Foregrounding Intersectionality in Considerations of Diversity: Confronting Discrimination in Science Teacher Education

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Abstract

This paper contributes to a small but significant body of research addressing issues of prejudice in science education. It is written in the form of a critical incident analysis that uses the framework of intersectionality to examine deficit ideologies and biases inherent in science as a body of knowledge as well as science teacher education. If left unchecked, these prejudices can filter through into school science education, reinforcing the stereotypes of who can contribute to the field of science. The paper makes a call for science teacher educators to support teacher candidates as they move past an academic understanding of diversity in science education to examine their personal dispositions. Suggestions are made for approaches that can be adopted to facilitate the forms of deconstruction necessary for progress to be made in this area.

Keywords Science teacher education · Diversity · Equity · Critical incident analysis

Introduction

Children and youth as subjects of school-based science education are at the heart of the concerns about teacher preparation addressed in this paper. Researchers in North America refer to broadening participation and closing achievement gaps in K-12 science education (e.g., Leonard et al. 2016; National Research Council 2012;

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Rodriguez 2015). Strategies addressing achievement concerns are often calculated to increase the performance of minoritized students in science education.¹ Absent from many conversations about increasing the diversity of students engaging with science education is a specific articulation of how structural/societal conditions have contributed to the variance in student performance and how this situation can be perpetuated in the daily practices and deficit ideologies of science teachers. I use the approach of critical incident analysis to explore how, if left unchecked, science teacher education can fail school students because of its failure to confront the prejudicial ideologies of science education into which teacher candidates (TCs) are often inducted. The aim of this paper is to help science teacher educators to prepare TCs to examine their own practices, perspectives, and prejudices with regard to science and student diversity in science education.

The paper is centered on a critical incident that illustrates a fundamental concern in science teacher education: the lack of attention given to issues of bias and prejudice in science education. When teacher educators present science as an unbiased and fully objective body of knowledge (Leden et al. 2015; Mesci and Schwartz 2017), they are often inattentive to the social, historical, and philosophical tradition within which school science education has arisen. Science teacher educators have a tendency to reinforce Eurocentric traditions that insist upon certain patterns of logic, terminology, and practice in school science education (Calabrese Barton and Yang 2000; Warren et al. 2001). In so doing, they fail to acknowledge that school science is the result of the quest to explore the interests and questions of a mere subgroup of people in the world's vast population, in ways that are valued and revered by that same subgroup. As far back as the 1980s, historian of science Robert Young penned the compelling argument that a racist (or otherwise prejudicial) society produces a prejudicial science education since ideologies guide the values and theories of those developing, working within, and establishing the bounds of knowledge systems (Young 1987). In this paper, I make the argument for science methods courses in initial teacher education to deconstruct not only who teachers are but also what teachers teach.

The Critical Incident²

It is common practice for teacher educators to give their teacher candidates (TCs) assignments that encourage the forging of explicit links between theory and practice. One such assignment that I set for my generalist elementary and middle school TCs asks them to read an assigned, peer-reviewed journal article, use an active learning strategy to explore the key elements of the article with the class, and then demonstrate how the concepts can be used practically in a science classroom. Even

¹ Throughout this paper, I prefer to emphasize processes of oppression by referring to individuals who are minoritized and marginalized rather than using the term minority. Although the terms are not synonymous, many individuals experience both effects in concert. I use minoritization to define the process whereby societal structures support the subordination of certain people or groups of people within a given context so that their representation within a particular field is reduced, relative to others (as if they were in the minority in society, irrespective of their actual numerical representation). Marginalization processes result in similar silencing of individuals or groups so that their ability to exert power is reduced due to the relegation of their interests, concerns, or needs to the fringes or periphery of the focus of a more dominant societal group.

² The reader will note that this paper is presented as a first-person account. This is done to accept authorship and ownership of my words rather than hiding behind the passive third person conventions that have characterized communication in the Western modern science tradition (Medin & Bang 2014).

though teacher candidates (TCs) are often challenged by some of the language and concepts presented in research articles, they are generally enthusiastic about proposing theory to practice applications. One example of this exercise, completed by a group of TCs a few years ago, remains seared in my mind. The TCs were presenting their analysis of a journal article about social justice and teacher agency in science education (Moore 2008). One member of the group advanced the slide and revealed a large and striking image in monochrome. As the presenter proceeded through the prepared script, he suddenly stopped mid-sentence and started making profuse apologies. I was at the back of the classroom making notes on the evaluation form, but the presenter seemed to be making his apology directly to me. The stimulus for this abrupt pause in proceedings was the image of a flock of caged birds being liberated by another bird. The cause of the TC's consternation seemed to be a sudden realization that unintended meaning might be conveyed in the caged birds being black, and the liberating bird white. At the beginning of the apology, the teacher candidate (TC) referred to my research background in postcolonial theory. He stated that all members of his presentation group had reviewed the full presentation numerous times and not one of them had seen any significance in the image, but now he could see how the image could be misread, emphasizing how *I* might misread their intention. Being deliberate about maintaining eye contact and showing a neutral facial expression, I gestured that he should continue with the presentation, but he had not finished making his point about the image. As he continued, the apology transitioned into a clarification. The presenter emphasized why I should see this as children being free to express themselves in science. As the TC's composure continued to unravel, the justification continued; he explained that when they picked the image, they did not think about the colors, and now the group felt terrible that the bird in charge of liberation looked like a white bird acting as savior to the black birds. I gestured again that the TC should continue with the presentation and he finally acquiesced. As another member of the team took over, I was taken aback by another unexpected image, revealed a few slides later; it was a large headshot of Frederick Douglass accompanied by some text about science education.³ Failing to see the link between the image and the text, I listened intently to see how the group had reconciled the work of this North American abolitionist and a TC's agency to enact social justice in the science classroom. Not only was the link never made explicit, but the TCs never referred to the name or work of the person whose image emblazoned the screen. I was very confused about what was happening, but I noted that members of the presentation group were stealing glances at me, perhaps hoping to detect hints of approval; I could offer nothing. The presentation continued, and the group had planned an appropriate curriculum-linked activity for their peers to tackle.

When reviewing the reflection that the group wrote about the presentation, I realized that they were much more prepared in critical literacy than in deconstructing their own positioning. The reflection provided an appropriate critique of assumptions attending the term *urban* in the article, but there was an immediate attempt to use this analysis to suggest that the issues presented in the paper may not have been applicable to the Canadian context.⁴ It seemed as if the TCs had not really understood the point of the paper. While their reflection zeroed in on the

³ Frederick Douglass (1818–1895) was an escaped slave, prominent abolitionist, political activist, and civil rights leader in the USA.

⁴ The teacher candidates noted that in US research literature, the term *urban* is often used as a proxy for communities with high proportions of people of African American and Hispanic/Latinx identification; in Canada, people identifying as Black and Hispanic/Latinx represent 3.5% and less than 1% of the nation's population respectively. In addition, although Canada does have a documented history of African slavery, most Black Canadians represent first and second generation immigration activities, from the Caribbean and Africa (Statistics Canada 2019).

research design employed by the author, the style of writing, and the number of concepts engaged, the TCs seemed to totally miss the point that the paper was about them, teacher candidates, trying to grapple with social injustices that reside in school science education and with which they must engage; even if they do nothing to make a change, they must understand that they are doing something to maintain the status quo. As I reflected on how the presentation had unfolded in the class, I realized that had my body not been in that room (for I am a Black woman) the TC may not have had that moment of confrontation,⁵ a moment when what was taken for granted was confronted with different/imagined perspectives because I was sitting in front of him and my approval would influence his grade. I resolved that I could not let this moment pass without a lesson being learned and started re-evaluating my strategy for the remainder of the course. I realized just how careful I need to be to make sure that my TCs do not reduce the study of inequity to an abstract academic exercise.

Theoretical Framework: Intersectionality

This paper concerns how educators approach student diversity in K-12 school science education and the message that a teacher's disposition conveys to students of science education. In order to theorize diversity, I utilize a framework that is both critical (i.e., seeking to reveal and challenge power structures) and acknowledges the multidimensional experiences and identities of today's science students in North America. The intersectionality framework challenges those whose experience of addressing diversity in science education begins and ends with issues of gender disparity. When the framework is applied appropriately, it resists simplistic dilutions that reduce all students to the state of being unique (Rios et al. 2017). Arising from "the inadequacies of the mainstream feminist movement to address the issues, concerns and struggles of racialized women" (Bunjun et al. 2018, p. 7), the term intersectionality was popularized through the work of Kimberlé Crenshaw who used the expression in her 1989 exposition on the experiences of Black women in relation to employment law and policies (Crenshaw 1989). She illustrated how multiple forms of inequity can be compounded through societal interpretations of the identities of individuals, making a distinction between structural and political intersectionality (Crenshaw 1991). Structural intersectionality concerns the interrelation of societal categories of power that organize and prioritize people according to various social groups. Political intersectionality shines a spotlight on the conflicting affiliations of individuals seeking to organize to effect social change in practice or policy. Crenshaw illustrated the overlap of these two forms of intersectionality in the assertion that "women of color are situated within at least two subordinated groups that frequently pursue conflicting political agendas" (Crenshaw 1991, pp. 1251–1252).

In addition, Crenshaw addressed a third dimension of intersectionality, representational intersectionality, that considers the imagery and media discourse that attends the portrayal of individuals facing multiple discriminations as is seen with the stereotype

⁵ In this paper, capitalized Black and White do not signify dominance or empowerment (as have been used by others); rather, they indicate that the terms are modes of social categorization, based on the individual's African or European descent (not necessarily their recent history). This is seen with other proper adjectives that can also be nominalized such as the term Hispanic, which suggests ancestral affiliations with Spain.

of angry, oversexualized Black women and girls (Muhammad and McArthur 2015). Sleeter (2004) and Gorski (2016) illustrated how this dimension of representational intersectionality is significant when confronting notions of student achievement gaps. Sleeter and Gorski asserted that the deficit ideologies that are deeply embedded in societal beliefs regarding the outcome disparities of students of color living in impoverished circumstances are based on underlying convictions that a child's poor school performance is the natural outcome of certain "ethical, dispositional, and even spiritual deficiencies" (Gorski 2016, p. 380) of the child and their community. Sleeter suggested that the teacher holding such deficit ideologies will have "low academic expectations, cool student–teacher relationships, and uninspiring classroom instruction" (Sleeter 2004, p. 133).

Christensen and Jensen (2012) emphasized the value of considering intersectionality in terms of dynamic processes: "racialization rather than races, economic exploitation rather than classes, gendering and gender performance rather than genders" (Choo and Ferree 2010, p. 134). This approach draws attention to human actors in social systems and resists the tendency of researchers, and other readers, to linger in the realm of theorization. Christensen and Jensen also explored the analytic strength of intersectionality as a methodological framework, stating that "life-story narratives and the analysis of everyday life" (p. 109) can serve as a starting point for an analysis of intersectionality. In this paper, I use an intersectionality framework to explore the critical incident (outlined above) that has influenced some significant shifts in my approach to science teacher education.

Methods: Critical Incident Analysis

Critical incident analysis has an established history that originates in organizational and industrial psychology (Butterfield et al. 2005). The approach was formulated to enhance system efficiency and identify priorities for a given job specification (Flanagan 1954). Over time, the application of this research methodology has broadened, particularly in service and care-based contexts. More recent interpretations of the methodology have been used to enhance teacher reflexivity in educational contexts so that teachers can better understand their roles in the workplace and develop more effective problem-solving strategies (e.g., Griffin 2003; Tripp 2012). Flanagan (1954) proposed that, "to be critical the incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer and where its consequences are sufficiently definite to leave little doubt concerning its effects" (p. 327). The incident described in this paper has direct implications for science teacher education and, as a result, would have likely consequences for K-12 school students. It is hoped that the process of exploring the experience might be generative, providing insights for myself and those who are, and wish to be, part of the movement to promote greater equity in school science education. I am aware that in the process of telling and retelling a story, distilling and editorializing tend to occur, giving the original account a life of its own. While I make every effort to accurately and objectively recount the incident as it occurred, and analyze it afresh rather than presenting already-interpreted conclusions, I acknowledge that my perspective, being a participant in the event, is limited.

Analysis

Situating Science Education in its Historical Context

Noblit (2013) identified science as the “lingua franca of the globalized world” (p. 240). In making this assertion, he underscored a clear message about the fundamental value that has been placed on scientific modes of thinking the world over, and characterized globalization (which can be read as a contemporary reformulation of European colonization) as the process by which this interpretation has been spread. Noblit went on to explain how the cultural trappings of science, with its precise language and powerful legacy, require interrogation by those in the field of science education research who teach and promote affiliation with this body of knowledge. Nevertheless, it is common to teach science without placing it in its historical and ideological context. Borrowing from Shizha’s (2007) notion of science as “a culture for the privileged” (p. 305), Mensah and Jackson (2018) described science as White property, stating that the heritage of science tends to “reify a White, male ownership of science” (p. 9); they went on to explain that this conceptualization of science as White property “limits the teaching and learning of science as a right for students of color or other marginalized groups, such as women, students of poverty, and students in low-resourced urban and rural areas” (p. 9). Given these researchers’ assertions about the social positioning of science in North America, it is imperative that our TCs understand that by ignoring the cultural heritage of science education, they are reinforcing its status as the property of White male privilege.

At the outset of each course, I share a short biography with my TCs. I include details of my background as a school science teacher, my perspective on Western modern science as a discipline, and aspects of my philosophy of science teaching. I explain that there are many aspects of my identity that make this educational journey novel for us all. I identify myself as a Black woman from England, of Caribbean heritage, and I invite my TCs to journey through the course, exploring with me what the positioning of a teacher might mean for students in various educational settings. I always address aspects of identity because I want TCs to question and challenge what it means to interact with others as our full selves, acknowledging the various biases that such interactions may reveal. There are times when during this introduction, I see TCs embodying their discomfort; many will look away from me or feign comfort while breathing heavily, particularly when I use the word Black. I am aware that such vocalizations may be uncomfortable, but if teacher educators do not discuss the complex social issues impacting school classrooms every day, how will TCs be prepared for more than perpetuation of the present business-as-usual inequities? The TC making the presentation in the incident described above had not seen how his position of compounded privilege, as a White man with a tertiary level of education, readily related to the article he had read about teacher agency in regard to social justice issues in the science classroom. Only when he saw me in front of him, and the racial aspect of my own intersectionality was foregrounded, did he begin to see how the Black/White dynamic of the teacher/student authority symbolized a complex representational intersectionality.

All science teacher educators must help TCs to deconstruct the social positioning of science and their own positioning in relation to Western modern science. TCs need to explore what the various dimensions of their own privilege may inadvertently convey about the knowledge that they share. Just as my presence as a Black British woman, holding the position of a science teacher educator in a Canadian university setting, presents considerable dissonance for many of my TCs, it is important to acknowledge and address the short burst of discomfort that they

feel at moments when it is least expected. In my role as a science teacher educator, I prepare teachers to facilitate conditions for the effective education of students in Western modern science. I am explicit about the fact that I am teaching a certain brand of science and regularly remind my TCs how and why I feel that it is so important to emphasize this (as I believe that there are other valid schemas that people use in their endeavors to systematically study the natural world).

Being Attentive to the Dispositions of Science Teacher Candidates

In October 2017, Universities Canada—the body representing universities and colleges across the country—announced its Inclusive Excellence Principles.⁶ This document outlined a commitment to seven principles for promoting equity, diversity, and inclusion in institutions of higher education (Universities Canada 2017); among the seven was a commitment to “work to generate greater awareness of the importance of diversity and inclusive excellence throughout Canadian higher education.” These affirmations suggest that matters of race, gender, and other diversities should be reflected, not only in what Orpwood (1985) described as the *intended curriculum*—programs, courses, and documents that capture the policy-makers’ vision for education—but at all levels of university education, including the planned, taught, and learned curricula.

Reflecting on the incident described above, I am concerned that my TCs may be just tolerating my concerns about equity and inclusion in the school science classroom while resolving that I assert these challenges just because I have an axe to grind. Perhaps they feel that I have been placed in my academic position as a tokenistic gesture to fill a diversity check box. While it is possible that there is some truth to both of those assumptions, I cannot afford to have TCs leaving my course and disregarding the deconstructions of diversity in science education that I have tried to introduce. One way of reinforcing these ideas is to ensure that colleagues in other courses are committing to the same modes of knowledge deconstruction. As described by James (2017), it often rests on the most marginalized of professors to “deal with issues of ‘diversity’” (p. 155) even when they are, ostensibly, employed to teach outside of this genre. If Universities Canada is truly committed to progressing education in the ways stated, then consideration of equity and diversity need to be on the agenda of every university instructor. To reinforce this point, I add details of a further encounter associated with the incident above.

Speaking with the presentation group members after class, I explained that I was a little confused about certain elements of their presentation, so I asked them to share with me the essence of the article, as they saw it. Group members disclosed that the ideas outlined in the paper were not totally clear to them, but they felt that they had done a good job of communicating what they had grasped. When I asked why they had not sought help from me before the presentation, as I had repeatedly offered to all groups, one TC offered that they thought they would be able to figure it out and did not want to bother me. Finally, I asked about the Frederick Douglass image and they explained that while they forgot to mention his name, they thought I might recognize him as one of the people who fought to abolish slavery. I pushed further to try and access their line of reasoning by asking how they thought that the

⁶ Similar initiatives have been promoted by university governing bodies in other countries around the world, e.g., the equality, diversity, and inclusion policy of Universities UK (Universities UK n.d.) and the diversity, equity, and student success initiative of the Association of American Colleges and Universities (n.d.).

article related to slavery, but they just looked at each other in silence. I realized that I could not continue this discussion and maintain my composure, so I ended by stating that I would continue addressing the issues raised in the article in subsequent classes and suggested that they should ask questions as and when confusion arises.

I want to make it clear that I am not suggesting that my TCs were demonstrating racism or expressing any form of prejudice in the incident described (if that was their disposition, it certainly was not evident to me through the incident). Rather, I am concerned that even when exploring a paper that explicitly addressed social injustices, and the teacher's role in combatting them, my TCs could do little more than access the paper as an academic document such that when opportunity was presented for a more critical and personal engagement with the subject matter, they could not, or would not, engage. I also saw nothing inherently racist in the caged birds image; rather, the TC's response, combined with the gratuitous use of Frederick Douglass' image, suggested a troubling conception of how to address diversity in the classroom. I saw my TCs' attempts to keep me (and the various aspects of my intersectionality) happy. They were trying to give me what they thought I wanted from them. I was troubled by the idea that this tokenistic approach might be how my TCs would address encounters with minoritized identities in their own classrooms. I noted the sequence of emotions that the presenting TC went through when confronted with a disturbing message in the caged bird image; he first had a moment of realization that briefly turned to embarrassment, accompanied by an impulse to apologize but that apologetic stance quickly transitioned to a defensive position where intent was justified and I was somehow implicated as a person who may be too sensitive (even though I had done and said nothing). When my TC ended in a position of irritation, I wonder how much could really be learned from the situation and how to nurture a more humble stance that would facilitate learning.

The Challenge of Unlearning Privilege⁷

Systems of science education can marginalize, and indeed oppress, students in multiple ways. Even if science TCs believe the knowledge system of Western modern science to be innocuous, it is important that TCs see how the practices, norms, and social context within which science education is constructed and enacted can reinforce modes of discrimination that differentially impact the student population. When I frame my teacher education courses with the challenge of engaging the full diversity of learners, I want my TCs to know, from the outset of the course, that we are assuming a complexity of identities in the student population. I see many of my TCs glazing over as I discuss diversity, and I am sure that many are just wishing for me to stop; their discomfort is palpable but, I believe, understandable. In order to access understandings about diversity, I do not ask my TCs to imagine being someone else or think about times when they felt oppressed (in part, because I am unconvinced of the effectiveness of such approaches); I want them to hear and be attentive to the messages that teachers send to children every day about their place in science education. There is a level of intentionality with which I am asking my TCs to engage in the process of teaching. I challenge my TCs to examine why they might have been the exception rather than the rule in their educational

⁷ The notion of unlearning privilege was explored extensively by Spivak (1990) in her critique of colonization. She explained that unlearning privilege requires the individual "to recognize that the position of the speaking subject within theory can be an historically powerful position when it wants the other actually to be able to answer back" (p. 42).

experience. I ask what difference in quality they imagine exists between their minds and the minds of those who did not make it through. Such discussions open up opportunities to explore social structures and influential discourses about certain demographic groups as well as confronting bell curve assumptions.

As I teach, I keep in mind Crenshaw's vivid illustration of intersectionality (Crenshaw 1989). She illustrated how antidiscrimination policies and laws tend to be written for those who would be privileged but for a single factor such as their gender or their race. Crenshaw used the imagery of a basement stacked with people who face various combinations of disadvantage in the society. Above their heads (on the main floor of the building) are the privileged, walking around, freely engaging in activity in a manner that is uninhibited, but below ground level is layer upon layer of people who can gain access to the upper floor only through a single open hatch; only those on the top layer, those who would be on the ground floor but for their single layer of impediment, are able to truly imagine themselves ever reaching the hatch and escaping to the main floor. As with all analogies, there are limitations regarding the degree of extrapolation, but the point here is well made; systems of science education in North America are not structured in such a way as to ensure that all students are able to interact *above ground*. There is acceptance that science will not be for everyone and educators often interpret the lack of success in the field as a sign of cultural deficiencies in certain demographic groups or as a simple matter of choice (even though it should be suspicious that people from the same marginalized groups seem to be the ones who opt out of science). Change in such systems is limited by teachers who adhere to bell curve assumptions and have deficit expectations of the dispositions of "the low-income/immigrant child" (as opposed to framing students as children living in low-income circumstances or children who recently migrated to Canada) and images of science as a domain "owned" by White middle class males. I explain to my TCs that these understandings about societal representations of intersectionality are ways to help us explain, not excuse, a social context. This is where the social justice agenda can be used most effectively, when teachers start to see who they are as participants in the complexity of the school science education system.

Implications and Ways Forward

I end this analysis with what I hope will be a few tangible ways forward for science teacher educators. By sharing some of the strategies that I have adopted since the incident outlined above, I hope that, as teacher educators, we can start to open up conversations that will support our TCs as they grapple with issues of social inequity in educational systems. It is also my hope that teacher educators are more able to encourage TCs to think more deeply about the Western modern science knowledge system so that the TCs are informed enough to address histories, philosophies, and assumptions of science with their students, particularly those at middle school age (since this is often the time when disengagement from science is most evident; Archer et al. 2010).

As stated above, one fundamental feature of my science teacher education courses is the framing of the overall course objective as preparing TCs to foster engagement for a diverse range of learners. Since this is stated as the guiding objective for the course, we frequently return to this objective to gauge how we are progressing in the course. The objective also frames the assignments which require TCs to highlight ways in which their pedagogies respond to student diversity. I draw attention to the local Ministry of Education's emphasis

on English Language Learners and students identifying as Indigenous in Canada. In the course assignments, I require TCs to be attentive to diversity in their lesson planning, instructional activities, and assessment and evaluation. I do not have these course requirements merely to encourage TCs to be more culturally relevant; my aim is to encourage a personal deconstruction of who my TCs imagine students to be and to stimulate confrontation of deficit ideologies that attend the subject matter and impact us all as members of society. The idea is to shift the onus away from what students have to do or become in order to be successful in science and focus on how science teachers establish effective learning environments while confronting inequities that are pervasive in systems of education.

The biggest challenge in this approach to teacher education is that the aim is to influence teacher dispositions and not just behaviors, knowledge, or pedagogical skills. In relation to science education, Le and Matias (2019) refer to the difficulty of addressing K-12 science student diversity, noting that “the emotions of the mainly white female teachers when talking about race always shut down the learning and dialogue” (Le and Matias 2019, p. 21). I acknowledge that this can be a work that is very affectively triggering (for teacher educator and teacher candidate) but science teacher educators must persevere, no matter what their own identity might be or the local demographic profile of TCs or school students. Science teacher educators need to use their positions of privilege to reinforce the centrality of confronting and challenging systemic bias.

Another approach that I have found useful is to use data (simple graphs and charts) from my own research and ask TCs to create a story around the data. In my research life, I explore the engagement of children from low-income communities with science education in school and informal education settings. Low-income communities are complex assemblages of people who are minoritized in society on multiple grounds (Burke 2020). I ask TCs to examine data that captures elementary and middle school children’s responses to statements about science, and based on the children’s responses, I ask TCs to explore questions such as: Who are these children? What do we know, what do we not know? What are some easy assumptions to make about the children or the context? How can such data reinforce and/or challenge stereotypes about children in low-income communities? Through this line of questioning, TCs begin to create a story around the data and summon to the fore their implicit pictures of the low-income child. I follow up these questions by sharing qualitative information that provides the children’s explanations for the statement responses they gave. I have found that this approach provides opportunities to open up conversations more readily than making assertions about everyone being biased. The data set that I tend to use for this exercise contrasts the perspectives on science presented by children in a low-income neighborhood with what informal science educators who work in that neighborhood think children will say about science (Burke 2020).⁸ The study challenges stereotypes about children in low-income communities, and, through the analysis, I encourage TCs to consider the biases they have with regard to children who may or may not come from backgrounds like their own.

This academic year, I started using one additional approach that has proven very impactful for teacher candidates (TCs). Figure 1 is a drawing that I commissioned to illustrate Crenshaw’s (1989) account of intersectionality as it specifically relates to science education. To introduce the image, I describe an open invitation being made for people to study and work at the House of Science. In the publicity information, the only criterion for entrance mentioned

⁸ Burke (2020) includes a raw data table that teacher educators could use to generate graphs and charts in similar ways as are described in the text.

Fig. 1 Welcome to the House of Science: Intersectionality in science education and practice

is an interest in science. Entry occurs individually, but, unbeknownst to the applicants, different parties are directed either to the basement or the main floor. Aligning with Crenshaw's conceptualization, people on the main floor are largely insensitive to the people in the basement, and the basement is too deep for people to access the main floor without standing on the shoulders of, or gaining some other form of aid from, others in the basement. TCs are prompted to find themselves (or someone like themselves) and their own story in the picture. They are then asked to pick someone who is unlike themselves and explain their activity in the House of Science: How did they get there? What are they doing? What is their likely future in relation to the house? It is important to encourage the TCs to explain how they know what they assert and what assumptions or evidence this knowledge is based on. As the discussion develops, I encourage TCs to note indicators of race, ethnicity, gender, education level, ability, conformity to norms and expectations, attentiveness to others, etc. This provides a stimulus for rich conversation where TCs think together about the emerging accounts, ultimately examining who or what the gatekeeping director at the entrance represents, as well as mechanisms for access to the main floor through the hatch. Although I experienced an initial reluctance for teacher candidates to engage in the discussion, perhaps for fear of exposure of negative stereotypes and prejudices, I found the prompt "what is the artist trying to portray?"

helpful in encouraging engagement that starts at a safe distance and moves inward as far as the TC will allow.

Conclusion

All teacher educators impact issues of social inequity, either by avoiding them (thereby reinforcing the status quo) or by confronting them in some way. To ignore the legacy of science education is to leave unexamined mechanisms of marginalization that maintain a contemporary form of colonialism. Reflecting on the central incident of this paper, I appreciate that while the intersectionality of my physical presence in the science education classroom encouraged TCs to be more mindful of the way they were presenting what they had previously considered to be neutral information, this physical triggering would not be true for all teacher educators. Citing Rodriguez (1998), Underwood and Mensah (2018) stated that piecemeal approaches to social justice are far from effective, rather teachers should consider such concerns to be the “driving principle in the development and implementation of [empowering] policies, curriculum, and assessment” (Underwood and Mensah 2018, p. 591). This places a responsibility on all teacher educators in all subject areas, and, in light of Universities Canada’s commitment to confronting the lack of equity and diversity considerations in higher education, this presents a new way of framing the underlying purpose of the work that we all do as educators. When equity, diversity, and inclusion issues are conceptualized as policy concerns that will influence our rating as a department, faculty, or university, we have a tendency to think about progress in terms of numbers of individuals, using compartmentalized identity categories (as is critiqued through the intersectionality framework). This allows teacher educators to avoid challenging dispositions and behaviors that reinforce harmful ideologies. As stated by Mensah and Jackson (2018), “there are tangible aspects of life that White[, middle class] people claim as their own” (p. 7) and from which people of color and other minoritized groups are excluded; my aim is that compulsory science education should no longer be one of these fields. I hope that this paper will be used by science teacher educators to stimulate dialog and provide an artifact around which constructive and meaningful conversation foment in the many spaces of science teacher education.

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