

# SOUTH AFRICAN SCIENCE CURRICULA INTENTIONS AND ENACTMENT IN RESPONDING TO GENDER INEQUALITIES

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## Abstract

The South African science curricula aim to equip learners, from all socio-economic or cultural backgrounds, with essential knowledge, skills, and values to meaningfully participate in their communities as informed citizens. Furthermore, the curricula stipulate that issues of inequality and social justice, such as gender inequality, should be addressed in science classrooms. Historically, the female child has been marginalised when tackling fundamental life challenges which require STEM-related knowledge and skills. Learners' interests in science-related subjects also remain a critical issue in South African schools, more so for females as they are often demotivated and find science challenging. Previous studies have blamed the curricula for lack of explicit guidance to teachers, resulting in poor curricula implementation. The present study argues that poor female learners' participation and performance, and lack of interest in science, emanate from the curricula silence on how gender inequalities can be addressed in science classrooms. The study sought to determine the extent to which the science curricula guide teachers to respond to gender issues in their classrooms. This paper reports on the extent to which science curricula deliberately guide teachers on what gender issues they need to address, why they should address them and how they can do this, whilst teaching science topics. The study is guided by critical social theory as theoretical framework. In a qualitative case study, data was collected through analysis of curricula documents for the three science domains: Natural, Physical and Life Sciences, in terms of how content should be taught in relation to gender issues. Data collected were subjected to content analysis. Findings revealed that science curricula documents show superficial relationships between content and gender issues. There is a lack of guidance to teachers on how to enact gender responsive teaching. One example is the superficial reference shown in the Life Sciences curriculum on the importance of a balanced diet for different genders, and human population growth and gender distributions. The findings provide implications for both science curricula designers and policy makers on the need to articulate gender matters in the science curricula and also provide guidance on how science teachers may implement gender responsive teaching and learning in their classrooms to reduce or eradicate inequalities. The author acknowledges the study's limitations in portraying gender as binary rather than as a continuum.

**Keywords:** *Gender inequality, gender stereotypes, science classrooms, social justice.*

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## 1. Introduction

Despite incremental progress in women's representation in some countries and not others (Miller, Eagly, & Linn, 2015), Science, Technology, Engineering, and Mathematics (STEM) fields continue to be male dominated, as persistent gender disparities in participation and leadership roles remain evident (Kerkhoven et al., 2016; UNESCO, 2015). In the South African context, the national science curricula purport to empower learners, irrespective of socio-economic or cultural background, with the knowledge, skills, and values necessary to engage meaningfully in their communities (Department of Basic Education [DBE], 2011). These curricula also claim to prioritise issues of inequality and social justice, including gender inequality. However, such aspirations often remain theoretical rather than practical. Historically, girls have been systematically excluded from opportunities that demand STEM competencies, with this marginalisation deeply rooted in both societal norms and educational practices.

Crucially, female learners continue to report lower interest and confidence in science, which contributes to their underperformance and disengagement in the subject. This is not merely a reflection of individual aptitude or preference, but rather the result of a structural failure: the science curricula's silence on how teachers should explicitly confront gender inequalities in the classrooms. While policy rhetoric gestures toward inclusivity, its lack of practical, gender-sensitive pedagogical strategies renders it

ineffective. This study therefore argues that the underrepresentation and underperformance of female learners in science is not an incidental occurrence but a systemic issue, stemming from a curricular void that fails to offer actionable guidance on how to dismantle gender biases in science education. If science classrooms are to become really inclusive, curricula must do more than mention gender inequality but rather equip teachers with the tools to meaningfully address it.

### **1.1. Purpose of study**

The purpose of this study was to critically examine the extent to which the South African science curricula explicitly guide and support Life Sciences, Physical Sciences (Grades 10-12), and Natural Sciences (Grades 7-9) teachers in addressing gender issues within their classrooms. This analysis aimed to identify the degree of alignment between curricula expectations and practical teaching strategies for promoting gender equity, with a particular focus on how these curricula enable teachers to recognise and challenge gender biases, create inclusive learning environments, empower all learners to fully participate in science education. Therefore, the study sought to answer the following research question: How do the South African science curricula address gender issues within the classrooms?

## **2. Literature review**

Different STEM curricula around the globe continue to articulate issues of inclusivity to ensure diverse learners are catered in the classrooms. Inclusivity in this case refers to the provision of opportunities for underrepresented learners to receive quality education through not only the creation of conducive learning environments but also by equipping them with the knowledge and skills to be successful (Lynch, et al., 2018). Lynch et al. (2018) argued that such STEM-focused curricula require well prepared STEM teachers. In this study I argue that the preparedness of STEM teachers should not only be viewed in terms of subject matter knowledge but also in terms of pedagogical knowledge and skills that help teachers to transform the knowledge so that it becomes more accessible to diverse learners.

In essence gender inclusivity and sensitivity should be a priority of the curriculum if gender responsiveness is to be realised. In a study to determine how teachers employed gender responsiveness to attain gender equality among the learners and the gender-responsive teaching strategies used in delivering science lessons and learning activities, Canuto and Espique (2023) pointed out that gender responsiveness start with lesson preparation then the teaching and learning materials, the gender responsive language used till the teaching and learning strategies and activities used to implement the lesson. Based on this point, it means that the curriculum should be articulate in the way it guides teachers to teach the different content topics if gender responsive science classrooms are to be realised.

Notably, gender matters such as biases, stereotypes, inequalities, gaps and discrimination manifest in classrooms (Hernandez & Cudiamat, 2018). Researchers such as Wigati (2019) have a positive view of schools as significant systems to alleviate gender disparities. An important question arises that, if schools and science classrooms are to address gender issues, what do the science curricula say with regards to how this should be done. Is this left in the hands of the science teachers and school management to design what they consider as gender responsive teaching and learning? If there are guidelines stipulated in the curricula, are they explicit to ensure teacher proof?

### **2.1. Theoretical framework**

As a way of unravelling the sociohistorical inequities that are prevalent in societies, the current study is framed by critical social theory (Kincheloe & McLaren, 2011). In essence critical social theory links and explains social reality with practical aims to address social injustices. Kincheloe and McLaren (2011) argue that societal inequality persists not merely because of overt structures of power, but because those who are oppressed often internalise their subjugation as natural or inevitable. This acceptance becomes the most insidious tool of oppression, allowing privilege to be reproduced without resistance. By framing dominance as normal, the status quo is maintained, and critical questioning is silenced. Kincheloe and McLaren's critique challenges teachers and researchers to expose and disrupt these internalised hierarchies, rather than passively accepting them as fixed realities. In the current study the injustices relate to the lack of gender responsive science curricula or the lack of guidance on how to design gender responsive teaching and learning environments in the science classrooms.

## **3. Methodology**

This was a qualitative case study which involved the analysis of the South African curricula documents for the three science domains: Natural Sciences, Physical Sciences and Life Sciences. The analysis process involved identifying the following aspects related to gender as a way of ensuring

inclusivity in the science classrooms: 1. The curricula intention to addressing gender matters; 2. How gender responsive teaching and learning should be implemented; 3. Topics where gender is incorporated or mentioned; and 4. Examples of activities or strategies to address gender in terms of how content should be taught in relation to gender issues. Data collected were subjected to content analysis.

## 4. Research findings

### 4.1. South African science curricula general aim and principles related to gender

The broader science curriculum, as part of the National Curriculum Statement Grades R-12, operates under foundational principles of inclusivity and sensitivity to diversity, including gender (including the Natural, Life, and Physical Sciences). This aims to ensure equal educational opportunities for all learners irrespective of gender, but this is a general principle of the curriculum's design and implementation rather than a specific articulation of gender issues within most subject content areas. Teachers are guided to use curriculum differentiation strategies to address diversity, which could implicitly include considering gender. While the curricula clearly articulate the principle of gender inclusivity as part of the broader curriculum's commitment to social justice, equal opportunity, and addressing diversity, they do not provide explicit examples or stipulations on how gender-responsive teaching and learning should be implemented within the specific content or activities of all the science disciplines.

Examples of gender inclusivity in the CAPS FET Life Sciences and Physical Sciences Grade 10-12 curriculum are encapsulated in the foundational principles and aims of the National Curriculum Statement Grades R-12, rather than in specific content topics or practical activities outlined. The CAPS was designed as an effort to bring transformation aimed at redressing educational imbalances of the past and ensure equal educational opportunities for all learners from diverse backgrounds. To place the imbalances in context, before attaining democracy in 1994, South African education system followed a curriculum where the majority Black populace received education that was 'inferior' to the education received by the white minority populace.

Among other issues, the current National Curriculum (NCS) explicitly endeavours to equip learners, irrespective of their gender, with the knowledge, skills, and values necessary for self-fulfilment to allow meaningful participation in society. In this way the NCS demonstrates DBE's commitment to gender equality in terms of access to education. In essence due to its reference to gender, human rights, inclusivity and social justice, the curriculum outlines the need to be sensitive to issues of diversity such as gender. Thus said, by considering issues of gender and social justice, the curriculum therefore addresses the United Nation Sustainable Development Goals (SDGS) for example quality education (SDG 4), gender (SDG 5), and reduced inequalities (SDG 10). Because inclusivity is central to teaching and learning, this requires teachers' understanding of how to recognise and address barriers to learning, and how to plan for diversity, gender included.

The following sections provide an analysis of each of the three science curricula to assess how matters of gender are articulated. Specifically, the analysis focuses on the topics where gender matters have been mentioned, how gender is articulated in those topics, and to determine how teachers are guided to address gender issues related to those topics.

### 4.2. Gender inclusivity in life sciences curriculum

The topics, practical activities, and assessment requirements in Life Sciences focus on mostly scientific concepts and skills. These are presented without specific instructions or examples related to gender-responsive pedagogy or content differentiation based on gender. Therefore, the examples of gender inclusivity provided in the sources are the foundational principles, aims, and mandated approaches to teaching and planning for diversity that apply to the Life Sciences curriculum as a whole, rather than specific instances of how gender is addressed within the subject's content or teaching methods itself.

The topics in the CAPS FET Life Sciences Grades 10-12 curriculum that explicitly mention aspects about gender or males and females are primarily found where the biological differences between sexes are central to the subject matter or when discussing factors influencing biological processes in humans. The curriculum refers to gender in the topics that follow.

**4.2.1. Grade 11: Human nutrition.** Within the discussion on Human Nutrition under the "Life Processes in Plants and Animals" strand 1, the content specifies discussing "the importance of a balanced diet and changing requirements due to age, gender and activity levels" (DBE, 2011, pp. 44). This clearly shows that nutritional needs differ based on gender.

**4.2.2. Grade 12: Reproduction in vertebrates (specifically human reproduction).** Under the "Life Processes in Plants and Animals" strand for Grade 12, the topic "Reproduction in Vertebrates" is listed, with a specific focus on human reproduction. This topic inherently involves the biological structures, functions, and processes specific to males and females, such as testes, ovaries, copulation, ejaculation, ovulation, and menstruation, which are distinct aspects related to male and female biology.

While other topics (e.g., mitosis and meiosis) discuss fundamental biological processes that occur in both sexes, and in other concepts such as endocrine system, which involves hormones, including sex hormones (not explicitly), the curriculum content shows the distinction of males and females or mention gender-specific requirements primarily in the context of human reproduction and human nutrition. The curriculum does not provide topic-specific examples for this beyond the biological necessities of human reproduction and the nutritional point in human nutrition.

### **4.3. Gender inclusivity in natural sciences curriculum**

Analysis of CAPS Senior Phase (Grades 7-9) Natural Sciences curriculum identified aspects about gender or males and females primarily within the Life and Living knowledge strand, specifically when discussing Human Reproduction and Systems in the human body. The details follow.

**4.3.1. Grade 7: Life and living.** Within the topic of sexual reproduction, under the sub-heading of human reproduction, the curriculum mentions the biological roles of males and females in reproduction. It states that "the main purpose of reproduction is for the sperm (male sex cell) and egg (female sex cell) to combine... and produce a baby" (DBE, 2011, pp. 20). This section also covers puberty, describing it as the stage "in the human life cycle when sexual organs mature for reproduction" (pp. 20). It further details the distinct structures involved, listing the male and female reproductive organs. The content also links puberty to the release of sex hormones (testosterone and oestrogen) from the testes and ovaries, respectively, and indicates that these hormones cause secondary sexual characteristics.

**4.3.2. Grade 9: Life and living.** The topic systems in the human body include the reproductive system. The dedicated topic of Human reproduction in Grade 9 reiterates the purpose (gametes combining) and puberty. It also highlights the role of the pituitary gland triggering testes and ovaries to release sex hormones (testosterone and oestrogen), causing secondary sexual characteristics. It also lists and describes the male reproductive organs and female reproductive organs as stages of reproduction.

### **4.4. Gender inclusivity in physical sciences curriculum**

The Physical Sciences curriculum does not mention specific teaching methods or content adjustments aimed at making the teaching and learning 'gender-responsive' beyond the general principles of inclusivity for all diverse learners.

## **5. Discussions**

The findings show a clear superficial of treatment of gender issues within science curriculum documents. Although the Department of Basic Education (DBE, 2011) nominally acknowledges gender by stating that every learner, regardless of gender, should be supported to reach their full potential, this reference is relegated to the curricula's general aims and principles, lacking any meaningful integration into the actual content or pedagogical guidance. A closer examination of the Life Sciences curriculum reveals only a token mention of gender within the context of human nutrition, a gesture that falls short of meaningful engagement. Beyond this isolated instance, the Life Sciences and Natural Sciences curricula mirror the Physical Sciences curriculum in their complete silence on gender.

This absence of explicit gender considerations and pedagogical strategies for inclusivity undermines efforts to promote equality in science education. Crucially, it contradicts the assertion by Lynch et al. (2018) that STEM-focused curricula must be underpinned by teachers who are not only well-prepared but also equipped to navigate and address gender dynamics in their classrooms. The current science curricula fail to provide such guidance, thereby implicitly upholding the gender biases it claims to challenge. This signals a critical oversight in curriculum design and teacher support, one that perpetuates the marginalisation of gender issues in science education rather than dismantling them. An inclusive curriculum should embed gender responsiveness within its structure, content, and instructional expectations. Considering the social critical theory, this mirrors what Kincheloe and McLaren (2011) lamented as the institutionalisation of these ill practices which may end up as normal, yet they are not.

## 6. Conclusions

Considering the analysis made, it shows that the three science curricula do not stipulate any gender responsive teaching and learning. Whilst in principle the curricula commit to responding to the needs of all learners from diverse contexts, gender included, it does not guide teachers on how they should do it. It is silent on the implementation strategies which leaves the teachers to do as they see fit. The findings provide implications for both science curricula designers and policy makers on the need to articulate gender matters in the science curricula and provide guidance on how science teachers may implement gender responsive teaching and learning in their classrooms to reduce or eradicate inequalities. The author acknowledges the study's limitations in portraying gender as binary rather than as a continuum.

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