



## Intersectionality as personal: the science identity of two young immigrant Muslim women

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### ABSTRACT

This paper studies intersectional multiplicity by encompassing the ways individuals shape relationships between social structures and their science identity. We discuss the science lives of two sixteen-year-old British South-Asian Muslim women studying in a single-sex independent school in London, both of whom aspire to science careers. Adapting McCall's 'intracategorical complexity' in favouring a case study approach, we present the multiplicity of our participants' relationships with exclusion and inequality, discrimination and privilege within their lived social settings, and how these relationships shape their identities and ambitions to become scientists. Our findings reveal that despite their similarities in their societally ascribed intersectional makeup, Ayesha and Hanya differ in viewing their intersections as challenges and/or opportunities. They both portray agentic control towards 'going against the grain' as future women scientists by negotiating their intersections as they develop their science identity.

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## Introduction

Brittney Cooper (2015) describes intersectionality as the 'key analytic framework through which feminist scholars in various fields talk about the structural identities of race, class, gender, and sexuality' (p. 1). The term 'intersectionality' has certainly initiated a swathe of work that has established multi-dimensional modes of analysis of Black women's life experiences (for example, by Crenshaw, 1989). This is in contrast to a 'single-axis framework' that considers and proposes, interventions considered narrowly through a single 'lens'. A tunnel-focus 'erases Black women in the conceptualisation, identification and remediation of race and sex discrimination by limiting inquiry to the experiences of otherwise-privileged members of the group' (Crenshaw, 1989, p. 140). Intersectionality, then, does not depend on a single component but thrives on a conglomeration of defining features and foci. While the term originated with Black feminists in the U.S.A., we use it here to explore the experiences of South-Asian women in the context of the U.K.

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The work we report drives down from the intersectional to personal and, in doing so, we run counter to those who argue that intersectional analysis is essentially broad and thematic, inappropriate for ‘zooming’ to the level of the individual. Collins and Bilge (2016), for example, posit intersectionality as a thematic tool of critical analysis, themes concerning (a) power, (b) relationality, (c) social context, (d) social justice, (e) complexity, and (f) social inequality. At this level, the focus tends towards ideas and ideologies; on unveiling hidden discourses on poverty, racial oppression, gender discrimination – on how intersectionality’s analytical perspectives have been adopted by scholars to a wide array of overarching social contexts (Knapp, 2005). From this perspective, intersectional analysis reflects how power struggles appear in multiple domains to create asymmetric politicised positions that disrupt and confirm institutional and organisational inequalities (Ruiz Castro & Holvino, 2016). We argue, however, that such struggles can be identified at an individual level, that social structures and institutions form part of the ‘master narratives’ of identity and, in this case, of science identity.

Though much of intersectional exploration takes place at what Chan (2017) calls the macro-system level, there have been many calls to drive this analysis down to the micro, in terms of peoples’ lives (for example, Hankivsky et al., 2017), to what Patil (2013) terms ‘domestic intersectionality’ and Avraamidou (2016) as life-history interactions. At this micro-level, intersectional analysis reveals complicated identity negotiations of being, for example, young, a woman, student, daughter, scientist, as well as how these identities interact, nest, and shift (Wells et al., 2015). Our view aligns with Jang’s (2018, p. 1275) four core premises to the theoretical foundations of intersectionality at the micro-level:

- Simultaneity – the influence of diverse social categorisations on the lives of people cannot be separated
- Multiplicity – the relationships among diverse social categorisations are multiplicative
- Power relations – diverse social categorisations constitute interlocking, mutually constructing or intersecting systems of power
- Social context – intersecting power relations vary across different social contexts.

The micro-level literature, for us, emboldens our commitment to developing a commentary on the nuances of lived experience in terms of a multiplicity of identities, the ways that intersectionality is made personal. Our particular interest lies in how young British South-Asian Muslim women from Bangladeshi and Pakistani heritage approach study and/or careers in science, understand the relationships among their social identities and how they come to perceive these relationships, and we use this as a vehicle to explore this micro-level ‘personal intersectionality’. We acknowledge that some literature is available, including that related to British South-Asians beyond India, Pakistan, and Bangladesh heritage. In this paper, however, we limit the focus to just two British participants, of Bangladeshi and Pakistani heritage.

Although not specifically directed at science education, we see Mirza’s (2018) approach to intersectionality is important for a number of reasons. First, we are inclined to voice South-Asian feminist cultures in order to reveal some British South-Asian Muslim women’s [science-oriented] experiences of privilege, negotiation, barriers, and resistance towards or against the pre-determined structural forces of gender, ethnicity, race, migration, class, and religion. Second, we mirror Mirza’s approach to capturing ‘embodied lived

experiences' of women so as to explore the tension between the demands of globalisation and 'labelled traditionalism' for these ethnic minority women. Third, we see identity formation and transformation as an ongoing process of 'being to becoming' and so use intersectional analysis not only to illuminate the extensional structural forces of inequality and perceived oppression by the society but also agentic interpretations, embodied practices, and personal choices of the minoritised women to 'resist and rename the regularity effects of discourses of education inequality and subjugation' (Mirza, 2009, p. 4).

In this paper, then, our use of intersectionality is to study individuals' science identity at the micro-level. The expression science identity itself has a wide press, in some cases drawing on psychological measures (for example, Vincent-Ruz & Schunn, 2018) or on sociological frameworks such as Bourdieu's in others (for example, Archer et al., 2015b). In general, it is seen as a composite of internalisation from personal experience and social construction with others in particular contexts (Brown, 2004). In this vein, our's is an 'ecological model' (Salehjee & Watts, 2018) that encompasses the ways a person shapes power relationship within multiple social contexts, between their 'extensional intersectional powers' (social-structures) and their 'intentional agentic core' (agency). In exploring this definition of science identity, we trade on such responses as: 'while I am a South-Asian Muslim female, I do care about scientific learning'; 'a science career is of importance to me', 'I have a personal attachment to science' and 'becoming a scientist matters to me'.

## Women and science

There is a considerable body of research on women's participation and their identity within science education. Two elements in particular – 'personal agency' and 'recognition by others' – feature in the classical work by Carlone and Johnson (2007) with fifteen successful American women-of-colour (Latinas, Africans, and Indians). These authors distinguished between 'research scientist', where the women were recognised by themselves and by others as a person of science, and 'altruistic' scientists. The latter saw themselves as scientist but 'redefined whose recognition mattered to them, and, in some cases, redefined what it meant to be a woman-of-color in science' (p. 1199). Others experienced a 'disrupted' scientist identity: women-of-colour who, despite not being recognised as a science person by others due to their underprivileged status, still survived and retained their science identity. In their later work, Carlone et al. (2015) mapped the school lives of thirteen nine-year-old girls over four years and concluded that 'larger social structures such as race, class, gender, and sexuality and classroom structures ... constrain individuals' agency to engage in untroubled and sustained science identity work' (p. 474). Carlone and Johnson's emphasis is on the 'extensional intersectional' impact on women-of-colour rather than any personal agency in their development of science identity. Indeed, they argue that 'women-of-color [are] not free to develop *any* kind of science identity' (p. 1192) [our emphasis]. Religious beliefs, too, can be added to the mix. Barnes et al. (2017) describe the travails of twenty-eight Judeo-Christian biology undergraduates in the U.S.A. These students experienced considerable 'discomfort' through teachers and peers' anti-religious comments, feelings of being seen as 'outsiders' and 'underestimated' as biologists because of their religious beliefs. Barnes et al. claim these negative experiences resulted in

intersectional tension between cultural and religious identifications, with a negative impact on these students' science identity. Similarly, some authors in the U.K.'s secondary school's context have confirmed such discomfort among Muslim students while engaging with scientific explanations of the origins of the universe and of life. For example, Hanley et al. (2014) studied four English schools focusing on students aged 14–16. They produced an engagement typology for teachers and recommended going beyond self-beliefs by appreciating how their students' religious beliefs might contradict specific science topics, resulting in students (including Muslim students from mainstream schools) resisting engagement in the classrooms. This study is important; it looks, though, at only the religious aspect of discomfort and failed to consider other intersections such as gender and ethnicity, which could also have contributed to students' lack of engagement and resistance. It highlights the fact that research on intersectionality that focusses on science and religion is very limited (Avraamidou, 2020).

Our view on this, however, is that people, even those with 'disrupted' identity find sufficient freedom and agency to develop science identity by negotiating extensional intersectional powers at a personal intentional level. Hazari et al.'s (2013) work with 7505 American college students, explored the intersections of gender, race and ethnicity on science identity formation and point out that science identity is a personal matter, 'the experience of a women-of-color is not necessarily the combined experience of being a woman and being of color – it can be unique in and of itself' (p. 84). As Francis (2001) says: 'Thankfully we are not without agency. We can choose to talk to, form relationships with, and read about the experiences of people with different material characteristics' (2001, p. 73).

There are similar bodies of work in Britain. Smith (2011), for instance, examined trends in post-compulsory science educational choices made by U.K.-based women over the last fifty years, and reported a gradual but steady increase in women's participation in science. Within this, though, there are very clear disparities. Archer and colleagues' (for example, Wong, 2012; Archer et al., 2013) decade-long work in the U.K. maps science education and career aspirations, and they report that women, especially ethnically minoritised women, seldom identify themselves as scientific. 'Recognition by others' is one clear reason given in that women (Black African/Caribbean) are not generally perceived by others as scientific, and science careers are seen for the women as less 'thinkable' within the White, male, middle-class dominant culture of science professions (Archer et al., 2015b). In her more recent work, Archer (2018) makes use of intersectionality to describe injustices among working-class British pupils aged 11–16 from five co-educational schools over one-academic year. She argues that separating out social class from other gendered and racialised extensional powers is not possible. Working-class girls of Pakistani and Bangladeshi heritage are least likely to recognise themselves as a 'sciencey person' in contrast to boys from high-income families (mainly Chinese and Indian), who are most likely to choose science after the compulsory age of science education (Homer et al., 2014).

It is difficult to discuss Archer et al.'s work without mentioning of their use of Pierre Bourdieu's sociological approach, and their coining of the term 'science capital'. Archer et al. (2015a) use this concept to understand the reproduction of social inequalities in science participation through macro-level systems. It has found its critics (for example, Jensen & Wright, 2015) who argue that adding 'science capital' to Bourdieu's existing range of concepts is distracting and unnecessary. In a similar way, adding –

say – ‘numeracy capital’ or ‘sports capital’ adds little understanding to ‘cultural capital in sports’. Our own work pulls away from this large-scale sociological overview in order to explore personal perspectives of the young people at the receiving end.

### **South-Asian Muslim women in the U.K. and science choices**

This leads to our particular interest in the multiplicity implied by the heritage, immigration, religion, gender, class, and ability of the two schoolgirls we describe in this paper, multiplicities that shape both the structural dynamics of power and inequality in social spaces and their individual identities (Collins & Bilge, 2016). Research on Pakistani and Bangladeshi women’s science education is very limited. The Social Mobility Commission (2016), for example, has noted that, ‘there is less evidence to explain differences in STEM uptake across ethnicities [...] Therefore a clear need to deepen the evidence base on these differences is required’ (p. 39). Insufficient attention, then, has been focused on the intersectionality of South-Asian Muslim female students’ affecting their educational and career aspirations.

The majority of South-Asian heritage Muslims in the U.K. are from Pakistan (43%), Bangladesh (16%), and India (8%) (Census, 2011). The Pew Research Centre (2012) reports on the importance of religion in the lives of Muslims and how Islam forms an important aspect of their identity. A number of studies (for example, Haw, 2010; Social Mobility Commission, 2016; Wagner et al., 2012) have explored the continuing inequalities, exclusion, and oppression among Muslim girls in the U.K. Recent studies describe Muslim women’s negotiation between both Eastern and Western cultures, for example, in terms of veiling (Afshar, 2008), acceptance, or rejection of parental expectations (Bhopal, 2011) and self-determination during schooling/college years (Ludhra, 2015). Meeto’s (2021) three-year-long study included nine 15/16 aged South-Asian (Afghanistan, India, Mauritius, Pakistan, and Sri Lanka) Muslim women from one British inner city secondary school and described their ‘agentic practices’ during their negotiation and shifting positions within society. According to Meeto, Muslim South-Asian women negotiate and/or shift their positionalities, values, and lifestyles on a day-to-day basis.

Pakistani and Bangladeshi Muslims constitute the youngest age profile in comparison to all other immigrant categories in the U.K. (Census, 2011). The majority of young Muslims have been born in other countries and immigrated to U.K. before the age of 16. Overall, South-Asian women are reported to pursue science careers in greater numbers (EngineeringUK, 2015) but this is still at a much slower rate than the increase in their population. Moreover, the BIC and HESA data show a greater reliance on medical and biological science-based careers than physical and chemical sciences. A fairly recent survey by the U.K.’s Business in the Community (BIC, 2015) has shown an increase in women’s aspirations towards science, with the first choice for South-Asian women being medicine: Indians (44%), Pakistanis (41%), and Bangladeshi (36%). Second came biological sciences – most popular among Bangladeshi women (32%) as compared to Pakistani (28%) and Indian (19%) women. In third place was dentistry, with similar numbers. The Higher Education Statistics Agency (HESA, 2015/2016) added veterinary science and education to this list. This imbalance is confirmed by some

U.K.-based educational studies such as Archer, Dawson, DeWitt, Seakins, and Wong (2015a) and Dawson et al. (2020).

Our work here is similar in kind to Avraamidou's (2020), who has highlighted the life of Amina, a Muslim and Kurdish-Turkish woman. Her case illustrated various stereotypes and feelings of being 'other' and an 'outgroup' while becoming a Muslim physicist. Our paper introduces two case studies of younger South-Asian Muslim women in the U.K., Ayesha and Hanya (pseudonyms), one related to neurosurgery and the other to quantum-physics. Our purpose is to zoom-in towards the particular interplay of religion (Islam) with the formation of science identity. As Mirza (2009) points out, this is a very limited area of research and one that needs increasing attention. Rather than make broad general claims, however, our approach looks to give voice to these young British South-Asian Muslim women in their aspirations to become scientists. Ayesha and Hanya struggled to be recognised as such because they are young women from working-class families, both immigrants and practicing Muslims living in a predominately White country. Therefore, we see the need to explore the power relations derived from their Muslim British Bangladeshi and Pakistani families, their schools, teachers, peers, and the socio-cultural contexts through which they engage with science.

## Research question

The discussion so far, highlights the need to voice personal experiences and agentic actions of British South-Asian Muslim women towards their educational and career ambitions instead of voicing broad general claims about South-Asian women living in the U.K. In highlighting women's agentic inclinations toward becoming future scientists while remaining in Islam and belonging to South-Asian immigrant communities, we view that intersectionality provides a platform to analyse how extensional powers shape science identity on a personal (intentional) agentic level (Salehjee & Watts, 2020). This discussion on intersectionality-as-personal moves between the major intersectional social structures and forces at play and their unique recognition by individuals as they agentially shape their science identity. Therefore, our specific research question is:

How does the 'personal intersectionality' of two British South-Asian Muslim female students' affect their educational and career aspirations?

## Methodology

### *Research design, data, and participation*

This study has aimed for an in-depth understanding of the intersections of the extensional British South-Asian Muslim young women at a personal level, employing a case study approach. A case study approach supports 'in-depth studies of a single group, culture or site and have long been associated with ... qualitative' studies (McCall, 2005, p. 57). Our research is similar to McCall's understanding of 'intracategorical complexity' in favouring a case study approach to explore intersectionality among a single group of people (such as Crenshaw's (1989) focus on Black women). As mentioned earlier, this research project involved Ayesha and Hanya, at the time of the data

collection, studying in a single-sex London school catering for National Curriculum key stages 3 and 4 (GCSE) and sixth form for ages 11–19. The school's recent (2019) score on pupil performance in up to 8 qualifications, including English, maths, and science, is almost 10% above the local authority average and nearly 13% above England's average scores. All the girls are from ethnic minority heritage, principally from Pakistan and Bangladesh. The proportion of students who speak English as an Additional Language is much higher than other schools in the same area.

Ayesha and Hanya were chosen from our previous 2014–2015 study (Salehjee, 2017) with a class of thirty twelve/thirteen-year-old Muslim girls. The sample inclusion was opportunistic because one of us (SS) was their science teacher in the school in 2015. That previous study explored girls' experiences, inclinations, and aspirations towards science education and careers based on their exposure to newly-designed science interventions for one-academic year (2014–2015) followed by semi-structured interviews in 2015. SS subsequently left the school for university work but, four years later in 2019, had the opportunity to return for a follow-up study. This return visit allowed us to interview seven of the thirty girls who, in 2015, were determined to continue with science subjects post-16, but who saw gender as a barrier to choosing A-level [pre-university] science. Returning in 2019 was important because by this time these girls were about to leave compulsory school science education. These second interviews allowed us to capture in-depth data and a fuller picture concerning both the discrimination and privilege they perceive to exist in their immediate social settings – and how these relationships shape their science identities and future science choices. Of the seven, we have chosen to present Ayesha's and Hanya's stories here because of the more meticulous articulation of their relationship with their immediate social settings and the ways they have shaped (and are shaping) their identities and ambitions to become scientists.

We employed semi-structured interviews to gather the in-depth data, using probes and spontaneous questions to deepen our understanding. For example, after a suitable preamble, our first question was: How do you identify yourself? And if the response was: 'as a person who wears a headscarf – like the other female members of my family', then our questions probed further about their perception on privileges and/or discriminations of 'religion and family' which can impact on them to continue with their studies in science education. We assured the school and the girls of full confidentiality and they were happy with the pseudonyms we assigned to them. They were interviewed individually, discussions lasting forty to fifty minutes concerning their A-level choices and career decisions. Interview conversations took place in quiet, private areas, within the school at times convenient to the girls. One-to-one interviews in a quiet space were ideal for sharing viewpoints freely free from the presence of teachers or classmates.

### ***Analytical procedures and method***

In aligning with 'intracategorical complexity' utilising a case study approach, we initially choose some socially ascribed categories to begin the study and resisted any fixed choices to the possible combinations of intersections (Christensen & Jensen, 2012). We did not investigate different social groups such as White middle-class men, but kept these different social groups as reference points through background literature. Our choice

of categories were gender, ethnicity, religion, and heritage, and were based on our prior 2014–2015 study indicating that these categories had the potential to impact the science lives and science identity of British South-Asian Muslim women. During data analysis, we actively noted how other categories intersect with our choices of categories.

One limitation in such research lies in the researchers' positionality. SS is currently a university lecturer in Scotland. She is Ayesha's and Hanya's ex-science-teacher, passionate about science education, South-Asian female and Muslim. MW is a White non-Muslim male, dedicated to extending and enriching the science education of his South-Asian Muslim students and colleagues. Therefore, the data-transcription, analysis and presentation of the data was undertaken by SS and MW individually and separately, and then cross-checked between them. We then asked an Asian female colleague to be a 'critical friend' and to evaluate/critique our analysis of the data.

A second limitation concerns the trustworthiness of intersectional data involving the distinctive nature of each of the major strands (Squires, 2007), because different intersections and power relations work differently – but not independently – at the level of personal agency (Phoenix, 2011). For example, when asking Ayesha about her career choices, she highlighted both ethnicity and gender by discussing the privileges experienced by South-Asian boys over South-Asian girls. There were many such intersecting interactions, for example explications of South-Asian families' expectations of 'obedience' from daughters; matters of age and respect; the distribution of domestic and non-domestic responsibilities; facility with English and the 'language barriers' of Bangladeshi parents; the weight of family history – Hanya's father's small mechanics shop, for example, in Kashmir. These personal details are interwoven with broader intersectional categories – not least of which is 'being multi-national Muslim daughters'. To mitigate this, we sent the full-individual-transcripts, the short cameos (as presented here) and our themes to Ayesha and Hanya for member-checking – and their thoughtful comments and amendments were then incorporated accordingly.

### *Ayesha: a future quantum physicist*

'I wonder how a Muslim girl like me can study Physics'. Ayesha is the eldest child of the family. Born in Bangladesh, her family moved to India and then, at the age of three, she moved to Portugal before arriving in England at the age of nine. Ayesha's father is a market-trader and her mother stays at home. Her parents did attend school but remember little of it and were never 'into sciences'. Despite this, Ayesha's passion for science was evident throughout her conversations.

I always wanted to become a scientist from a very young age – I think age five or six. Like, you know, my friends always used to say 'I want to become a fairy' but, for me, I could never relate myself to that [being a fairy]. During my childhood in Portugal, I didn't see a lot of children's films and stuff like that, it could be because I was more heavily into sciences and used to think more about the world around me rather than thinking about unnatural fairies. I remember when I was in playgroup, I started looking at things and started questioning like 'Why is this? Why is that?' And I think this is how science started to grow on me. And when I came to England I went into a primary school where I was taught some science. And I just got fascinated because it was linking with my thoughts I had previously.

Over time she has expressed strong feelings towards, initially, becoming a physicist then growing more precise towards becoming a quantum physicist. From our second



conversation, at age sixteen, Ayesha imagines that the major hindrance to becoming a quantum physicist is if society does not accept her as a physicist.

### *Hanya: a future neuro-surgeon*

Hanya is the second child in the family. Born in the Netherlands, she moved to the U.K. at the age of five. Her parents were born and lived in Pakistan for twenty-five years before moving to the Netherlands and then to England. Her mother did not attend college and studied very little science at school – she currently has home duties. Her father studied science and maths at the age of eighteen and then worked in his father's mechanics shop in Pakistan. He is now a businessman and runs an automobile company in London. At age eleven, Hanya was very anti-science but, over the following years, her perceptions changed. This transformation was, in part, due to a number of school science-based activities, such as 'girly kinds of stories', writing poetry linked to science and attending a STEM course at a London university. A pivotal point came at the age twelve after watching the film *'Inside Out'*. From that time onwards she has focused on achieving good examination grades and choosing science subjects for A-level study.

Yes, I do see myself as a science person. It's because it is one of the subjects that I enjoy most – now. I think it [science] is very interesting because you always learn new stuff, it just never stops, there's always something to discover. Well, this interest originated in Year Eight. I remember watching *'Inside Out'* film on Riley – a girl like us – and then talking about it in terms of the brain, senses and misconceptions about learning. I really think that my interest started from watching that film, and mainly by having a discussion about it in the classroom. And I just become more interested in it as the time goes by. Before that, I was not interested at all. Now, I am so much more interested in it than learning other GCSE science topics ... I'd like to go into brain studies in future so I do [read about] this in my own time.

She had also expressed strong inclination toward studying English and law, inclinations that have also been present over the four years. What has changed, however, is her current emphasis on biology and chemistry for A-level study. From our second set of conversations, Hanya believes the major deterrent to becoming a neurosurgeon would be examination grades.

Now we present our findings under the five themes exhibiting intersections of heritage, religion, gender, and class.

### *Being multinational*

Both girls are confident that being British citizens will have a positive impact on their education and professional choices. Ayesha identifies herself as British because she has lived in the U.K. for some time and through her acceptance of what she calls 'British values':

Ayesha: I moved from Bangladesh to India, then to Portugal and then I came here. So as a British girl I say that I have lived in England enough to know what British values are, and I have incorporated them in my life, you know, like I will show tolerance to people because obviously I want the same thing back from them ... On the whole, I believe I have opportunities as a British citizen to study what I like – much more than my parents did, who grew up in Bangladesh.

She also mentioned that being South-Asian is simultaneously a privilege and a challenge:

Ayesha: I don't think that my South-Asian identification will hinder me from going to university because in universities there are lots of Asians and there are lots of Pakistani/Bangladeshi transfer students. Their parents are rich, though, and this is the reason they're able to study in the UK. I believe I will be an outcast [among these students]. But then I will be all right with them because they will be Asians.

Hanya did not mention her immigrant status at this point, possibly because she came to England even before attending pre-school. In a previous conversation she did talk about visiting Pakistan during her summer-holidays and mentioned that her cousins there see her as 'very different' – which Hanya attributes to her fluency in English, and 'posh' accent – 'nothing else'.

Hanya: I have British identification in terms of a passport. I see myself as a student who studies in Britain. So, it won't bother me as I have a British passport and all the rights as any other British girl. However, as I said before, some might see me as an outsider – maybe my appearance worries some.

Hanya was conscious of her appearance because she wears a hijab, headscarf worn by Muslim women in public – therefore intersecting heritage with religion.

### *Being young multinational Muslim women*

Both girls take religion seriously in their lives – religious identities that seldom conflict, they say, with their science lives. Ayesha's determination to study science transcended such barriers – she would, she said, quietly and safely observe her religion regardless of any counter opinions. Hanya, on the other hand, seemed more determined to present herself as a Muslim in out-of-school formal science spaces.

Interviewer: How might your religion impact on your study of science?

Ayesha: Obviously I'm very religious because I go to a religious institute. So, as a Muslim, I think I'm okay. I have a lot of determination towards science-based future studies ... I know who I am and so I know what is good for me – or I will certainly find a way!

Hanya: I especially liked the Brunel University course we did. At first, I was not going but my teacher persuaded me. The good part of it is, when I went there, I really enjoyed it – we were the only two Muslim girls there – and I feel that I actually have to put myself forward to grasp these opportunities. It felt good to represent us as Muslim women doing science. There were not even other girls in the sessions. You just have to push for it; you can't just wait around for the opportunities to come out for you ... I see myself as a Muslim girl, who wears hijab and who follows Deen [complying with Islamic law, beliefs, character and deeds], who wants to learn, seek knowledge [through the Quran] and do well so that I can make Allah satisfied with me. I think a Muslim girl gets fewer opportunities but – like I said before – you just have to strive for these opportunities, you can't wait for them to come to you.

Ayesha also mentioned that she would be seen as a Muslim girl wearing a hijab (Avraamidou (2020)), possibly putting herself at a subordinate level compared to Muslim boys, and discriminated against by others:

Ayesha: I have British values and morals, but some people don't see that. It could be possible that people won't accept me as a British girl. I would then need to be modest and show them that I'm not what they think I am, and the stereotypes are wrong. In today's society it seems like we have to continuously prove ourselves to be worthy of something because we are seen as outsiders to some people. And I think because of what is happening in the news and in society, we Muslims especially Muslim girls, are discriminated against because Muslim South-Asian men might be seen as a Christian, Hindu or Sikh – you cannot [instantly] see differences in them. But Muslim girls wear headscarves and, because of that, people can easily identify them as Muslims.

### *Being multinational Muslim daughters*

Contemporary families may not map directly onto 'households', families are often spread between different houses, or all live under one roof. In transnational families, family members commonly live dispersed among households that are, quite possibly, situated within two or more nation-states.

Interviewer: Tell me about being a daughter and your family [science] conversations.

Ayesha: As a daughter I'm quite caring – and I can say that for certain because I do a lot for my parents. I am the oldest daughter and I have to do certain things – my parents immigrated to England and so I have to do paperwork, talk to solicitors and do some local council work for them. I believe that, because of this experience, I've grown as a person. I don't think other girls have to do this stuff at my age, but I do it and I'm grateful for that. In relation to science, my parents talk like I should become a dentist or an optician. I guess Asian parents always want their daughters to do something very professional like becoming a doctor, and their sons to be engineers or businessmen. My parents are quite strict, obviously, because they are Asians – and they do want me to get into dentistry. But I will have my own say on that!

Archer et al. (2013) point to the discrimination among parents in seeing some sciences as inherently masculine. Ayesha is an obedient and caring daughter and is only mildly critical of her parents, she realises that, compared to 'elite White parents', they are unaware of the depth and breadth of other sciences. She says:

Ayesha: My parents want me to become a dentist like my cousin Saira. But my role-model is someone like Einstein or any other physicist. Which is kind-of sad because I know that for a British White girl, if their parents are doctors or engineers, then their children can become scientists or whatever they like to become. But in my family, my parents are not in the field of science so I don't have someone to talk to about quantum physics.

Like Ayesha, Hanya portrays herself as an obedient daughter (Ludhra, 2015) but at the same time has strong agentic control (Salehjee & Watts, 2020) in becoming a surgeon, rather than what her father choice of career for her:

Hanya: I see myself as a responsible child of the family, and I also see myself as someone who can make my family happy through helping my siblings. At home my Abba [father] talks about engines and about his work [at an automobile company], but it never interests me. When we are sitting down, he talks about how he learnt about motors through his experiences in working in his father's small mechanics

shop in Kashmir, and sometimes he talks about university options in [mechanical] engineering. My brother gets involved in this because he is interested, but I get bored very quickly. If I get very good grades in physics – which I don't think I will – and if my father says that I should carry on doing physics at A-level, then I will consider this. But I don't think I will carry on with it later [at university]. Instead, I will ... work towards becoming a surgeon. This would not be exactly following where my father's interest is, but ...

In this respect, and compared to Ayesha's parents, Hanya's father offers more space for her to choose her education and profession. With Einstein as her role-model, Ayesha might 'go against the grain' and challenge her parental professional preferences but, at this moment, that rebellion seems to be limited. The intersectional dimension for Ayesha, of having Bangladeshi parents unfamiliar with science, is evidently a barrier. Hanya, on the other hand, seems more determined to challenge her father's ideas.

### *Being working-class multinational Muslim daughters*

At this point, Ayesha's religious values intersect with her working-class family life. While she needs money to go to university, she is adamantly against taking a bank loan and paying interest (De Gayardon et al., 2019). Again, her determination to go to university makes her think of other possible ways to achieve this. She recognises the dilemma – the extra hard work she might have – including paying bank interest contrary to her religious values.

Interviewer: How does being from a working-class family impact on your future science education and career plans?

Ayesha: Because my parents earn a certain wage, I may or may not be able to go to university, because of the fees. Obviously, because I'm Muslim, I have my own principles of not paying bank interest – but then I might have to because my parents can't afford it. Or I have to struggle with my parent's money and do some extra work shifts to go to university – so that I don't take interest to pay my university fees. I will be really struggling to get the knowledge that I want!

Hanya, on the other hand, takes her working-class identity as a positive trigger to repay her parent's sacrifices to give her numerous opportunities in life (Victor & Zubair, 2015). She clearly intersects religion and family elements with her class identification – intersecting, too, with her science identity – in a positive way:

Hanya: [Being from a working-class family] motivates me because, if you think ten years ago, my parents were still in Pakistan and didn't have opportunities [as] I do. My mum didn't get to go to college and my father had to work very hard in this country [England]. They have expectations of me like all parents of immigrants have when they come here, and their children must study hard and get good jobs like any other British person. They have done so much for me; it not only motivates me but I also understand I have so many opportunities over here. Obviously, I don't want to let them down and want to prove that I can be productive – as a Muslim Pakistani woman.

### *Being talented working-class multinational Muslim peers*

Both the girls were confident about their scientific ability, of seeing themselves as ‘sciencey’.

Interviewer: Do your peers/friends see you as a ‘sciencey’ person?

Ayesha: Well, I see myself as a sciencey person. Science has always been part of me because I love science a lot. I think science is the only subject that I get excited about. But I sometimes feel that my classmates ruin it – I remember once I was talking about quantum physics and a few of them got frustrated with me [saying] ‘always talking about it all the time’. It’s not that they don’t want to do science, they just don’t want to get so much into science in the way I do, like I want to go deeper in science, but they don’t.

Hanya: Yes, they do. I feel sciencey myself, I am comfortable with it; as I am comfortable talking about general scientific issues with my school friends, and that automatically makes them see me as a sciencey person.

Ayesha is a confident and able science student in her class, she prefers doing what she wants to do – make meaning of her life through the lens of science, especially physics (Archer et al., 2017) – despite her classmates. Hanya, on the other hand, is pleased that her peers view her as a ‘crazy’ (determined) sciencey person.

From these descriptions, they both exhibit considerable agentic control of their aspirations. While some reports describe young British Pakistani and Bangladeshi Muslim women as having high aspirations but low achievements (Department for Children, Schools and Families, 2008). In the initial interviews in 2015, both girls believed that being British South-Asian women would not hinder their future science education and/or professional choices because of the multi-heritage city (London) in which they live. Lately, though, they do recognise some of the challenges they might encounter at university (Ayesha – finance; Hanya – being seen as an ‘outsider’). Despite this, both seemed ‘agentially’ determined to become scientists.

### **Intersectionality is personal**

Giordano (2017) calls for an ‘expansion of access to a kind of [science] knowledge that is traditionally kept out of the hands of marginalized groups’ (p. 18). In this paper, we have taken an intersectionality approach to science identity, using it as an exploratory framework to explore the science lives of Ayesha and Hanya. We have sought to shed light on the multiplicity of their relationships with power and inequality within social settings and how this shapes their science identities. Our interview questions were designed to discuss extensional powers (gender, religion, class, heritage) and the girls responded by discussing the impact of these powers in their lives – not least in how these interact and intertwine to form the basis of their science identity development.

We see the process of identity making, then, as a dynamic, contextual, and relational process (Sang et al., 2013; Sluss & Ashforth, 2007). In revisiting Jang’s (2018) points from earlier, we have made a point of discussing the simultaneous influences of diverse social categorisations on Ayesha and Hanya’s lives as talented working-class multinational young Muslim women in the context of science education within the U.K. We see (as they do) their relationships among such diverse social categorisations as multiplicative, it is simply not possible to pull a single thread of their lives for discussion separate

from all of the others. Diverse social categorisations certainly constitute interlocking, mutually constructing, and intersecting systems of power in their lives – being young women, daughters, school students, religious adherents and members of peer groups all bring the impact of associated social systems. Finally, it is certainly the case that intersecting power relations vary across different social contexts and both young women recognise, for example, the particularities of studying within British schools and culture. In this way, our findings resemble to Crenshaw's (1989) ideas of multiple grounds of identity formation, as:

- (i) While both girls see themselves as British, they understand the possibilities of being viewed as outsiders because of being immigrants (Ayesha), their working-class status (Hanya) and being Muslim girls – through wearing hijabs (both). They want to grasp opportunities as young Muslim women and not waiting for a 'push' from others (family and teachers)
- (ii) While both seemed intent on re-paying the struggles endured by their parents' migration to the U.K., they were also willing to counter their South-Asian parental wishes that align with gender-based professional choices. For both, being multinational immigrants provides an opportunity to achieve better science-based careers than was available to their parents
- (iii) Both will seek ways to meet the financial struggles of university studies, despite Islamic prohibitions on bank interest (Ayesha), and any overt discrimination through wearing a hijab.

These findings allowed us to voice women's agentic inclination of becoming scientists along with remaining in Islam and belong to South-Asian communities and appreciating parental sacrifices as an immigrant but also negotiating to go with/without their parental wishes and to other extensional intersectional – forces impacting their sense of personal agency. Needless to say, each role and relationship illustrates additional complexities that rely upon context, responsibilities, expectations, obstacles, and opportunities in developing a science identity.

These findings acknowledge that intersectional approaches to science identity development of these young women are unique. They are quite similar in many ways and yet very different. Being South-Asian Muslim from a working-class and immigrant background, they tend to take these social obstacles as opportunities and/or as a challenge rather than multiple-jeopardies; to shape them according to their intentional agency. That said, their responses to extensional intersectional powers differ, as well as the way they negotiate their intersections with these powers as they develop their science identity.

Rossi in her article 'Women in science: Why so few?' questioned the shortage of female scientists in academic careers (1965, p. 1196). Nearly fifty years later, scholars still pose the same question. The kind of research we describe here invites educators and education policy makers to invest time and funding in equipping parents, teachers, schools, and students from diverse backgrounds to acknowledge and strengthen the agentic control of women towards education and careers 'from' and 'in' science categories (Wong, 2015). This articulation of identity development is not the end but rather an invitation for further development. As Carbadó et al. (2013) maintain, theory – including

intersectionality ‘is never done, nor exhausted by its prior articulations or movements; it is always already an analysis-in-progress’ (p. 304). We believe that, in taking this approach, of viewing intersectionality from the eyes of the racially minoritised women, science education will benefit – such a theoretical framework raises awareness of the issues and insights of neglected groups of young women, acknowledges and highlights their science lives. That is, intersectionality made personal.

## Disclosure statement

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