Chapter 6
Science Aspirations and Gender Identity: Lessons from the ASPIRES Project

Louise Archer and Jennifer DeWitt

Theoretical Approach

Our approach draws on feminist poststructuralist theorizations of identity (e.g. Archer and Francis 2007) and Judith Butler's (1990, 1993) theorizations of gender as 'performance'. Our conceptual framework understands identity as non-essentialised – identity is not 'fixed' or ever 'achieved' (Anthias 2001), rather it is fluid, contested and produced through discourse (Burman and Parker 1993; Gee 1996). That is, identities are constantly developing – they are always' in process' (Hall 1990: 222). We see gender as intersecting with, and mediated by, other aspects of identity, such as 'race'/ethnicity and social class (Archer and Francis 2007; Calabrese Barton and Brickhouse 2006). In this way, identities can be understood as social products, produced within and through discourse and social relations: they are 'real fictions' that are constructed through social life and relations of power (Foucault 1978; Weeks 1981).

Butler's work (e.g. 1990, 1993) has been particularly influential within gender theory, especially her conceptualisation of gender as performative. From this perspective, gender is not the inevitable 'result' or product of a person's sex – it does not emanate 'naturally' from particular (sexed, racialised, classed) bodies. Rather, gender is socially constructed and produced through discursive and bodily 'acts'. Gender is, therefore, not something you 'are' or 'have' – it is something that you 'do' (perform) and continually re-do. Gender identities are powerful illusions (Butler 1990: 185/6) in that they appear 'real' and enduring but the patterned and

L. Archer (✉) • J. DeWitt
Department of Education and Professional Studies, King's College London, Waterloo Bridge Wing, Franklin-Wilkins Building, Waterloo Road, London SE1 9NH, UK
e-mail: louise.archer@kcl.ac.uk

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predictable nature of gender identities is achieved through the repetitive nature of their continual enactment (Renold 2005). In other words, gender is created through a myriad of verbal and bodily performances in which children 'do girl' (or 'do boy') (Butler 1990: 185–6).

We also use Butler's concept of 'intelligibility' to understand the context within which children and adults produce gender identities and the social pressures that they experience to perform particular (normative, socially sanctioned) identities:

> "Intelligible" genders are those which in some sense institute and maintain relations of coherence and continuity among sex, gender, sexual practice, and desire. (Butler 1990: 23)

Consequently, Butler argues, some gender performances are rendered 'unintelligible' (i.e. those which are more subversive or counter-hegemonic). That is, 'the cultural matrix through which gender identity has become intelligible requires that certain kinds of "identities" cannot "exist"' (Butler 1990: 24). For instance, sociological research has shown how children still in primary school can experience considerable pressures to perform particular heterosexualised versions of masculinity and femininity (Renold 2005).

The ASPIRES Study

The ASPIRES project is funded by the UK's Economic and Social Research Council as part of its Targeted Initiative on Science and Mathematics Education (TISME). The study is a 5-year, longitudinal exploration of science aspirations and career choice among 10–14 year olds in England. It comprises a quantitative online survey that was administered to a sample of over 9,000, 10/11 year-old students in the first phase (students will be tracked and surveyed again in subsequent phases at ages 12 and 14) and in-depth, repeat interviews with pupils (at age 10/11; age 12/13 and age 13/14) and their parents (who are interviewed twice, once when their children are age 10/11 and again at age 13/14). This chapter is primarily based on analysis of the Phase 1 qualitative dataset, which comprises 170 interviews with 78 parents and 92 children age 10/11 (Year 6), drawn from 11 schools in England. At points throughout the paper contextual information is provided from the survey as a means for framing the qualitative data analysis, although full details of the survey and its methods, analyses and findings are discussed in separate publications (DeWitt et al. 2010, 2011). In this chapter we focus particularly on data from the girls (see Archer et al. 2010a, b, 2014 for discussion of masculinity and boys).

The students and parents who were interviewed were recruited from 11 primary schools in England (one in the Midlands, two in the Eastern region, two in the South East, four in London and one in the South), which were sampled from

the 279 schools that responded to the Phase 1 survey as part of the wider study.[1] A sampling frame was constructed to represent six target categories of school (e.g. 'multiethnic urban/inner city schools'; 'working-class suburban'; 'predominantly white, middle-class suburban schools'; 'independent single sex') to ensure a range of school contexts and populations and prospective schools were purposively sampled from within these target categories. Nine of the schools were state funded primaries and two were private/independent schools (ie. Fee-paying schools, typically attended by high SES students). Students came from a broad range of socioeconomic classes and ethnic backgrounds.[2]

Following extensive reviews of literature from relevant work within the fields of science education and sociology of education, two topic guides (for use with children and parents) were developed and piloted. The children's interviews covered areas such as: aspirations (and sources of these aspirations); interests in school and out; what they like/dislike about school; attitudes towards and engagement in school science; broader perceptions of science. Parental interviews focused on: family context; perceptions and experience of the child's schooling; involvement in education; child's personality and interests; their child's aspirations, their own perceptions of and relationship with science and engineering, including their thoughts about why so few children pursue science post-16.

Interviews were conducted by four of the research team (Louise Archer, Jennifer DeWitt, Beatrice Willis and Billy Wong), with the majority of the interviews being conducted by the second author. Of the interviewers, three [LA, JD and BW] are White middle-class women (with English, American and French national backgrounds, respectively) and one [Billy] is a British-Chinese male PhD student. Interviewees were invited to choose their own pseudonyms, hence the majority of pseudonyms cited in this paper reflect the personal choices of interviewees.

All interviews were digitally audio-recorded and transcribed. In line with the study's conceptual approach outlined earlier, data were analysed using an analysis of discourse approach (Burman and Parker 1993). Initial coding and sorting of the

[1] 9319 Year 6 students from 279 schools (248 state schools; 31 independent schools) completed the Phase 1 questionnaire between October and December 2009. (The Phase 2 survey took place in autumn 2011 and phase 3 will occur in winter/spring 2013.) The sample represented all regions of the country and was roughly proportional to the overall national distribution of schools in England by attainment and proportion of students eligible for free school meals. Of the students who completed the survey there were: 51 % boys, 49 % girls; 846 (9 %) in private schools, 8,473 (91 %) in state schools; 75 % White, 9 % Asian (Indian, Pakistani, Bangladeshi heritage), 8 % Black (Black African, Black Caribbean), 1 % Far Eastern, 8 % mixed or other. The survey itself covered topics such as: aspirations in science; attitudes towards school science; self-concept in science; images of scientists; participation in science-related activities outside of school; parental expectations; parental school involvement; parental attitudes towards science; and peer attitudes towards school and towards school science.

[2] Social class categorisations were assigned by the lead author and second author using the NS-SEC (an official UK government classification system for socio-economic status) as a guide to categorise parental occupations. Ethnicity was assigned based on self/parental reported ethnic background.

data (on key topic areas, themes and by responses to particular questions) was undertaken by two researchers (LA and BW) using the NVivo software package, with the lead author providing a check on reliability of coded extracts for the specified codes. The lead author then searched coded extracts to identify discursive gender repertoires and patterns of aspirations/relationships with science, which were then tested and refined through successive phases of coding and analysis, iteratively testing emergent themes across the data set to establish "strength" and prevalence (Miles and Huberman 1994). In line with the stated conceptual framework, the lead author then developed and tested theoretically informed hypotheses to see if they were supported or challenged by the data, for instance to identify interplays of power and practices of power and gendered discourses within respondents' talk. Draft analyses were then fed back to other team members (especially those who conducted fieldwork) for checking against their readings of the data.

Masculinity, Femininity and Science Aspirations

Our survey of over 9,000 10 and 11 year-olds indicated that the majority (over 70 %) of children reported enjoying science, held positive views of scientists, took part in science-related activities in their spare time and felt that their parents valued science. However, a much smaller proportion (under 17 %) aspired to careers in science, suggesting a disconnect between children's interest in 'doing' science (at school and in their spare time) and 'being' a scientist (Archer et al. 2010a). We found no notable gender difference among the 648 children in the survey sample who were classified as 'uninterested in science' (i.e. there were roughly equal proportions of boys and girls who recorded the lowest scores on all the five science aspirations items on our questionnaire), but notably fewer girls (n = 92, 37 %) than boys (n = 159, 63 %) were classified as being 'science keen' (n = 251[3]) (i.e. those scoring very highly on all five science aspirations items). We were interested, therefore, to explore why girls seem less likely than boys to aspire to careers in/from science at age 10/11, even though both genders generally enjoy science at school at this age – and what makes some girls develop science aspirations but not others?

Which Girls Have Science Aspirations?

Our data suggests that children from 'middle-class' backgrounds are more likely to develop and sustain science aspirations which, as we discuss elsewhere, reflects differences and interactions between family practices, values and science

[3] i.e. 3 % of boys and 2 % of the girls are 'science keen'.

capital[4] (Archer et al. 2012a). For instance, of the 92 'science-keen' girls who completed the survey, only 11 % (n = 10) were classified as having very low/low cultural capital (cf. 25 % of the total sample with very/low cultural capital) whereas 60 % (n = 55) of science keen girls had high or very high cultural capital (cf. 41 % of the total sample with very/high cultural capital).[5] This suggests a link between family cultural capital and the likelihood of a child developing science aspirations. Likewise, in the interview sample, the majority of girls expressing science aspirations were from (upper and lower) middle-class backgrounds,[6] suggesting a class bias in terms of who tends to see science careers as potentially 'for me', irrespective of the majority of children's reported general interest and enjoyment of science both in school and out. Although the 'science aspirant' boys we interviewed came from a range of ethnic and social class backgrounds, it was striking that there was only one clearly working-class girl (Georgia) among our science-aspirant girl interviewees (the others were from upper and lower middle-class backgrounds). Given that science-aspirant girls are proportionally 'over-represented' within the interview sample (as compared to the survey), we found this class imbalance particularly striking.

Of the 55 girls in the interview sample, 17 expressed science aspirations; 13 identified science-related aspirations and 25 expressed aspirations unrelated to science. As we discuss below, the development of girls' science aspirations (or not) seems to be influenced by two dominant popular discourses, namely public perceptions of science as 'clever' and as 'masculine'. These associations were evident within the rationales given by those girls who did not see science careers as 'for me' *and* were prominent in the identity work undertaken by those girls who did aspire to careers in science, with the latter going to considerable lengths to navigate a way through dominant associations so as to present themselves as 'normal' girls.

[4] Science capital is defined as the material and cultural science-related resources that a family may be able to draw on, such as science-related qualifications, knowledge, understanding ('scientific literacy') and social contacts (see Archer et al. 2013a, b, 2014).

[5] Due to the problems in getting children age 10/11 to self-report their parental occupations in order to enable a more accurate assignment of social class, we also used items designed to ascertain measures of 'cultural capital', to provide a rough and ready indication of social class (see DeWitt et al. 2012). In the whole sample, 25 % of children were classified as having low or very low cultural capital and 41 % as having high or very high cultural capital.

[6] In the interview sample there were proportionally more students from upper and lower middle-class backgrounds than from working-class backgrounds, so to an extent this is a reflection of the sample – yet the imbalance is clearly reflected in that just one of the science aspirant girls was from a working-class background as compared to the over-representation of working-class girls among those classified as having no science aspirations (see Archer et al. (2013a, b) for discussion of data from girls with no science aspirations).

The Popular Discourse of Science as 'Clever'

The first, and most prevalent, theme noted within both interview and survey samples was the association of science with '***cleverness***'. Over 81 % of the 9,000+ survey sample agreed or strongly agreed that 'scientists are brainy' and an association of science with 'cleverness' was evident among both parent and child interviewees – including those who personally identified and those who disidentified with science. Although a principal component analysis[7] of the survey items suggests that perceptions of cleverness/braininess were viewed largely as positive attributes (being related to positive views of scientists rather than pejorative views), as we argue elsewhere (DeWitt et al. 2012), these close associations between science/scientists and cleverness/braininess may also contribute to many children's views of science and science careers as unusual, exceptional and 'not for me'.

The girls in our interview sample who held science aspirations all self-identified as, and were identified by their parents, as 'clever', 'bright' high academic achievers. For instance, PJ said 'I like studying' and Preeti explained how 'I'm very interested in science and science lessons in school and er I get some high grades in my science test'. Likewise, Thalia's father explained how his daughter is a 'high achiever' across all subject areas, a view similarly expressed by other parents. These girls tended to be part of academically achieving, like-minded friendship groups. As Luna's mother (Stella) similarly explained "there's a group of them that are all quite clever [. . .] they're all quite similar actually".

In contrast, those girls who did not hold science aspirations were more likely to describe themselves (and be described by their parents) as either 'middling' or 'not clever' pupils. For instance, when asked by the interviewer "who is into science?", Louise (a white, working-class girl who expressed some of the most resistant views of science in our interview sample) replied "Well the clever ones are. Like the ones that are going to the grammar school are into like every subject. . .. They don't mind having lessons'. She continued 'its just strange how all the clever ones are into science'. Likewise, Victoria2 (white Eastern European, working class, Metropolitan School) gave her reasons for not wanting to become a scientist as "cos most scientists are brainy and I don't want to be brainy". Interestingly Victoria2 did like some areas of science (notably animals and biology) but did not enjoy what she called 'the normal subject' of science. Despite her resistance to being 'brainy' she also held some more general, positive views of science, describing it as 'awesome' – suggesting a disconnect between her interest and respect for (some areas of) science and her view of herself as a learner and the capacity to see herself as a 'science person'. Flower (White, Eastern European, working class, Metropolitan School) also agreed that you have to be clever to be

[7] Principal component analysis is a way of measuring which items in a survey group together (are responded to in similar ways) and therefore suggest factors or components that underlie responses to survey items.

into science and was adamant that personally she would not want to follow a science career "because I'm not that smart". Likewise, Celina (white, working class, Metropolitan School) described those who are 'really into science' as "brainiacs, because they just want to do Science, they don't want to do anything else in their life".

We therefore suggest that the popular societal association of science with 'cleverness' means that science aspirations are not experienced as viable or appropriate for all students. That is, children who do not self-identify (and who are not recognised by others) as 'clever' and academically successful, may be less likely to see science aspirations as being 'for me'. We found that even where parents attempted to encourage their daughters' science interests and challenged stereotypes of science as being 'geeky' or 'for boys', they still unwittingly associated science with 'cleverness'. A particularly clear example of this is provided by the case of Danielle and her mother, Sandra. Danielle describes herself as a 'middle' student, a view that her mother, Sandra, concurs with ("Um, I think she's more of a middle of the range child. There's nothing really that she excels in"). Danielle has various interests, one of which is science, which she claims is one of her favourites lessons ("I'm not being a kiss-up[8] but my favourite lesson is actually science"). Sandra strongly supports her daughter's science interests and Danielle's father works as a mechanical engineer. Yet, science aspirations are unthinkable for Danielle, who feels "I'm not clever enough to be good at science". As Sandra explained:

Sandra: Yeah, that's what she said to me. I said why? She said oh, you have to be really clever, you have to be a geek.
Int: Mmm, how did you respond?
Sandra: [I said] 'What do you mean, what do you mean you have to be really clever and be a geek?' She said 'well, you do don't you? Everybody sees it. You have to . . . you see it on TV and [scientist character], she's a geek, no friends, got glasses'. [. . .] She said 'well, you have to be really clever and I'm not'. I said you are clever. You could do anything you want.

We suggest that the above example illustrates a disconnect between Danielle's construction of science (as 'clever') and her own self-concept as a 'middling' pupil – and that this contributes to preventing Danielle from perceiving science aspirations as 'for me'. This is likely to be the case for many 'average' pupils. In other words, the powerful popular association of science with 'cleverness' (and its perception as being a highly academic subject) means that identifying with science (seeing oneself as a potential 'science person') requires that students take up (and are recognized by others as embodying) a 'good student' identity

[8] 'kiss up' means to falsely flatter or in this case, to express a false opinion in order to gain favour with the interviewer.

(Carlone and Johnson 2007). Existing research suggests that this can be more difficult for working-class learners, girls and those from some minority ethnic backgrounds, due to dominant educational discourses that construct the 'ideal learner' as white, male and middle-class (Archer 2008). Moreover, the popular association of science with cleverness constructs science as an exclusive, distinct and exceptional field – something that is for the 'clever' few, and is not seen as 'for me' by the majority of students.

Science as a 'Boy Thing'/Science as 'Not Girly'

A second key theme to emerge from the wider interviews and survey responses was the discourse of science as masculine ('for boys'). This finding chimes with existing literature (e.g. Boaler 1997; Hughes 2001; Lightbody and Durndell 1996; Mendick 2006; Walkerdine 1990), which discusses how science (especially the physical sciences) and mathematics tend to be associated with masculinity. Although this view was not expressed unanimously (e.g. eight girls and six boys in the interview sample suggested that girls might be more interested in science and many children felt there were no gender differences in terms of interest in science), its purchase as a popular discourse was noted by children and parents alike. Over half of parents described science careers as predominantly masculine (although views differed as to whether this is due to 'biological' differences or social inequalities). We also found that those girls who were very keen on science and who held science aspirations tended to recognize that their interests were not shared by most of their female peers. That is, whether or not they personally subscribed to the view, there was a prevalent recognition among parents and children that science is popularly seen as not 'girly'.

As discussed in Archer et al. (2012b), the 17 girls in our interview sample who expressed science-related aspirations engaged in considerable identity work to 'balance' or accommodate their so-called 'masculine' science aspirations with wider popular discourses of science as 'clever' and 'masculine'. We found that they achieved this in one of two main ways – drawing on identity discourses of either the 'feminine scientist' or the 'bluestocking[9] scientist'. The 'feminine scientist' girls tended to balance their 'masculine' science engagement and aspirations

[9] The term 'Bluestocking' was originally a derisory term applied in eighteenth century England to denote women with scholarly and intellectual interests, but is currently popularly used to denote academic women. The term is used here as a (non-derisory)shorthand to capture and foreground the academic and 'non-girly' nature of these girls' identity performances and their lack of interest in performing more 'popular' hetero-normative femininities. Like Renold's (2005) 'square-girls' who are 'high-achieving, hard-working, rule-following and lacked any interest in popular fashion or 'boys' either as friends or boyfriends' (p. 64), the 'Bluestocking' girls in our study constructed themselves (and were described by their parents) as 'non-girly' and preoccupied with academic success.

with performances of popular femininity (as displayed, for instance, through their interests in fashion, clothes, popular music, sports and so on). Their parents placed particular emphasis on, and were evidently proud of, their daughters' ability to perform these 'balanced' identities that enabled their daughters to be recognised as both clever/liking science *and* popularly accepted as 'normal' girls. Indeed, these girls appeared to be popular and sociable class members. In contrast, the 'blue-stocking' girls foregrounded their academic, 'clever' identities and tended to explicitly define themselves as 'not girly'. While also enjoying a range of interests and by no means being unpopular, these girls were more likely to risk being seen as 'geeks' at school and were more likely to define themselves as quiet and report experiences of being bullied.

As discussed in Archer et al. (2013b), the 25 girls who did not aspire to science careers expressed a range of aspirations (often holding more than one aspiration at a time), but their ambitions tended to coalesce around traditionally gendered careers in the fields of (i) nurturing/caring professions, (ii) expressive/artistic/glamorous jobs and (iii) sports/active jobs (although other areas such as law, business and the police were also mentioned). In line with the findings from wider research on children's aspirations (e.g. Francis 2000), these girls were primarily motivated by vocational concerns (e.g. 'to help others'). As Francis & Skelton (2005) discusses, notions of care (of others and of the self) are integral to 'traditional' (dominant) constructions of femininity and tend not to be voiced by boys to the same extent. The girls' aspirations also revealed high levels of interest in the body and appearance (e.g. aspirations for 'glamorous' and/or jobs in the beauty industry), which similarly resonate with dominant discourses of hetero-femininity (Renold 2005), and intersect with classed discourses (e.g. see Skeggs 1997, 2003).

We suggest that the disconnect between these girls' investments in 'gender traditional' performances of femininity and dominant discursive associations between science and masculinity meant that even those girls who are interested in science could find it difficult to occupy science spaces comfortably–both symbolically and in terms of actual experiences and that this inevitably led them to seeing science as 'not for me'. For example, Sandra described how her daughter, Danielle, had stopped attending an after-school science club because "it was all boys" and how this had impacted on Danielle's perception that science is "a boy thing":

Sandra: I said why can't you do science? She [Danielle] said well, 'oh no it's a boy thing'. And I said 'it's not'. They had [science club name] at school. It's an after school club on Monday and she said 'I'm not going because it's all boys'. You can see what I mean when you're fighting against it aren't you? I said 'well you should at least go along and see if you enjoy it. It's all these experiments' and she said 'oh, it's fun, we did all this' . . .

Int: Sorry, is she going to this science after school club?

Sandra: She went twice [Int: She went twice] and then she stopped going because it was all boys and she had no girls to talk to.

We suggest that the above extract illustrates how 'liking science' is not enough to enable many girls to see science aspirations as 'for me' since the popular discursive alignment of science with masculinity mitigates in numerous ways against the development of an understanding or experience of how science aspirations might 'fit' with girls' everyday performances of femininity.

Conclusions

We suggest that the development and cultivation of science aspirations requires girls to engage in considerable identity work, not least to navigate dominant associations of science with 'cleverness' and masculinity, which construct science as an elite field which is only open to women within certain narrow parameters. That is, girls have to identify with, and be able to occupy, a 'clever' learner identity *and* negotiate a socially acceptable performance of femininity that can balance their engagement with the aspects of science that are perceived to be 'masculine' (and masculine notions of 'achievement') if science is to be a 'thinkable' aspiration. We suggest that for the 25 girls in our interview sample who did *not* aspire to science, science aspirations are largely unthinkable because they do not see science as fitting with either (i) their constructions of desirable/intelligible femininity or (ii) their learner identities and student self-concept. Moreover, this lack of fit may be further exacerbated by social inequalities, which render science aspirations less thinkable for working-class girls in particular (not least due to dominant classed associations of 'cleverness' with middle-classness, Archer 2008).

The girls in our sample who did hold science aspirations appeared to achieve this through just one of two options, either through restrained (heterosexualised) 'science femininity' or through an asexualized 'bluestocking' femininity, both of which tend to be associated more often with middle-class femininity. These narrow discursive spaces leave little possibility for other girls (e.g. working-class and/or other minority ethnic girls who may engage in more 'glamorous' performances of working class femininity, for example – e.g. see Archer et al. 2010b; Skeggs 1997) to imagine future science careers as 'for me'. The popular association of science with 'cleverness' (and its perception as being a highly academic subject) means that identifying with science (seeing oneself as a potential 'science person') requires taking up (and being recognized by others for occupying) a 'good student' identity (Carlone and Johnson 2007). This adoption can be more difficult for working-class learners, girls and those from minority ethnic backgrounds because dominant educational discourses construct the 'ideal learner' in particular gendered, classed and racialised ways that normalize the white, middle-class male pupil (Archer 2008; Renold and Allan 2006; Francis 2009; Skelton et al. 2010).

We thus conclude that science aspirations sit in an uneasy tension with femininity and must be continually carefully negotiated and defended against challenges from wider popular discourses which align science with masculinity. The root of continued gender inequalities in girls'/women's participation in, and

experiences of, science is, therefore, complex, multiple and highly resistant to change – and is especially problematic for girls who are not middle-class and who do not occupy 'clever' learner identities. Against this, it would seem that those (predominantly middle-class) girls who *do* hold science aspirations need to engage in sustained identity work if they are to be successful both as scientists and as girls (i.e. to perform socially valued forms of femininity) – *see also Part Four, this volume*. This requires careful navigation of dominant cultural associations of science with masculinity and curricula and cultures that are orientated more toward males. Moreover, as our research indicates, these dilemmas are already in place within the elementary school.

Implications

Based on our analyses, we suggest that work might usefully be undertaken to open up popular perceptions of the sciences – that is, to help a wider (and more diverse) range of children and parents to experience and see science-related qualifications and careers as not 'clever' and 'masculine' but 'for me'. There are two key issues associated with this aim: first, to ensure that the cultures operating within post-16 science (in colleges, universities and workplaces) are indeed equitable and do not alienate or disadvantage 'non-traditional' participants. Existing evidence suggests that there are still a number of challenges on this front (e.g. Carlone 2003; 2004; Ong 2005). This will require scrutinizing the cultures that currently operate within the sciences, to make sure that they are fair and inclusive. The second issue concerns how post-16 science qualifications and careers are popularly perceived.

One approach to the latter could be to increase the potential for (and/or families' awareness of) more diverse forms of participation in post-compulsory science. The children and parents in our study largely saw science jobs only in terms of becoming a scientist (or doctor or science teacher), suggesting little public awareness of either the diversity contained within 'being a scientist', nor of the immense diversity of science-related and/or science-informed jobs that exist. If we are to broaden and increase future participation in careers in and from science, it would seem fruitful to broaden teachers', families' and children's awareness of the instrumental benefits and 'transferable' nature of science qualifications (i.e. raising awareness of not only the benefits of careers in science but the diversity of careers in/from science. Indeed, it is particularly ironic that the KS4 programme of science study in England contains not a single reference to the need to educate students about possible future careers in/from science, even though one of the main rationales given for the importance of science to the UK curriculum is the preparation of the next generation of future scientists. Yet changing perceptions of the value of science for future careers is not only a matter of increasing public awareness of diverse routes – there is also a case for increasing the actual diversity of available

routes in/from science that go beyond the 'gold standard' of A level[10] and university degree routes in order to broaden participation in the sciences. This is not only a STEM 'pipeline' issue but, in our view, is an important social equity issue. Currently the material and cultural benefits that can derive from post-16 science qualifications and/or careers (not only job opportunities but also the value derived from being a scientifically informed citizen) are largely restricted to particular, privileged social groups (notably white, middle-class men).

Finally, we feel there is a strong case to be made for the implementation of strategies designed to increase science capital (Archer et al. 2012a, 2013a) within UK families, to help make science (and hence science aspirations) more 'known' and familiar within families' everyday lives. In other words, there is still a considerable challenge facing the science education community to enable and encourage more girls to see science aspirations as desirable and 'thinkable' for them (see also Jenkins and Nelson 2005). As Pamela (Black Caribbean girl at Chestnut Junior School, who aspires to be actress, dance teacher or sports teacher) explained, although she enjoys science and does well in it, a science-related future career would be "good for some people but not for me".

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[10] Post-compulsory examinations in the final year of UK secondary education, typically when students are aged 17/18. Used typically as entry requirements to university.

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