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Promoting sustainability in science education programmes: Becoming aware of gender stereotyping and improving practice

● Kelly Davis

As a lecturer in science education, the concept of environmental sustainability is heavily embedded within my teaching. However, this article aims to highlight the links between gender and sustainability. The sustainable development agenda 2030 states that one of its targets is to 'achieve gender equality and empower all women and girls' (United Nations, 2015).

However, the reality is that women are still under-represented in science, technology, engineering and mathematical (STEM) fields (Penner, 2015). This article explores the issue of this under-representation of women, and also specifically looks at changing practice within a primary science teacher training programme. The article not only explores gender equality for women, but also for men, highlighting the stereotypical barriers trainee male primary school teachers encounter.

The issues of 'unconscious bias' and 'stereotype threat' are also discussed, and changes in practice recommended. The article highlights the fact that teachers and higher education professionals are in the fortunate position where they can facilitate change; after all, education is the key to a more sustainable future for all (Nevin, 2008).

The very definition of sustainability is greatly debated, with authors such as Jucker (2002) suggesting that 'there are as many definitions of sustainability or sustainable development as there are people trying to define it' (Jucker, 2002, p.3). Johnston et al (2007) present a simplistic definition of sustainability, which refers to the concept of time and ensuring that something is continued, or maintained over a sustained period of time. Whilst there is obviously some link to time or duration, one may suggest that sustainability is an ongoing process of change, change with the 'hope' or 'aim' that it is continued indefinitely. Interestingly, there is also much debate surrounding the potential domains that warrant this 'sustained change'. Robertson (2014) speaks of the 'triple bottom line' when referring to the different domains. This refers to 'planet, people and profit', sometimes also known as the three Es: 'environment, economics and equity' (Robertson, 2014, p.3). For the purpose of this article, I will be focusing on the concept of 'equity'. Equity refers to 'social equity' or 'equality', which includes 'freedom from unhealthy living conditions, equal access to food, water, employment, education and healthcare' (Robertson, 2014, p.3). When discussing the concept of 'equality' and how this in turn is linked with sustainability, it is





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important to refer to the '*sustainable development goals*' (United Nations, 2015).

The sustainable development agenda 2030 states that one of its targets is to '*achieve gender equality and empower all women and girls*' (United Nations, 2015). Within this document, there are various 'aims'; two very applicable aims in relation to higher education include: '*Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life*' (United Nations, 2015). The second aim that applies to higher education is: '*Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels*' (United Nations, 2015). These aims are particularly relevant in the higher education arena, whereby the ability to obtain an undergraduate or postgraduate qualification may well facilitate the empowerment of women to ensure effective participation and, in turn, the promotion of gender equality at all levels in the future.

The 2014 World Survey focused on the concept of sustainability and gender equality. Findings

suggested that, for real sustainable development to occur, moves towards gender equality must be incorporated into any successful model for change (United Nations, 2014). Some might argue that sustainability and gender equality are not heavily linked. However, the United Nations (2014) report refers to the fact that, if we want to develop a truly sustainable world and future, we cannot '*ignore the rights, dignity and capabilities of half of the world's population*' (United Nations, 2014, p.7). Surely if we do not include women in the building of a sustainable future, we are limiting our potential resources? The United Nations 2014 report also suggests that women have a valuable role to play in the path to sustainable development, claiming that '*women's knowledge, agency and collective action*' have the ability to help to transform the idea of a sustainable future into a reality. The report findings go further, to report that '*failure to capitalise on this would be a missed opportunity*' (United Nations, 2014, p.7). Stevens (2010, p.7) also suggests that there is a definite link between sustainable development and gender, stating that in fact '*the lack of progress on gender equality may be at the heart of the failure to advance on sustainable development*'. It is also suggested that, if women had the access to, and held more of, the leadership





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and decision-making roles, then the journey towards a sustainable future for all would be quicker and more likely to occur (Stevens, 2010), aside from the knowledge, skills and general abilities that women have to offer in the journey to a sustainable future.

It is also important to remember that sustainability incorporates the concept of 'social justice' and the importance of developing a society in which gender does not hinder a person's chances in life. It does, however, still have to be accepted that women all over the world are still experiencing inequalities across the board because of their gender. Women are still struggling with lack of access to work, occupational segregation, gender wage gaps, access to education and exposure to violence (United Nations, 2015). Whilst many of us in the United Kingdom may feel that societal constraints related to gender do not hinder our chances of promotion or leadership possibilities, the very real fact is that women are still under-represented in political and decision-making processes (United Nations, 2015).

Whilst feminist perspectives obviously play an important role in the gender debate, these

perspectives in particular highlight specific flaws in much of the discourse surrounding sustainable development. Feminist critiques of the current picture of sustainable development argue that '*women's rights are consistently being negotiated out*' (Post 2015 Women's Coalition, n.d.). It has also been suggested that there is a lack of understanding, that for many women the issue is not complete exclusion, but 'exploitative inclusion', inclusion in '*very unequal terms*' (Post 2015 Women's Coalition, n.d.). It is this type of gender inequality that the students we teach may well experience within the UK workforce and it is therefore this type of gender inequality that we need to work, with our students, to eradicate and transform, now and in our future generations.

Women in STEM

As a lecturer in science education, my role is to teach science to trainee primary school teachers. This is an interesting area in terms of sustainable development, particularly when referring to science and the gender inequalities that can manifest themselves within the Science, Technology, Engineering and Mathematics (STEM) community. Although the picture is now a great deal more





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positive in terms of women being represented in the sciences at university level, there is still not complete parity between the two genders within science higher education (Sax, 2000; Zakaib, 2011). Penner (2015) highlights that women are still *'under-represented in areas of science, technology, engineering and mathematics'*. The question remains: why are women still under-represented in the STEM subjects at university level and in employment? Authors such as Penner (2015) make reference to the importance that research has placed on gender-related attitudes and stereotypes and the impact that this in turn has on the representation of women in science-related disciplines. Miller *et al* (2015) found that *'pervasive stereotypes associating science with men emerge early in development and exist across cultures'* (p.631). These gender stereotypes are thought to play a part in influencing children's future career paths. These gender stereotypes link heavily with lecturers' professional practice and that of the trainee teachers whom they teach.

Even if women enter the STEM professions, they leave at a much higher rate than their male peers. There are a number of factors that have been found to be the reason for this lack of retention of women

in STEM subjects. Workplace environment (including innate gender bias, lack of potential career progression and pay discrepancies), bias (unconscious bias of fellow colleagues, leadership, etc.) and family responsibilities (higher percentages of women become the primary carer for children) are all factors thought to contribute to the poor retention of women in the STEM fields (Hill *et al*, 2010).

One of the first exercises that I ask my first year science specialist students to do is to draw a scientist – the first image that enters their heads (Chambers, 1983). It is still surprising that, out of a class full of science specialist trainee teachers (largely female), only one or two draw female scientists. They are then asked to look around the room and consider this and then discuss the concept of stereotypes and the factors in our lives that could have played a role in these unconscious stereotypes. Thirty years on from Chambers' original (1983) research that found that only twenty-eight out of five thousand children drew a female scientist, it seems that these stereotypes still exist and are deep-rooted within our unconscious (Miller *et al*, 2015). At this point, one might question the importance of this in terms of





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sustainability and the concept of equity. If our students, who are the teachers of tomorrow, are demonstrating this unconscious bias regarding gender roles, then will this be perpetuated throughout the primary schooling system, unless these unconscious stereotypes are identified now and students are given the guidance to address these stereotypes in their own teaching?

The concept of 'unconscious bias' suggests that we all *'form stereotypical associations and make inaccurate judgements about people (positive or negative), without explicitly being aware that we do so'* (Muneer, 2015, p.1). Unbelievably, it is even possible to demonstrate bias against the groups that we, ourselves, belong to (Muneer *et al*, 2015). Stereotypes can negatively affect the students we teach in unexpected ways, creating what is referred to as a 'stereotype threat' (Spencer *et al*, 2015), whereby the student will 'live up to' the stereotype and behave in a way that confirms the stereotype (Spencer *et al*, 2015). Sterling (2001) highlights the fact that *'gender discrimination continues to permeate education systems'* (p.13). Although the idea of failing to address common stereotypes at university level may not seem as dramatic as 'gender discrimination', when talking about the

education of the teachers of tomorrow we are dealing with high stakes here. These teachers could play an important role in the next (and future) generation's uptake of STEM subjects (Miller *et al*, 2015).

Changing practice

Once potential barriers to gender equality have been highlighted, then it is important for higher educational professionals to reflect on how issues such as unconscious bias can be combated at higher education level. Muneer *et al* (2015, p.1) suggest that there are seven ways of *'mitigating unconscious bias in teaching and learning'*. These steps include the importance of understanding that unconscious bias exists and that everyone has some form of it (Muneer *et al*, 2015). By understanding this, then, as lecturers, we will be able to incorporate ideas and activities within our teaching to counter these unconscious biases.

Socio-cultural factors are thought to play a significant role in the reinforcement of gender stereotypes, in science in particular. *'Media, opinions of teachers and peers, participation of family members in science'* and a number of other





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socio-cultural factors are thought to contribute to this issue (Miller *et al*, 2015, p.631). With numerous influencing factors, when addressing our practice and rather than just identifying that gender stereotypes are still prominent in our society (previous practice), we need to incorporate and model these examples of conflicting stereotypical gender roles to the students whom we teach, whilst encouraging them to do the same when they are teaching children. Miller *et al* (2015) discuss the importance of continuous and repeated exposure to examples of counter-stereotypic women in a variety of contexts. The variety of contexts will be particularly imperative for children; otherwise the examples presented will be *'dismissed as atypical'* (Miller *et al*, 2015).

There are a number of recommendations for ensuring the recruitment and success of women in scientific fields whilst at university and beyond. Teaching students about real life applications of science, publicising the achievements of women in STEM subjects, teaching children, students and academics about stereotype threat and the importance of the growth-mindset, creating an open and safe environment and discussion regarding bias (colleagues and students), all play an

important role in encouraging and retaining women in science and in higher education (Hill *et al*, 2010). It is very important that we (as higher education professionals) incorporate these ideas into our lecturing at university level and encourage our students to do the same in their own teaching.

Gender equality for all

The premise of this article is the promotion of gender equality for a sustainable future. Up to this point I have spoken about the under-representation of females in STEM-related disciplines. However, I teach teachers to teach science to primary school children and the recruitment of females on this course is fairly high, although it must be stated that some of the women we do recruit often struggle with particular scientific areas (such as physics) because of a lack of confidence in their own abilities (this could potentially be linked to the stereotype threat). Across the whole of the Bachelors of Education programme, there are fewer males than females. Recently it has been reported that *'one in four primary schools in England has no registered male teacher'* (Teaching Times, 2008). There are concerns that, if there are very few male primary school teachers, then there could be an





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'over-feminisation of primary schooling' (Skelton, 2005, p.197). Skelton describes the fact that much academic discourse in this area has been surrounding the 'over-feminisation' of primary schooling, potentially leading to the 'disaffection' of boys at primary school. Whatever the resulting impact of very few males in primary school teaching, clearly the current state of play does not reflect (or promote) a fair and equitable model for gender sustainability.

Why are so few males entering the primary school teaching profession? Cushman (2005) found that trainee male teachers had concerns ranging from *'the status of primary school teaching, the level of the salary and issues relating to physical contact with children'* (p.228). Primary school teaching is often seen as a 'woman's job', aligning to outdated stereotypical gender roles of women being 'caring' and 'mothering', males being the 'breadwinners' and the 'masculine' gender (Skelton, 2003). Clearly the causes for the low number of male primary school teachers (and retention of these) are multifaceted. In order to develop and sustain a *'teaching force which is representative of both sexes (as well as representative of a range of ethnicities, social class and so on)'*, it is necessary

to make changes at all levels of the educational journey (Skelton, 2005, p.207). Whilst the male students whom I teach are comfortable with the science (they appear to be more confident in the majority of cases), conversely they are not as confident with their interactions with children from the start of the course (contrary to their female counterparts).

Sustainable practice and gender equality

It is very interesting that, within my practice, I teach groups of students who are often facing societal gender stereotypes. I teach science to women, who are significantly under-represented in scientific fields and leadership/decision making roles, and I teach male primary school teachers, who are also significantly under-represented in their chosen careers. Although I have often thought about the under-representation of women in STEM subjects, I had not as frequently reflected on the stereotypes and barriers to learning (and training) that trainee male primary school teachers face. I am now determined to change my practice as a lecturer, incorporating not only counter-stereotypical images of men and women, but creating an open and honest environment with my students. I plan to





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incorporate the concept of unconscious bias into my teaching, with the aim of encouraging my students to consider their own biases and reflect on how they too can adapt their practice with children, in order to feed into the pursuit for a country and world where one's gender does not restrict or inhibit one's life chances, or the ability to be heard on an equal platform to others (Spencer *et al*, 2015).

Throughout the process of writing this article, I have discovered that equality and social justice are not loosely linked to sustainable development; they are at the very core of it. Gender does not define what we are capable of, and a society that perpetuates this is a society that limits and obstructs the development of brilliant minds such as Rosalind Franklin, whose input was integral to the discovery of the DNA double helical structure. As teachers and higher education professionals, we are in a fortunate position where we have the ability to facilitate change. After all, education is the key to a more sustainable future for all (Nevin, 2008).

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