

Black women scientists: Outliers in South African universities

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Abstract

Black women scientists are living in an important time in South Africa as the socio-political landscape is changing rapidly, effecting changes in many dimensions of identification, particularly, ‘race’, gender and class. This paper draws data from in-depth interviews with a cohort (n=10) of Science scholarship students to explore experiences of alienation and belonging at university. Although these young women are, by definition, ‘high performers’, selected from the top five percentile of their secondary schools, they may still enter university study with limited access to dominant forms of cultural capital, including English proficiency and scientific terminology, and other forms of less tangible knowledges. The participants recount multiple experiences of non-belonging in the university context, both in and outside of classrooms, and a sense of alienation from their chosen fields of study. However, the findings also suggest that the establishment of affective bonds with particular institutional spaces and people, stabilises their sense of self and belonging. Perhaps simultaneous membership of two outlier groups, a marginal and an elite group, which creates alternating senses of alienation and belonging, may provoke new modes of academic life and ways of doing science.

Keywords: Black women in science; academic identity; university; cultural capital; belonging and alienation.

Introduction

The production of scientific knowledge and the education of future scientists is infused by the historical, cultural and political legacies of South Africa. While the Science, Engineering and Technology (SET) fields of enquiry may promise transformative or developmental effects for society, such effects are not inevitable or easily attained, and class inequalities remain deeply entrenched in scientific practices (Sooryamoorthy, 2015). Gendered and racialised discourses are always enmeshed with structures of class, but the meanings of these intersectional (Crenshaw, 1991) categories are further complicated and entangled through the particularly racist and sexist formulations of science in South Africa’s history. The Bantu Education Act of 1953 provided the establishment of a racially differentiated system of education, designed to entrench the privileged position of whites by deliberately providing Black learners with inferior education (Kallaway, 1984). This was especially the case for mathematics and science which were typically not available in the majority of black schools. Where they were offered, teachers were often woefully underqualified to teach these subjects (Mouton & Gevers, 2009). Furthermore, the provision of higher education was racially segregated (Dukhan & Cameron, 2012; Mabokela, 2010) and apartheid schooling was

designed to deliberately ‘underprepare’ (Bradbury & Miller, 2011) students for higher education and hence for particular places in the world of work.

The shift to democratic government in 1994 initiated transformation in both educational and socio-economic spheres. This political change happened in the context of global trends towards a ‘knowledge economy’ in which value is determined and accrued through knowledge and skills rather than the exchange of manufactured goods and labour (Thorlindsson & Vilhjalmsón, 2003). African governments have tended to promote science over humanities on the assumption that the SET fields hold the key to development, conceptualized as a linear trajectory following in the slipstream of Western industrialization and global economic developments (Mama, 2003). However, colonial and apartheid legacies remain strongly evident, as is obvious in the urgent demands of the current South African student fallist movement demanding financial access and the decolonization of institutional practices and curricula (Hefferan & Niefertgodien, 2016).

The South African Constitution is committed to the principles of non-racism and non-sexism, and acknowledges people’s right to education. However, participation rates in higher education remain racially skewed: 55% of White youth (age cohort 18 – 24) and 47% of Indian youth go to university, whereas the comparable figures for ‘Coloured’ youth and Black Africans are only 14% and 16% respectively¹ (Centre on Higher Education, 2016a). Although more women than men enroll in higher education, specific SET fields of study remain gendered: in engineering and technology (76% of the students are male), computer science (63%), architecture and environmental design (63%) and mathematical sciences (61%) (Council on Higher Education, 2009).

A further alarming statistic is that in 2015 only 47% of students in life and physical sciences, 51 % of students in mathematical sciences and 54% of engineering students complete the degree in 5 years and 50% students enrolled in 2010 for SET dropped out of university (Centre on Higher Education, 2016b). Soudien (2010) argues that “[e]xclusion in the higher education system in [South Africa] continues to be characterised, perhaps no longer formally, by racism [but] it can be rendered also in class terms’ (p. 883). It is therefore clear that in addition to changing the demographic composition of the student body, radical changes to pedagogical practices and institutional cultures inherited from the colonial and apartheid past and exacerbated by neoliberal economic forces are required. In this context, being a Black woman in the sciences entails more than individual aptitude, challenging multiple axes of power: ‘race’, gender and class. Therefore, this study focuses on the positionality of Black female students taking science studies at university in terms of their experiences of alienation and belonging at university.

Conceptual framework

Parents with little education and low income are not only less financially able to support their children’s education but also have less appropriately valued symbolic, cultural and social resources to offer (Bourdieu, 1986; Akala & Divala, 2016). Recent analyses of socioeconomic patterns by the economist Thomas Piketty (2015) demonstrate

that these intergenerational effects continue to be perpetuated in global contemporary life. Even in societies, such as the US, where access to education is ostensibly democratic, Piketty (2015) shows that the primary predictor of access to higher levels of academic study and associated economic opportunities in the workplace, is parental levels of education or, in Bourdieu's (1986) terms, the cultural capital that they are able to pass on to their children. This cyclical pattern of reproducing inequality (Bourdieu & Passeron, 1977) remains both gendered and highly racialized in South Africa.

Access to information and university education are vital components of class and wealth formation (Thorlindsson & Vilhjalmsson, 2003; van Zyl, 2016) and the (im)possibilities of social mobility. Further, academic disciplinary traditions are differentially valued and, in the contemporary global landscape, scientific knowledge and technological applications are increasingly powerful. Existing patterns of power and privilege in education are therefore reproduced through fossilized (Vygotsky, 1978) traditions of knowledge and pedagogical and other institutional practices. Bauman's (2000) ideas about 'liquid modernity' notwithstanding, higher education is often in the business of what Essed and Goldberg (2002) call 'cultural cloning', which is a "systemic reproduction of sameness [that is] deeply engrained in the organization of contemporary culture, in social life generally, and in the racial, gendered and class structures of society, in particular" (p. 1067).

The links between knowledge and power are articulated and reproduced not only in relation to economic capital but also in relation to other forms of symbolic and cultural capital, creating intersectional identities (Crenshaw, 1991). Access to particular dominant forms of knowledge is globally gendered with women stereotypically understood to be 'better suited' to the humanities or being stronger in emotional qualities than rationality (Tamboukou, 2006; Shanyanana & Waghid, 2014). In the same way that access to the goods of education and employment (particularly in SET fields) is gendered, in South Africa, schooling and work remain racialized, tapping into similar stereotypes of blackness associated with the emotional, embodied world and inherently irrational mind (Dyer, 1997). Race is thus implicated in the formation and reproduction of knowledge systems and, consequentially, of class structures.

Structural power is perpetuated and maintained through the construction of boundaries that determine the standards of 'normality' and access to economic, political, social, intellectual 'goods' (Bourdieu, 1986; Yuval-Davis, 2011). However, hegemonic power may be fractured in historical moments of change and through the way in which particular individuals may inhabit multiple and contradictory social categories. Change in social structures and knowledge-making practices may therefore be provoked by young people from historically disadvantaged groups (in terms of race, class and gender) entering the elite world of university study in the SET fields. Conversely, as Brickhouse, Lowery and Schultz (2000) assert, learning in science entails more than content knowledge, and students are assimilated and socialised into the cultural norms, discourses and practices of science.

The process of learning may thus be thought of as developing a sense of

belonging or a feeling of being 'at home' (Yuval-Davis, 2006) in the scientific 'community of practice' (Lave & Wenger, 1991). However, belonging is paradoxically largely activated through experiences of exclusion (Anthias, 2006) and the development of students' identities within the academy typically entails ambivalent experiences of belonging and alienation. Although literature about academic identity is well represented in the sociology of higher education and the notion of 'science identity' is receiving increasing attention, little attention has been paid to intersections of 'race', class and gender and the particularities of academic identity in the sciences (Carlone & Johnson, 2007).

This study focuses on the academic identity of a group of science scholarship students and examines their experiences of alienation and belonging at Wits. We propose that these women could be viewed as living at a cultural crossroads by virtue of their coexisting membership of a highly marginalized group and an elite group, 'outliers' (Gladwell, 2008) in both senses of the term. On the one hand, the lingering effects of apartheid policies have resulted in the continued marginalisation of Black women. However, on the other hand, the value and prestige associated with the sciences in the post-apartheid and global socio-economic context simultaneously places them in a uniquely powerful position. They are marginal rather than centred (by 'race' and gender) but also, exceptional rather than average (by intellectual ability). Their simultaneous membership of these two outlier groups creates shifting senses of belonging and alienation in academic communities aligned with white, male and middle-class normative constructions of the science and scientists.

Methods

This article is based on a wider qualitative study that utilised in-depth interviews to explore the ways in which a group of young women SET scholarship students reflect on university culture and their developing academic identities as science students. The research took a phenomenological approach, emphasising the meaning-making of the participants in their narrative recollections (Wengraf, 2011) of entering university and their difficulties in making the transition from school to university.

This study took place at the University of the Witwatersrand (Wits), a historically white university (HWU) where the student population is changing and, although still racially skewed, approaching national demographic representation (Wits, 2015). The general gendered pattern in the HE sector is also reflected at Wits where 66% of the students in the Faculty of Engineering and Built Environment were men and 34% were women; whereas in the Humanities this pattern is reversed with women making up 71% and men 29% of the student body.

One of the authors (Liccardo) conducted individual interviews with the young women while she was employed by the university unit that administered the scholarship programme. An experience-centred approach to narrative (Squire, 2008) focuses on the participants' subjective accounts of everyday life at university and sought to capture their views on university 'preparedness', academic challenges, and support systems. These

affective stories are illustrative of the ways in which wider social processes and institutional practices are personally experienced. The interviews were approximately one hour in duration, audio-recorded, and transcribed verbatim.

Data analysis

The data were analysed in three consecutive stages. First, demographic profiles were developed for each of the women as presented in the table below.

Table 1: Profile of participants

Pseudonym	Home language	Parental level of education	Parental occupation	Secondary school	Field of study	Academic level
Devyani	English	Mother (Grade 11) Father (Matric)	Mother (administrator) Father (unemployed)	Former model C	Civil Engineering	3 rd year
Cecilia	isiZulu & seSotho	Mother (Grade 8)	Mother (domestic worker)	Former model C	Architecture	3 rd year
Amna	English	Mother (University) Father (Diploma)	Mother (teacher) Father (teacher)	Former model C	Biological sciences	3 rd year
Esther	sePedi	Mother (University) Father (University)	Mother (teacher) Father (teacher)	Rural	Chemical Engineering	2 nd year
Joyce	seSotho	-	Mother (nurse) Father (clerk)	Rural	Electrical Engineering	Repeat 2 nd year
Judith	TshiVenda & English	Mother (Diploma)	Mother (teacher)	Rural	Aeronautical Engineering	Repeat 2 nd year
Kate	isiZulu	Mother (Currently university student)	Mother (clerk)	Former model C	Biological sciences	3 rd year
Manka	isiZulu & English	Mother (Grade 11) Father (Technikon)	Mother (unemployed) Father (IT technician)	Former model C	Computer science	3 rd year
Mpho	English	-	Father (self-employed) Mother (nurse)	Former model C	Biological sciences	2 nd year
Nomxolisi	seTonga	Mother (Grade 12) Father (Grade 12)	Mother (teacher) Father (principal)	Rural	Computational & Applied Mathematics	2 nd year

The women were all Black² university students from multiple linguistic and cultural backgrounds, and registered for a variety of SET degree programmes. Although parents of four of the students had post-secondary education, all of the women were first generation entrants to university study in SET fields. It is also interesting to note that one or both parents of half the group were teachers. Six of the ten participants attended relatively advantaged former Model C secondary schools³, while the other four attended (typically under-resourced) rural schools. This profile suggests that while all participants are disadvantaged by race and gender, the possibility for studying SET disciplines at an HWU may only be possible for children from families in which there has been some (albeit only minimal) mobility for the older generation. It is likely that these students are part of the so-called 'missing middle' (Merten, 2015). Their experiences of university life are therefore to be read from this positionality.

Second, the data were coded and grouped thematically (Braun & Clarke, 2006) to inform the scholarship programme about the kinds of support that students need and to inform teaching-learning practices in SET courses. What emerged through this inductive stage of analysis was that while academic matters are clearly important, the university experience beyond the classroom is equally significant. Therefore, the third and final phase of analysis that is reported on in this paper, focused on these experiences of university life in greater depth and entailed reading these narrative accounts deductively through the theoretical lens of identity theory, understood as fluidly constructed in terms of belonging and alienation.

Results and discussion

The data presented are clustered into three key themes, enabling us to explore the experience of these young women as ambivalently belonging and not-belonging to the exclusive (and exclusionary) scientific academy: 1) academic identity and sense of self, 2) alienation and practices of exclusion and 3) belonging in place and through networks of support.

Academic identity and sense of self

For these young women, being a successful SET student is who they understand themselves to *be* rather than simply something that they do. They have an intellectual identity as students at a prestigious HWU (Bradbury & Kiguwa, 2012) and their self-narratives are crafted around their history as successful school learners and their futures as potential scientists. The extracts of data below demonstrate what happens when this identity is thrown into question when they fail academic tasks for the first time in their lives.

Judith: You know for the rest of my life, I always define myself as someone who always passes. Someone who always does well especially academically. So now that you've failed, you don't know who you are anymore. You're not sure who you are anymore. You just have to like go again and search for who you are, but like you lose your confidence along the process. Because you define yourself as that.

You don't see all the other things, you just see academic stuff.

Mpho: You still have that something that de-motivates you because you did bad in your tests: you don't understand anything and feel like a failure. There is that fear of failure, and I think that is my drive, to making sure that I do not become a failure.

Participants struggle to reinterpret them-selves, interpreting failing test scores as more than a measure of specific competencies and knowledge, implying something about their value as persons. The shock and destabilising effects of those early failures are vividly recalled. The temporal and historical quality of identity, as expressed in recollective narratives (Wengraf, 2011) means that the past is actively alive in the present, contributing accumulatively to growth in knowledge and understanding of one's self and the world but also resurfacing earlier hurts that undermine the sense of self. The following exchange is an example of visceral, emotional memory.

Sabrina: So what was your experience of failing these two courses?

Kate: Oh, I had depression. Oh I was, oh, I just, I remember I couldn't take it, even now it's like. Ja, it's still, it's so hard – like I've never in my life like failed, ever. I've just always been the kind of person that like gets the marks and so-

Sabrina: But you're more than someone that gets good marks. You've got such an amazing personality. You're more than-it's so important not to define yourself by your marks.

Kate: Ja it's cool [starts crying]. Ja, I'll get over it, I think.

Sabrina: Oh okay. You know, if you don't excel, it's okay.

Kate: I have to. I have to.

In addition to the academic demands at university, many of the participants spoke about high levels of expectation from the scholarship programme staff, family, friends and community.

Nomxolisi: Even in primary school and at the village at home because I am the first person to pass my Matric, the very first. But now things are not working out [due to failing courses] and I don't want to let everyone down and myself. That [being a role model] is what pushes me because I know the eyes are on me.

These external pressures are internalised and the participants define themselves in terms of excellent academic performance, culminating in emotional exhaustion and/or depression when they are unable to meet these demands.

Alienation and practices of exclusion

Participants reflected on their schooling and the disjuncture between school and university, pointing to various ways in which they felt 'underprepared' (Bradbury & Miller, 2011) for SET degree studies. The unevenness of the school system is keenly felt and one of the students who attended a former Model C school, explains her sense that

she has an advantage over her peers who went to township or rural schools.

Mpho: Academically, they [high school] did a great job [in preparing me for university] because there I got a lot of skills. I came here knowing virtually from other schools people didn't know, and you know when you're raised in such a way that you assume that everybody is brought up that way. ... The Biology teacher I had [in high school], she would use a lot of examples ... So, it was little skills, the basic things people still do not know even like drawing graphs, people fail too you know.

Former Model C schools benefit from well-trained teachers, resources and community investment, while rural schools continue to face serious problems related to a lack of resources and less qualified teachers. Participants pointed to gaps in skills and content knowledge that make the transition to university differentially difficult (Liccardo, Botsis & Dominguez-Whitehead, 2015). For example, many rural schools do not offer technical drawing, identified by staff and students alike as providing critical foundational skills.

Judith: I only knew what I was going to do, Engineering, but I didn't know that I was going to do something like drawing, because I couldn't even draw like just a simple drawing. But it came to my surprise ... in Engineering you have to do drawing. So I thought, maybe in High School, if they knew you're going to do something like Aeronautical Engineering, they should introduce courses like drawing.

This perception is supported by research that indicates that first-year female Engineering students typically needed specific academic support in Engineering graphics for the development of the requisite spatial and visual abilities for effective design (Potter, Van Der Merwe, Kaufman, & Delacour, 2007). Similarly, many students from disadvantaged schools have little access to computer facilities.

Devyani: I wish they [high school] offered more courses like, I would have loved to have computer programming. Because for us it's rush, rush, rush and those that had done computer programming, understand it so they can programme better than us and we struggle.

Manka: He's a good lecturer and he is passionate about the subject itself but he expects you to have a lot of background on the course and even at first year. Like we did some programming [at school] but we did programming in another programming language and that was easier than Java. So [here] you just do programming in one block and then that's it. Because lots of people in our class - or lots of people who made it - actually did [programming] in High School because there is [programming] as a subject but we didn't have that in our High School.

This absence of adequate preparation that is frequently not recognized by lecturers is primarily accounted for by the persistently racialised class hierarchies of

South African schooling. However, gender is also highly relevant in determining ‘choice’ as Amna’s poignant account highlights:

Amna: The last time I did Art was in Grade 6 or 7 and then that was painting and then when we were supposed to do technical drawing, they put me with a sewing class, I had to do embroidery. So I was doing embroidery when everyone was doing technical drawing.

In addition to the absence of particular background knowledge and skills, the medium of instruction at university is English, which is not the mother tongue of the majority of students, and several women allude to this as a big learning hurdle. Although secondary school education is officially conducted in the medium of English, in the racially and linguistically homogenous schools from which many of these students come, code-switching is standard practice.

Esther: They [school teachers] teach in English. But then something you don’t understand they even, they can’t explain in English, so they just translate to Zulu, and they explain it like that.

This means that in the university context, students often find themselves grappling with new and rapid flows of language in the lecture situation. This may inhibit the kind of dialogical talk that is critical for a questioning engagement in academic learning (Taylor & Lelliott, 2015). Although Esther emphasises the difficulties of studying in a ‘foreign’ language, her comment below intimates that the question of ‘race’ and difference is embedded within this discourse about language.

Esther: It’s like at University maybe there’re different people, there are whites like everybody is here, and in my school you were only like Zulu people that there was no one else and like the most spoken language was Zulu.

This suggests that it is not just ‘English’ but wider social and cultural practices that are unfamiliar for these students. As McKinney (2007) notes, English proficiency is associated with whiteness and the most highly valued forms of cultural capital. Even mother-tongue English speakers find the new specialist terminology of scientific discourse, a challenge.

Devyani: English is a big barrier at Wits. Even with me, I mean I am not the most well-spoken person but I did speak English and I did do English higher grade, but there’s a lot words that you come across and you think, “What are they talking about?” The worst is when you get a test or an exam question and you’re like, “What are these people talking about?” It’s like you can’t do the work if you can’t understand what they are asking of you. You get words and it means two things in the engineering or the maths world than in normal life and then you will sit there and you will want to cry because you didn’t ask what it meant. So the thing is you better ask.

The knowledge, skills and language identified as critical by these students may or may not align with the epistemological concerns of expert scientists, but their accounts serve to highlight the alienating effects of pedagogical practices and the need for curriculum transformation (Jacobs, de Bruin, van Tonder & Viljoen, 2015). However, instead of this interpretation, students feel that their lack of knowledge and skill is seen as a sign of being stupid, a personal deficiency rather than a systemic failure of schooling.

Joyce: I remember we had a test. It was like 45 minutes and we really needed to be like quick typing and everything and like we didn't have to write anything down. It was like on the computer ... and you get there, they just give you, like you have to download the question from the computer. They didn't even tell you how to do it.

Devyani: You had to do your own work and it always feels like in class everybody knows everything but everybody is in the same boat so you too scared to ask people because they might think you are dumb.

In this way, university study perpetuates a sense of alienation and exclusion (Yuval-Davis, 2011) even while increasing the inclusion of Black (and women) students. Confidence in their own abilities is further undermined by assessment tasks that seem to reward conformity, despite the asserted value of 'critical thinking'.

Cecilia: I'm doing [this course] and it's interesting. I like what we were designing but I don't like the way it's been taught and the way it was being marked. So I felt like she wanted us to do what she wants and when you came with your own, if it was different from what she had in mind then you didn't score as well. It's difficult especially because you have your own ideas.

It is clearly the task of those steeped in scientific knowledge traditions to teach and induct students into established disciplinary domains. However, rather than 'cloning' (Essed & Goldberg, 2002) students in their own image, academic teachers should encourage students to develop their own critical intellectual voice.

Belonging through networks of support

In contrast to the alienation experienced in lecture theatres and in interactions with academic staff, the participants spoke of developing affective bonds with particular people and in relation to 'safe' spaces at the university that stabilise their sense of self and identity.

Manka: Because sometimes I walk around feeling like, "Oh no, can I come upstairs?" [to the scholarship programme office]. And then we come and you have these big smiles and it makes me feel better, so that helps. Like I know if I am stranded I can go there. Oh ja and the other girls, definitely! Like having sisters all around you, ... there is always someone there that you can go to, someone you can talk to, so it's always good to have them around. Also academically because

we did some stuff together.

The formation of these social bonds is particularly significant for these young women because they live in the university residences and the campus is therefore quite literally also 'home'. Research demonstrates that residential students face additional challenges in adjusting to university (Pancer, Pratt, Hunsberger, & Alisat, 2004) and that social integration and the quality of new friendships for women residential students may be even more valuable to them than academic integration. Without negating the absolutely critical factors of financial and academic support, social support may be key to retaining intellectually talented students and improving the current extremely poor throughput rates in the South African higher education system.

While most of these points of belonging (Yuval-Davis, 2011) were outside of the classroom context, there were some promising indications of connections beginning to form within academic communities of scientific practice.

Cecilia: Ja, but this year it's different, they are encouraging us to be on our own way. Even construction, they have showed us design by inquiry. So what he says is sometimes when we design, not all of us get ideas like that, we don't have a concept like that, some people get it and they start drawing and they're there. But some of us we get stuck and then what he says is, he divided the page in two and then you have your personal stuff and then what's outside and he says the perfect design is when you fuse the two. So like sometimes you must just start drawing and then like without even thinking about it, your beliefs will come through and then what's outside and affecting you will come through as well. Just keep drawing and drawing and then before you know it, you'll come to a concept and you will get like a light bulb moment.

The question is whether these outlier women can increasingly find ways to use the networks of support and relationships that they create across institutional spaces to create a place of belonging within the scientific tradition.

Conclusion

The current country-wide student fallist movement calls attention to the imperative for the "demythologization of whiteness because democracy in South Africa will either be built on the ruins of those versions of whiteness that produced Rhodes or it will fail" (Mbembe, 2015, p. 3). The racialised gender gap in SET fields raises critical concerns around the politics of scientific enquiry and the continued marginalisation of Black women in higher education and society. Black women scientists, as outliers in South African universities, are positioned at an 'abnormal' distance to white, male and middle-class normative constructions of science and scientists. By challenging this marginal position, the formation of a new social grouping of Black women in higher education in the sciences could potentially cultivate new "ecologies of knowledges" (de Sousa Santos, 2007). Centring black women scientists would contribute to social, economic and intellectual development, as diversity and equity are the cornerstones of

transformation and innovation. However, as demonstrated in this paper, the pursuit and production of scientific knowledge in South African universities remains deeply rooted in its colonial and apartheid legacies. There is a marked disjuncture between these young women's sense of themselves as members of an 'academically talented' elite on entry to university and their subsequent academic struggles and failures. Young Black women students encounter various practices of exclusion at university and are very aware of their lack of particular requisite cultural capital for success. The scientific tradition, which is welcoming for those who share the characteristics, values and normalised practices of the dominant group, is experienced as alienating for those who are viewed as lacking dominant cultural dispositions. We suggest that establishing affective bonds with particular places and people at the university helps to stabilise their identities and create feelings of belonging. The experiences of these outlier high-flying Black women challenge the edifice of academia, demanding changes in institutional structures and pedagogical practices.

Notes

1. We use the apartheid-era racial categories here as these remain the official categories for organizational and state measures of transformation.
2. 'Black' is utilised as an overarching term for African, Coloured (mixed-race) and Indian.
3. Former Model C schools are schools that were reserved for white learners in South Africa under apartheid but opened up to black learners in a limited and conditional way in the early 1990s (Hofmeyr, 2000). The single education system of the democratic state post 1994 ostensibly deracialises education but most former Model C schools are now very expensive, excluding children from poorer black families, and township and rural schools remain homogeneously black.

Acknowledgments

The authors acknowledge the Student Equity and Talent Management Unit (SETMU) for access to the data. We would also like to thank the two anonymous reviewers who provided useful feedback to the first version of this paper.

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