting at one girl “yes, I know your dad!” They argue about which boy and girl had Ayesha as a daughter//

Salma is looking a bit dejected and quiet, on her own at the back of the class //

Youssef is called on by Mr Hobbes to answer the question on the board, but he has not done it yet. He blames the girls for distracting him (18th Nov).

- Patrolling of Muslim femininity through performances of masculinity and notions of 'honour' (see also Archer 2003)
- Performances of 'devoutness' as technologies of power – drawing boundaries of in/authentic (“she’s Indian!”)
- Foucault: the exercise of power requires ‘... to be able at each moment to supervise the conduct of each individual, to assess it, to judge it, to calculate its qualities or merits’. (Foucault 1977, 143).
- Challenge for funds of knowledge approaches – deployment of ‘dark’ funds (Zipin 2009)

Girls' responses and negotiations

- Gramsci – no hegemony is absolute but contains/produces spaces of resistance
- 3 main performances by girls:
 - 'Talking out'/ talking back
 - Withdrawal
 - Engagement with science through femininity

(i) Talking out/ talking back

- Girls attempting to possibilise themselves – as having agency and as authentic science subjects

Qadir and Salma are still needling each other. He keeps saying to her “you're dumb”. Salma retorts “oh if I'm dumb, how can I speak?” (18th nov).
- Some girls attempt to perform muscular intellect – but tend to meet with sanctions:
 - Zaria continues calling out responses to most of the sentences/questions. (But Ms Dennis never seems to respond – neither disciplining her nor valuing the responses...) A girl comes in and Ms Dennis hands her a worksheet. Zaria calls out again – ‘Insulin!’ Ms Dennis finally responds – ‘Insulin, don’t shout.’ (Ms Dennis, Bacons, 3rd Feb)

(ii) Withdrawal, 'doing our own thing'

- In classrooms where they are 'outnumbered' the girls tend to sit in close huddles together:

Jana We don't mind, 'cos we quite like it, having our own space, 'cos we feel comfortable.

All: We don't mind, we don't mind

Tanisha: 'Cos we could like join in with them and talk like in a big class and that, but we prefer to like stick to our own thing

- Issue: are girls 'performing scientifically'? Marginalised from active learning and 'voice'?

Moreover – met with resistance by boys

- Boys challenge this practice (e.g. as ‘gossiping’, ‘mucking about’) as an unintelligible way of performing science – which, in line with muscular intellect, requires confidence public displays of ‘talking science’, rather than quieter small group discussion

Youssef: The girls don’t do anything.

Hassan: They keep just gossiping.

Waadi: Yeah.

Qadir: They talk about boys.

Haroon: And then when Mr Hobbes asks them a question, they don’t even answer anything.

All: Yeah, yeah

Youssef: Like, uh, uh.

LA: So they're quieter, is that what you're...?

Yunis: Yeah, they keep talking and that’s what distracts us

(iii) Engaging with science through femininity

- Performances of 'art' and 'creativity', such as doodling, drawing, colouring and making paper crafts
 - Taylor and Moira are drawing clouds, hearts and pretty letters. // I see girl1 making origami, Moira and Taylor at the back still drawing (Mr Okello, 26th feb)
 - "It's more neater because, like, where it's in colour, we want to make it look, like, nice, instead of just being black and white, so we put more effort into it. (Tanisha, Mr Hobbes, Y7 girls)
- Engagement with science through specifically 'feminine' topics, such as childbirth (drawing on feminine FoK):
 - Ayesha suddenly notices the fume cupboard in the corner of the class and calls out: "Sir, what is that? That, sir, it looks like an incubator" (she points at the fume cupboard). Mr Hobbes asks "Do you know what an incubator is?" Ayesha answers "yeah, like when the baby comes out early". The girls all get excited and start to talk over each other and chip in. Mr Hobbes asks them "what does 'incubator' mean?" Ayesha says that "it warms it up". Mr Hobbes replies "yes, so it keeps the baby warm" (9th Feb).

But - resistance to girls' engagement through femininity

- From boys:

Incubator example: no boys attempted to join in the discussion about the incubator but rather shifted the conversation back 'on topic' (with Youssef calling out "I don't know what global warming is").

'Teaching reproduction, there were only girls listening. The boys started arguing about things - they feel that they don't need to know this' (Ms Dennis, teacher workshop discussion)

The girls mess about more than boys [...] They just like get coloured pens and they just like draw in their books and that. (student name, Mr Hobbes's class boys discussion group 2)

- From teachers:

- The teacher chastises: "Marisa you're obsessed with colouring in. Stop it now!" (Observation, Ms de Luca 20th October)

- 'Boys like physics and experiments. Girls would like more cells, drawing beautiful diagrams' (Ms Dennis, teacher workshop discussion)

Discussion – can the subaltern do science?

- Science as a symbolic resource – used by teachers & students in jostling for power, status, visibility and ‘voice’ within the ‘ideological battlefield’ of the science classroom.
- Very hard for the subaltern to do science: dominant performances all have potential negative implications for student ‘voice’, equity and learning/ engagement & close down opportunities to develop interest & authentic engagement/ identification & reinforce narrow views of what, and who, can be read as ‘performing science’.
- Particular issues for girls: ‘culturally entangled’ performances of muscular intellect and masculinity silence and render unintelligible girls’ performances of science & constrain girls’ voices in class

Questions for moving forwards

- Can all funds of knowledge be productively leveraged? How can we work productively with, and value, *everything* that young people bring with them?
- How can we sensitively yet justly challenge inequalities (e.g. boys' silencing of girls through racialized and sexualised performances) while also working to equitably support diverse young people to engage with science?
 - Multi-vocality – but not through absolute relativism (guided by a politics of value)
- How might we create conditions that allow 'subalterns' (as heterogeneously conceptualised) to 'speak' for themselves in ways that open up equitable identity possibilities for all youth?
 - 'Queering' science education (disrupt dominant discourses around who is the 'ideal' science student – deconstruct celebrated performances; critical engagement with power relations, more collaborative and democratic learning spaces)
 - Opening up ways of being, supporting teachers & students to reflect on celebrated identity performances and valuing more ways of 'performing science' to challenge muscular intellect – something we are trying in our intervention approach

Some project publications so far ...

- Archer, L., Dawson, E. Seakins, A., DeWitt, J., Godec, S. & Whitby, C. (2016/in press) “I’m gonna be a man here”: Performances of masculinity and engagement with science during a school/museum intervention. *Journal of the Learning Sciences*
- Archer, L., Dawson, E., Seakins, A. and Wong, B (2016) Disorientating, fun or meaningful? Disadvantaged families’ experiences of a science museum visit. *Cultural Studies of Science Education*. Published on iFirst, DOI 10.1007/s11422-015-9667-7.
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- Archer, L. Dawson, E., Seakins, A. DeWitt, J. & Wong, B. (2015) Author Response. *Science Education* 99(6): 1147-1149.
- Dawson, E., Archer, L., Seakins, A., DeWitt, J. & Godec, S. (under review) Selfies & Science Engagement: Girls Identity Performances in a Science Museum
- Seakins et al (under review) “You’re the expert”: engaging under-served students with science through performances of expertise on school and family museum visits
- DeWitt et al (under review) Dimensions of Science Capital: Exploring the potential of the concept of science capital for understanding students’ science participation
- King, H., Nomikou, E. Archer, L. & Regan, E. (2015) Teachers’ Understanding and Operationalization of ‘Science Capital’. *International Journal of Science Education*, 37(18):2987-3014.

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