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A Capability Approach
Its Potential for Transformative Education Research Focusing on Education for Sustainable Development and Gender Issues in Science Teacher Education

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Abstract

In this article, I use the capability approach to explore the role that the science, mathematics and technical subjects (SMTs) teacher education curriculum can play as a 'gender conversion factor'. This comes amidst evidence that a major hindrance to the participation of girls in these disciplines is a lack of gender responsiveness in the pedagogy applied in schools. Seven teacher educators, who were purposively sampled at a Technical Teachers' College in Zimbabwe, were the research participants. I adopted a case study design in which I used in-depth interviews, focus-group discussions and document analysis to generate data. Data was analysed deductively using predetermined themes based on an analytical tool anchored on Sen's two, but quite distinct, aspects of freedom, that is, the opportunity aspect and the process aspect of freedom. The findings reveal that there is a limited awareness of gender issues among teacher educators, and that these issues are not being transformed into curriculum practice. All in all, it is evident that curriculum practices of SMTs teacher educators are riddled with gender blindness and so trainee teachers graduate from college without the necessary agency to deal with personal, social and environmental conversion factors that can play a role in girls converting the curriculum into functionings (beings and doings) and wider freedoms and valued beings and doings (capabilities).

Background and Context

Economic and social development in any country relies heavily on a sound technology base, which can be achieved by placing an emphasis on science, mathematics and technical subjects (SMTs) at all levels of the education system. Ensuring good health, fighting diseases, protecting the environment, farming and developing agriculture, developing new industries and technologies, and even building resilience to climate change are all activities that require knowledge, skills and values offered by these disciplines. It therefore follows that there is a need to harness the intellectual and scientific capacity of both men and women for sustainable social, ecological and economic development of any country. Ironically, SMTs constitute the areas within the educational system where gender disparity in several of the poorest countries of the world is greatest (Sinnes, 2006; Cleggy, 2007; FAWE, 2008; Ministry of Labour & Social Services, 2010). Research has shown a persistently visible gender disparity in these disciplines – which is glaring from secondary school level and beyond – characterised by low female enrolment, poor performance and low retention. For example, Table 1 shows the percentages of men and women in the faculties of science in selected Southern African Development Community (SADC) countries.

Table 1. Percentage of men and women in Faculties of Science

Angola		Botswana		Lesotho		Malawi		Mozambique		Swaziland		Tanzania		Zambia		Madagascar		Zimbabwe	
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
40	60	28	72	26	74	37	63	23	77	28	72	30	70	35	65	33	67	24	76

Source: SADC Gender Protocol Barometer, 2011, p.96.

Researchers who advocate for gender equality in sciences (e.g. Kalu, 2005; Cleggy, 2007; FAWE, 2008; Chikunda, 2010) argue that one major hindrance to participation of girls in SMTs is the lack of gender responsiveness in the pedagogy applied in schools. This is further confirmed by the fact that, although it is now common knowledge that gender imbalances in SMTs exist, teachers are often unaware or unaccepting of this situation and would not naturally feel the need to address it (FAWE, 2008). Such research evidence seems to suggest that SMTs teachers are not receiving from their teacher education the necessary skills, knowledge, values and attitude to engage with social issues such as gender in their curriculum practice. It is such glaring evidence of gender inequality in education that arouses critics to question the commitment of teacher education, as a human development and training sector, to the global efforts towards gender equality in education as a means of achieving social justice.

Over the years, however, efforts have been under way to redress gender imbalances in education. Notable endeavours in this regard were conceived and nurtured by UN-sanctioned initiatives such as Education for All (EFA), the Millennium Development Goals (MDGs), the Beijing Platform for Action (BPfA), and Education for Sustainable Development (ESD). Milestones along the road towards gender equality in education in general have been achieved owing to these international efforts. For example, the Zimbabwe MDGs Country Report (2010) shows that gender equality in terms of enrolment at primary-school level is balanced; in fact, 2009 saw a pro-female enrolment rate of 50.5%. The SADC Gender Protocol Barometer (2011) shows that, in the region generally, girls perform better than boys at primary and secondary levels. This new finding shatters the long-held cultural myth that girls are less capable. Nonetheless, the same barometer laments the low participation of females in the faculties of science. This is despite gender affirmative action policies which have been implemented for years in various ways, such as allowing women access to university education (especially that in science-related faculties) with lower entry points than their male counterparts.

We may want to ask ourselves: What went wrong or where are we going wrong? Why is it that these efforts towards gender equality did not bring about the desired outcome in SMTs in the past years? It is from the viewpoint of what gender justice or gender equality in education should mean that a lot of capability approach-oriented commentators are less satisfied with the philosophy, and hence the efforts, behind the MDG and EFA programmes. For example, MDG 3 was broadly framed to 'promote gender equality and empower women' (Aikman, Unterhalter & Challender, 2005:44). Within the Goal, the target relating to education was set in terms of

eliminating gender disparity in primary and secondary education, preferably by 2005, and at all levels by 2015. Commentators raised concerns that a broad goal of gender equality in political, economic, social and cultural relations is thus interpreted in a limited form as equal numbers, for example of boys and girls in formal schooling (Aikman, Unterhalter & Challender, 2005; Unterhalter, 2005; Unterhalter & North, 2011). The argument is that gender inequality is deeply embedded in *cultural norms*, as well as in the norms of institutions, their decision-making processes, their forms of exercising power, and their rules, unwritten cultures, and approaches to allocating resources (Unterhalter, 2005) and cannot be washed away by mere parity of enrolment. Other commentators have also pointed out that gender parity is misread to mean gender equality, and equality is conflated with gender equity in education (Aikman, Unterhalter & Challender, 2005; Unterhalter 2005). Similarly, the right to education cannot be reduced to merely completing a particular level (McCowan, 2010). All that these arguments point at is physical access in education, which does not always guarantee epistemological access.

Despite these critiques, and after pronouncements of the need for gender equality in education by international bodies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), most governments and non-governmental organisations (NGOs) now enrol girls in school as a way of heeding the United Nations' (UN) call for education to be a basic human right. Herz and Sperling (2004) identified four key areas that are said to have 'worked' as a means for governments to get girls into school. These were:

1. Eliminating school fees and offering scholarships to certain populations;
2. Providing safe schools nearby every village;
3. Making school a safer place where girls are encouraged to learn; and
4. Providing quality education by way of educated and trained teachers, up-to-date books and a curriculum oriented to the contemporary world.

Very few of these efforts actually concentrated on the transaction between teachers, learners and ideal content. Commenting on the challenges facing educational improvements and transformation to suit current societal demands, Ball and Forzani (2007:529) lament:

> As more and more diverse people need to learn more and more varied things than ever before... an educated citizenry is needed to tackle societal problems of health care, inequality, hunger, energy, poverty, and environmental sustainability. Yet delivering effective education remains a problem. Formal schooling and educational programs often fail. Students retain misconceptions even after instruction, basic academic skills are often undeveloped, and many youth leave school unprepared to participate competently in a democratic and diverse society. Most troubling is that education is delivered unevenly and inequitably.

This quote is, in my view, calling for transformation in teacher education. It is because of such ills as the persistent gender disparities in some sectors of education such as SMTs that the education transformation question comes to the fore.

Education transformation is embedded within the discourse on education for sustainable development (ESD), with environmental sustainability, gender and peace as some of the tenets. In this article, I work primarily with the aspect of gender within a wider frame of ESD and use a capability lens, assisted by the feminist paradigm, to explore the role of teacher education in achieving social justice through gender equality in SMTs. My point of departure is that gender discrimination in SMTs needs to be addressed in order for sustainable societies to emerge, and this needs to be done by unearthing and addressing the stumbling blocks that hinder girls from doing well in these disciplines. What is also required is that greater attention be given to these issues in teacher education curricula. Addressing SMTs education issues from a gender perspective is crucial to ESD and for longer-term, social–ecological sustainability, as many women, especially in sub-Saharan Africa, are responsible for managing household well-being, for contributing to natural resources management, for engaging with climate change risks as they produce food, and so on. Confronting gender discrimination within SMTs requires an orientation to education that is transformative, and the capability approach offers unique philosophical lenses for such an endeavour.

Theoretical Framing: The Capability Approach and ESD

The way we view education is continuously being challenged by the paradigm shift towards viewing development less and less in economic terms and placing the human being at the centre of concerns. In the same spirit, the United Nations Development Programme presents sustainable and human development in terms of enlarging people's choices (Hoffman, 2005). Sen, in his capability approach, expands the idea, arguing that development consists of the expansion of the capabilities of persons in order to lead the kind of lives they value and have reason to value (Sen, 2009; Elliot, 2007). Drawing on Sen (1992), Robeyns (2005) describes capabilities as being made up of people's potential functionings. Functionings are 'beings and doings' (Robeyns, 2005:65). Examples are being well fed, taking part in community or class activities, being sheltered, relating to other people, working in the labour market, caring for others, and being healthy, and so on (Robeyns, 2005:65). She further clarifies that the difference between a functioning and a capability is similar to the difference between an achievement and the freedom to achieve something, or between an outcome and an opportunity. Capabilities therefore correspond to the overall freedom to lead the life a person has reason to value (Kronlid, 2009; Sen, 2005, 2009; Nussbaum, 2000, 2005; Addobbo & Picchio, 2003). For Sen, from this viewpoint, development is about removing the obstacles to what a person can do in life, obstacles such as illiteracy, ill health, lack of access, or lack of civil and political freedoms (Fakuda-Parr, 2003).

Applying this to the SMTs teacher education curriculum, learning should be a capability to transformatively engage with sociocultural constraints that impede SMTs learning for any socio-demographic group. My reasons for using the capability approach to explore its potential for transformative education research towards gender equality in SMTs teacher education is inspired by Sen (2009), Unterhalter (2007) and Robeyns (2007), who, in exploring the idea of capabilities in support of the intrinsic importance of gender equality in education, came up

with three fundamental motives: firstly, because it helps establish conditions in which a broader capability set is available to girls and boys; secondly, because it alerts us to differential conversion processes linked to gender and other social divisions with regard to how resources are utilised to establish a capability set; and, thirdly, because of the importance of gender equality in basic education in preventing human insecurity and establishing conditions for capabilities and freedoms.

With regard to the second point, Robeyns (2007) argues that the relation between a good and the functionings to achieve certain beings and doings is influenced by three groups of conversion factors: personal, social and environmental. I discuss each in turn below.

Firstly, *personal conversion factors* (e.g. metabolism, physical condition, sex, gender, reading skills, intelligence) influence how a person can convert the characteristics of the commodity or resource into a functioning. She gives, as an example, a person who is disabled, or in a bad physical condition, or has never learned to cycle, for whom the bicycle will be of limited help to enable the functioning of mobility (Robeyns, 2007).

The focus on personal conversion factors is particularly important in a study focusing on gender. Feminist standpoint theorists support the view that men and women have different standpoints in life. Such theorists critique science as being developed primarily from the perspectives of one group, which is male (e.g. Harding, 1991; Keller, 1998; Kelly, 1985; Roychoudhury, Tippins & Nichol, 1995). In view of such arguments, the capability approach can help to evaluate, for example, how girls would convert goods and resources, like laboratory equipment such as batteries, wires, electrical equipment and other instruments that ordinarily are deemed to be for men, into their well-being in physics. In this particular case, a gender-responsive SMTs teacher education curriculum would acknowledge and encourage the differences between the two sexes as they engage with SMTs. Within such an initiative, girls, too, would be encouraged to value and appreciate their own experiences and interests as girls (Sinnes, 2006).

The same reason highlights the ability of the capability lenses to draw attention to gender and other subtle social divisions with regard to how resources are utilised to establish capabilities in a SMTs teaching and learning set-up. If we take a teacher as being a crucial 'resource' in any learning situation, one would expect learners of both sexes to access this resource equally. However, research findings point to the contrary. A substantial body of research suggests that most SMTs teachers enjoy teaching boys more, spend more time with boys, hold higher expectations regarding boys' achievements, use resources more suitable for boys, and urge more male participation (Kalu, 2005; McCullough, 2004; Prasad, 2004; O'Connor, 2000). In turn, boys tend to believe SMTs are their domain. Therefore, they tend to be more assertive and are more forceful in getting the teacher's attention through taunting and harassing girls who tend more towards compliance and conformity (O'Connor, 2000). Kalu attributes such gender-specific classroom behaviour to socialisation and gender-role expectations inherent in most African communities. In the case of a gender-responsive teacher education curriculum, it would be important for trainee teachers to be afforded the opportunity to engage with cultural and classroom underpinnings that may be detrimental to girls, based on such research findings, so as to develop skills and attitudes in them to broaden the scope and range of their capabilities.

In other words, teacher education, as a gender conversion factor, will be expected to equip future teachers with pedagogical knowledge, skills and attitude to assist girls to cross the gender divide that saturates the ontology and epistemology of SMTs.

Secondly, *social conversion factors* (e.g. public policies, social norms, discriminatory practices, gender roles, societal hierarchies, power relations) and, thirdly, *environmental conversion factors* (e.g. climate, geographical location) play a role in the conversions that occur from the characteristics of the good to individual functioning (Sen, 2009). The conversion possibilities within the capabilities approach offer a major critique of welfarist-/instrumentalist-driven approaches to gender equality as found in key policy initiatives such as the MDGs and the EFA documentation, as discussed above. Knowing the goods a person owns or can use is not sufficient in order to know which functionings he or she can achieve; or what capabilities he or she has reason to value. Therefore, we need to know much more about the person and the circumstances in which he or she is living, as well as about his or her agentive capacity (Sen, 2009). The capability approach thus takes account of human diversity in two ways: by its focus on the plurality of functionings and capabilities as the evaluative space; and by the explicit focus on personal and socio-environmental conversion factors that transform resources into functionings, and on the whole social and institutional context that affects the conversion factors and also the capability set directly (Sen, 2009; Unterhalter, 2007 and Robeyns, 2007).

Applying this to the SMTs learning and teaching scenario, establishing conditions in which a broader capability set is available to both girls and boys would mean a curriculum that is free of gender bias and stereotypes and in which the experiences of both females and males are represented. In this sense, one would expect an SMTs teacher education curriculum that engages with gender dynamics in the ontology and epistemology of school science. This would mean alerting trainee teachers to pay attention to, and be aware of, research documenting differences in girls' and boys' engagement and interest in SMTs, and making sure that teachers are able to design learning activities that capture such differences and interests (Sinnes, 2006). Furthermore, one would expect trainee teachers to engage with social conversion factors during their training (e.g. the patriarchal social norms and discriminatory practices, gender roles, societal hierarchies, and other power relations that may impede girls from accessing SMTs at the same level as boys). On the other hand, enabling social conversion factors such as the National Gender Policy would be engaged with to build agency for transformative education among future teachers; and enabling environmental factors such as safe and healthy schools near communities (with good sanitation facilities) may also facilitate transformative education and increased participation of girls in schooling, and potentially therefore also in SMTs.

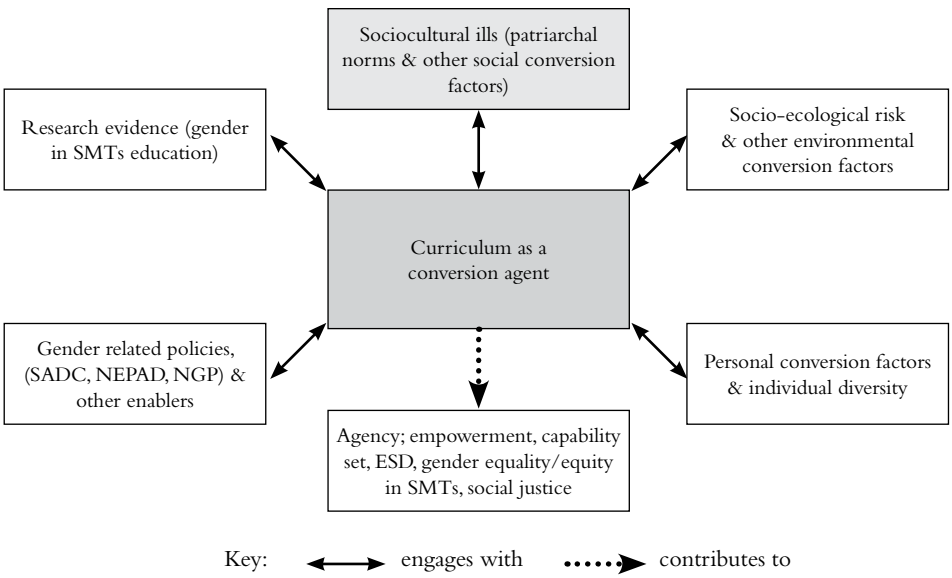
Sen's conception of the role of education, which is to establish conditions that expand people's substantive freedoms to do things that they have reason to value for their sake (Elliot, 2007), dovetails well with the principles of ESD. Education should equip people with knowledge of, and skills and values for, sustainable development, thereby making them more competent and confident to live a healthy, productive life in harmony with nature and with concern for social values, equity – including gender equity – and cultural diversity (UN, 2005), as well as concern for ecological sustainability and other aspects that contribute to the common good. Hoffman (2005) adds that ESD must be an education that aims to help people of all ages

better understand the world in which they live, and better act on this understanding. It needs to address the complexity and interconnectedness of problems such as poverty, consumption, environmental degradation, climate change, health, and population issues, including HIV/AIDS, conflict, inequality and the violation of human rights. ESD has to address these topics by providing not only information, but also the abilities needed to understand and use this information and to establish agency and attitudes supporting behaviour in the context of social practices that lead to sustainable development (UN, 2005; UNESCO, 2005).

To achieve this, the teacher education curriculum needs to be a 'gender conversion agent' itself. Such a curriculum would be a catalyst that would enable future teachers to 'convert' retrogressive gendered practices into capabilities for learners. In such a curriculum, there is a need to pay attention to negative social conversion factors (patriarchal norms and other sociocultural ills) and to engage them in a critical and transformative manner. There is also a need to take advantage of the enabling sociopolitical factors such as gender-related policies, critical and emancipatory pedagogies, and research on gender and ESD and to factor them into the curriculum.

The flow diagram in Figure 1 shows the context of a curriculum that is destined to be a 'gender conversion agent'.

Figure 1. Representation of a Teacher Education SMTs capability set curriculum



Objectives and Research Questions

The main goal of the research was to assess the SMTs teacher education curriculum as a gender conversion factor. The rationale behind this is the assumption that teachers and students alike

come from the same patriarchal background. There is a need, therefore, for teacher education, as an agent of the education and training sector, to play this conversion factor role so as to equip future SMTs teachers with the knowledge, attitudes and skills for gender-responsive pedagogies. To realise the goal of gender equality in SMTs, teacher education is mandated to play the role of a conversion factor by the National Gender Policy (NGP) in Zimbabwe (Ministry of Gender & Community Development, 2003), which stipulates the need to:

- Amend all relevant education and legal instruments in order to promote gender equality and equity;
- Encourage girls to take on science, mathematics and technology at all levels of education; and
- Introduce gender-awareness programmes in pre- and post-training teacher courses.

To realise the research goal, the study sought to respond to the following questions:

1. What capability set (opportunity freedom) is available for girls in the SMTs teacher education curriculum?
2. Which conversion processes are afforded by the SMTs teacher education curriculum so as to establish the capability set in view of gendered sociocultural constraints?

To infer on these broad questions, the study explored the level of gender responsiveness in the SMTs teacher education curriculum by interrogating teacher educators' perceptions of the push-out factors for girls in respect of SMTs, teacher educators' engagement with gender-related policies, and the role that teacher education is playing in bringing about gender equality in SMTs.

Methodology

Data was generated by means of a case study approach focusing on selected SMTs educators in a teacher education college in Zimbabwe, southern Africa. The case study employed document analysis, in-depth interviews and focus-group discussions. This methodological triangulation enhanced the validity of the research (Kelly, 2004; Cohen, Manion & Morrison, 2010), which, in the case of the study reported on here, can only be extrapolated to the specific case. When teacher educators are referred to in the text below, I am referring to those teacher educators involved in the study. Broader, multi-site case studies and/or questionnaire research will be needed for the study to be generalisable to all teacher educators in southern Africa. Seven in-depth interviews were held at the teacher education college: with the head of the division; with three lecturers in charge of each SMTs department (sciences, mathematics, technical subjects); and with one lecturer from each department. Two focus-group discussions were held, one for the technical subjects and one for science and mathematics. Document analysis focused on syllabi, enrolment policy, examination papers, research projects and other assessment tools.

Results and Discussion

To assist me to generate and analyse data, I designed a template (Table 2) based on the capability approach, ESD principles and feminist theory. The template as an analytical tool is anchored on Sen's two, but quite distinct, aspects of freedom, that is, the opportunity aspect and the process aspect of freedom. The opportunity aspect of freedom is concerned with 'our ability to achieve what we value … to pursue our objectives' (Sen, 2009:258). The process aspect attaches importance to the process of choice itself in order 'to make sure that we are not being forced into some state because of constraints imposed by others' (Sen 2009:258). The first two rows of the template were designed to infer the gender capability put in place in the SMTs teacher education curriculum so as to prepare future teachers to avail themselves of these freedoms in their own practice. The last two rows focus on assessing agency in the SMTs teacher education curriculum. Data was gathered and analysed abductively. The following themes were used:

- Knowledge of/perceptions on push-out factors for girls in respect of SMTs;
- Role that teacher education can play in improving the participation of females in SMTs; and
- Level of engagement with gender, ESD and curriculum transformation-related policies.

Knowledge of push-out factors for girls in respect of SMTs

Research tools were designed to use teacher educators' perceptions of push-out factors for girls in respect of SMTs and their views on gender imbalance in SMTs as indicators to infer their level of gender responsiveness in their curriculum practice. Under this theme, research items solicited information on teacher educators' knowledge of the factors that impact on the opportunity freedom or well-being achievement of girls in SMTs. In other words, items probed teacher educators' knowledge and attitudes regarding factors that impact on girls' physical and epistemological access to SMTs.

The findings reveal that all the teacher educators were familiar with gender disparities in SMTs education. Each one of them could tell a story showing gender inequality in terms of enrolment, retention and progression of girls and boys in SMTs from the secondary level of education and beyond. One could say that teacher educators in the sample had some basic levels of gender sensitivity, meaning that they had the mere ability to perceive existing gender inequalities as these apply to gender-disaggregated data only, especially when it came to enrolment and retention. However, this level of gender awareness did not seem to influence the curriculum practices of the teacher educators interviewed. Instead, teacher educators apportioned blame to the girls (blaming the victim) (see Evidence extract 1 below). Judging from such responses during the interviews (both individual and group), teacher educators were far from being classifiable as gender-aware, let alone gender-responsive in their curriculum practice.

Table 2. Capability template to assess gender responsiveness in SMTs teacher education curriculum

Aspects of capabilities (for boys & girls)	Aspect of Education	Expectations on teacher education (what teacher education should prepare trainee teachers for)	Assessment Standard for the SMTs Teacher Education Curriculum
Opportunity freedom. Wellbeing achievement (ability to achieve)	• Accessing, retention and progressing in SMTs • Better carrier prospect (aspects that are constitutive of one's wellbeing)	- Facilitate physical access (parity issues- affirmative action, -Enable cognitive access to SMTs	TE Level of gender awareness: • perception on push out factors for girls • perception of the role that TE can play towards gender equality • ability to use gender lenses in curriculum development • engagement with gender responsive pedagogies.
Process freedom (Wellbeing freedom)	Conditions to do well in SMTs (freedom from gender stereotypes, discrimination or violence (direct or symbolic), socio-cultural constrains etc.).	• Appropriate pedagogies, learning materials and assessment that account for gendered styles of learning. • Engaging with gendered cultural issues • Learning environment that values and appreciative of gendered experiences in SMTs • Critical of the gendered ontology/epistemology of SMTs- catering for gendered conversion processes	Open up alternative combinations of functionings for girls and boys in SMTs trainees: • engagement with gender responsive pedagogies. • engagement with gender/ESD related policies • develop capacity in trainee teachers to engage with gender socio-cultural constraints • develop capacity to create gender inclusive environment in schools.
Agency achievement	Success in(valuing and have reason to value) SMTs	Building agency in trainees focusing on gender differences and cultural constraints on girls. Critical look on rights in education, e.g. Rights and participation: Who (which groups) are defining what is to be taught and how it is to be delivered? (To what extent are women a part of this?) Rights and conceptions of the person: What are girls being taught about who they are in their education? Rights and institutions: Do the processes in which education is institutionalised and delivered allow girls' effective participation? Are girls'/women's existing situations enhanced or diminished through the education they receive?	• Critical/democratic pedagogies • ESD pedagogical strategies
Agency freedom	Having conditions to exercise agency (access to information, chance for discussion and evaluation of learning, freedom to make up one's mind without violence or shame)		

(adapted from Unterhalter, 2003 p.118)

Evidence extract 1

Researcher:

> Now let us talk about the possible push-out factors for girls from science. Why do you think girls become less and less interested in sciences as they continue with their education?

Participants (several interviewees):

- They [the girls] believe that science is for boys/is difficult.
- They put less and less effort [into] science as they proceed [with] high-school education.
- Girls are socialised to do easier stuff.
- Some look up to men to look after them in life.
- They are capable/able, but they put [in] less effort.
- At F3 (G10), they have acquired a gender identity and they want to be recognised as such by male counterparts – [the] implication... [it] is unfeminine to be good in physics, for example. Some even start [romantic] relationships.

Focus-group interviews:

- Girls perceive them [science and maths] as a male domain.
- They are normally weak in maths.
- I don't know why more boys than girls opt for physics; probably it's a perception that girls have that physics is a male domain.
- This perception, I think, is propagated by teachers themselves.
- Lack of motivation by teachers.
- Teachers propagate stereotypes.
- Society looks down upon females.
- Information technology is lifelong learning; it depends on the character of the person – females [are] not willing to continue learning.
- Males are more creative, more forthcoming, and [are] adventurous.
- Females not, probably due to socialisation … not that they are dull.

Supplementary items in the category of knowledge of push-out factors for girls in respect of SMTs looked at teacher educators' perceptions of patriarchy as both an ideology and culture and its impact on designing and learning of school SMTs. The idea was to further probe teacher educators' level of gender awareness and extrapolate this to curriculum practice in order to check whether there is provision for a gender capability set in the teacher education curriculum. Six of the seven in-depth interviewees were found wanting. They could not link cultural gender inequality inherent in patriarchy to SMTs learning and teaching. In the interviews and focus-group discussions, teacher educators acknowledged having witnessed, especially during their high-school teaching, attributes such as: boys being inclined to be more assertive and more forceful in getting teachers' attention, with girls tending more toward compliance and conformity; and boys taunting and harassing girls so as to cow them away

from active participation in sciences, especially practical activities that they (the boys) deemed male-oriented. Surprisingly, as shown in Evidence extract 2 below, teacher educators could not attribute such gendered pedagogical behaviours to patriarchal power socialisation and sex-role expectations inherent in most African communities, even though there is an abundance of such reports in the literature (e.g. O'Connor, 2000; Prasad, 2004; Kalu, 2005; FAWE, 2008; Rwodzi, 2006; Cleggy, 2007). Moreover, because of the 'blame-the-victim' response, teacher educators did not see it as core business to incorporate gender issues into their teaching.

Evidence extract 2

Researcher:

> Traditionally, in our African homes (Christian values as well), girls/females are expected to be obedient, submissive, passive… personality attributes that may not be in accordance with active participation as required in SMTs learning. How do you see this affecting learning and what can possibly be done to equip a trainee teacher to handle such cultural issues?

Interviewee 1:

> Learners should be able to draw the line between culture and academic aspects – when we are in class it's about learning, [and] nothing to do with behaviour at home. Opportunities [for] education for all are there; the fault is theirs [the girls], not the system.

Interviewee 3:

> Teacher education institutions should bring this issue [the impact of patriarchal socialisation] to the trainee teachers, [and] make them aware of gender stereotypes… This should be in our methods syllabus, [but] for now we don't talk about cultural issues in science education.

Using the capability lenses to interpret this evidence extract shows that lack of knowledge and/or improper attitudes to gender concerns result in lack of agency in the case of teacher educators. Such agency is required to transform curriculum practice and to adopt appropriate pedagogies that would engage trainee teachers in encounters with the skills, knowledge and attitudes to deal with gendered cultural issues that could improve the well-being freedom of girls in and through SMTs. Teacher education, in this case, is not doing as Sen (2009) suggests, that is, establishing conditions that expand people's substantive freedoms to do things they have reason to value for their own sake.

The ontology and epistemology of school science was also put under the spotlight in this research in order to assess the level of gender responsiveness of SMTs teacher educators. The idea was to assess whether SMTs teacher educators prepare their trainee teachers to be aware of, and equip them to respond to, the experiences, learning interests and styles of both girls

and boys in SMTs. Put, in simpler terms, interview questions were designed to check whether teacher educators were aware of the gendered nature of SMTs as taught in school; and hence of the need to alert trainee teachers to this and equip them with the relevant knowledge and capabilities. Evidence gathered shows that all of the teacher educators had some experience of the different ways in which boys and girls would prefer to learn. However, the teacher educators were not translating this into their own curriculum practice, as none of them was able to come up with clear-cut curriculum practices to ensure that trainee teachers get exposure in this regard. Evidence extract 3 highlights some of the opinions.

Evidence extract 3

Researcher:

> Do you think girls and boys may have different preferred learning styles?

Interviewee 1:

> Yes … there are girls who prefer to work with boys, these are clever girls –they have confidence… and may want to show the boys that they know just like them.
>
> There are girls who prefer to work in a group of girls only – the average and the weak ones.
>
> On the other hand, boys, whether weak, average or gifted can work with anyone; they don't care much. When they make mistakes they are not very worried … life goes on – it's an attitude thing.

Interviewee 5:

> Well, probably yes… . What I have seen is that the examples talk more about males and appeal more to boys than to girls… . Obviously, I know that examples [of women's] experiences will appeal more to girls. Unfortunately, most examples in textbooks make reference to males and their socially ascribed gender roles.
>
> We hope to improve as we work towards a new syllabus on equipping our trainee teachers to be able to pick out and engage with such issues in textbooks.

These responses make one wonder how the teacher education curriculum caters for the freedom of girls, both as regards the opportunity aspect and the process aspect of it in SMTs. The evidence shows that, despite their knowledge of preferred, different learning styles between girls and boys, teacher educators are not providing future teachers with the necessary capabilities, that is, the ability to achieve curriculum practice in a gender-responsive manner.

As a result, teacher education lacks the necessary agency to allow girls to flourish increasingly in SMTs. There is deprivation of capabilities on the part of the teacher education curriculum, capabilities that would allow future SMTs teachers to exercise their agency freedom so as to afford both girls and boys real opportunities to achieve well-being freedom in SMTs. Instead, SMTs teacher trainees are likely to graduate from college without the required 'agency freedom', that is, access to information related to gender and science learning. For example, the curriculum does not allow them to look critically at: who (Which groups?) are defining what is to be taught, and how it is to be delivered (To what extent are women a part of this?); what girls are being taught about who they are in their education; whether the processes in which education is institutionalised and delivered allow girls' effective participation; and if girls'/women's existing situations are enhanced or diminished through the education they receive.

The role that teacher education can play in improving the participation of females in SMTs

Sen (2009) argues that our evaluations and policies should focus on what people are able to do and be, on the quality of their life, and on removing obstacles in their lives so that they have more freedom to live the kind of life that, upon reflection, they have reason to value. In the same vein, I argue that the aim of curriculum development, which is the core function of teacher education, should be to remove obstacles to learning so that youngsters can flourish in school. In view of the gender disparity reported on above, one would expect a SMTs teacher education curriculum to be so designed as to remove obstacles that may hinder girls from flourishing in SMTs. Gender-responsive curriculum practice would entail responding to gender issues in an endeavour to find ways of eradicating the bias and discrimination, thereby ensuring equality and equity. Further, one would expect that teacher education (as a tertiary institution) should contribute to social justice by working towards the eradication of gender inequality, and by equipping future teachers with the necessary values, knowledge, skills and attitudes. This would be a way of responding to the National Gender Policy. At a global and regional level, this will be a synergic way of teacher education contributing to achieving some of the MDGs, the EFA agenda, and other subregional policy interests such as those framed in the SADC Regional Indicative Strategic Development Plan. It could also contribute to curriculum reorientation as encouraged by ESD. At individual professional level, this entails inculcating in both teacher educators and trainees qualities of reflexivity and agency.

With this in mind, I wanted to find out whether SMTs teacher educators are aware of the role that they can play (within teacher education) so as to improve the participation of females in the sciences. All this was done in order to assess the level at which SMTs teacher education operates as a gender conversion factor.

As noted above, SMTs teacher educators had some sense of gender disparities. However, they did not articulate any substantive gender-responsive strategies beyond suggesting greater involvement of girls in SMTs, and making links to the national policy. Their responses did not reflect, for example, making use of gender-responsive pedagogies and how these could be brought into the curriculum, or the efforts to deconstruct the SMTs curriculum and its

assumptions. The responses, as is apparent in Evidence extract 4 below, indicate that teacher educators gave a set of somewhat disjointed responses regarding the role that they play, or could play, as teacher education institution in equipping future teachers accordingly. Furthermore, the framed solutions seemed to rely on the girl child to respond to the complexities of the SMTs curriculum context. In general, there was some level of what can be described as 'gender blindness', the failure to realise that policies, programmes and activities can have different effects on men and women, and that this often leads to rigidity and unchanging attitudes to the more complex aspects of gender and SMTs, and to the wider constraints facing girls in SMTs, such as the masculine nature of the knowledge that is accepted as scientific.

Evidence extract 4

Researcher:

> What curriculum efforts are there/are you putting into your practice to impart gender-responsive skills, knowledge, and attitudes to future SMTs teachers?

Interviewee 1:

> The education [is failing to stress] to the girl child that we are all the same. There is nothing like subjects for boys and some for girls. … Teachers don't convey such messages to girls. … I sensitise my own trainee teachers [to] this. … Last week I spoke about it, giving a lived example [where] … 8 out of 10 who did well in a test were females.

Interviewee 3:

> We always try to make a reference to the low involvement of females in maths. … TEs [teacher educators] should try by all means in their practice to motivate girls to [study] maths/the sciences. … We always point it out that they [the trainee teachers] should try as much as possible to motivate our girl child out there to [engage with] maths/science.

Focus group:

- [There is] no college policy [on] gender-responsive pedagogy.
- There should be some national policy [on finding] mechanisms to promote girls' access to [the] sciences.
- A way [should be found] to incentivise girls to participate in the sciences, e.g. bursaries for tertiary education. However, they should enter tertiary [education] with the same score [as] boys … lower entry points tend to attract prejudicial attitudes.

This evidence led me to conclude that teacher educators in the context of this case lacked the tools/artefacts and institutional culture to equip future teachers with knowledge, attitudes

and skills regarding gender. Document analysis of syllabi, past examination papers and research projects did not show any institutional commitment to building a gendered capability set in curriculum practice. There was, however, a noted commitment in some minutes of meetings to factor in gender when enrolling students at the college. This means that the college is committed to ensuring physical access of females to SMTs, but, beyond this, there is no guarantee that future teachers will acquire skills and knowledge through training to ensure cognitive access to SMTs. Such an assumption and narrow conception of gender equality in education (Unterhalter, 2007) overlooks the existing gendered social relations in school bureaucracies and in the societies of which they are part. All in all, it is evident that curriculum practices of SMTs teacher educators in the context of the case are affected by gender blindness. Consequently, trainee teachers graduate from college without the necessary agency to deal with girls' conversion factors (personal, social, environmental) that can play a role in them converting the good (curriculum) into functionings (beings and doings).

Level of engagement with gender- and ESD-related policies

Gender-responsive policies are a social conversion factor that can facilitate the transformation of a good into individual functioning. In this case, the Zimbabwe National Gender Policy (Ministry of Gender & Community Development, 2003) clearly stipulates: encourage girls to become engaged in science, mathematics and technology at all levels of education; and introduce gender-awareness programmes for pre- and post-training teacher courses. It follows that the SMTs teacher education curriculum will benefit more from such pronouncements in the process of being a gender conversion factor curriculum. In contrast, as Evidence extract 5 shows, there was minimal or no evidence of engagement with such a policy in the teacher education institution, and little awareness of other global initiatives designed to achieve gender equality in education. This means that the social and institutional context provided by policy was not well engaged, even though it has the potential to influence the gender conversion factors that can establish the capability set for girls in sciences.

Evidence extract 5

Researcher:

> Do you in any way engage with gender-related policies, such as the National Gender Policy, in your relations with the teacher education curriculum, and, if so, how?

Several interviewees:

- Haven't heard of such a document.
- Haven't seen it; hence [there is] no college policy [on] gender-responsive pedagogy.
- Not sure … When we teach science, we just teach science.

Researcher:

> What do you put in place to ensure education for all in SMTs, as prescribed by Education for All frameworks for example?

Interviewee 2 & 4:

- There is equal opportunity to study SMTs for all the children [both sexes].
- We don't actually see any tangible barrier to deny girls equal access to SMTs.

Conclusion

Use of the capability lens to explore gender responsiveness in curriculum practices in this article has shown up some of the gaps that exist between policy and practice, and which need to be attended to for gender equality to be achieved in SMTs in teacher education in particular and in education in general. The agency aspect in the capability approach looks at what human beings can do to bring about improvements, particularly through policy and political changes. Sen (2009) regards such agency itself as a valued functioning. In other words, the agency aspect looks at the achievement of states of well-being. In this regard, it has become clear that, by and large, the teacher education curriculum is failing in two ways. Firstly, the policy practice gap implies that teacher education as an institution lacks the agency to put policy into practice in moving towards social justice and human rights as related to concerns associated with gender equality in SMTs. Secondly, and related to this; the curriculum is not building that agential capacity for future SMTs teachers to be agents of change.

Notes on the Contributor

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