Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.9, No.16, 2018

Initiatives of Ethiopian Government in Improving Females' Participation in the General Secondary School Science Education

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Abstract
The study was aimed to evaluate the status of male and female students in their instructional practices, particularly in science education under the GSSs of North Wollo Zone. To achieve the objective, Evaluative research was used. Documents of grade 10 national examination results were taken as the research pool. Of these, by considering their recentness, the researcher was selected the four year's (2013-2016) national exam result documents purposively. Accordingly, the required data was collected by using document analysis, and it was analyzed quantitatively by percentage, mean, Chi-Square test, and Standardize residual test. Sex (male and female), and the two extreme grade levels ("A" and "F" scores) were used as units of analysis. The finding of the analysis indicated how females were poor academically than their counterparts. The variations which observed between male and female students in terms of passing in to preparatory school by considering all nine courses, in terms of scoring "A", and scoring "F" in the three science subjects were 3.75%, 47.81%, and 12.76% respectively. This inequality is confirmed by the Chi-Square test analysis which shows that the calculated x^2 value (1098.8) greater than the critical value of x^2 (5.02). This verifies that male and female students have scored differently in the science national examinations. As a result, it is possible to say that female students were poor performer than males especially in the science subjects. Consequently, the researcher concluded as, although the FAWE's GRP is regarded as an important strategy to achieve gender equality in the instructional process, GSS female students of North Wollo Zone did not perform academically as males in the national examinations. Therefore, teachers' GRP practices of the zone need to be assessed and evaluated; MoE and Regional Education Bureaus, in collaboration with other stakeholders should make a concerted effort and should take appropriate actions in order to solve this inequality. The GSSs GRP practices have to be investigated; roles played by teachers, students, schools in general towards GRP also need to be evaluated.
Keywords: General Secondary School; Gender, Initiative; Pedagogy; Science Education

Chapter One
Introduction
1.1. Background of the Study
The acquisition and use of science and technology are critical for the achievement and sustenance of food security, as well as the promotion of public health and environmental quality. The importance of science and technology to modern societies, and the role of a technologically educated population in promoting social and economic development, has long been recognised (UN, 2002; 2002a, cited in Birhanu, 2015). The desire to improve science achievement through more effective instructional strategies and the increasing awareness in recent years of the teaching learning situation also has directed a lot of attention to understand how learners learn and how to help them learn concepts (Udeani and Okafor, 2012).

However, there are challenges which hit the instructional participation of students, particularly females in the educational organizations of Ethiopia. To begin with, societal perception of the nation towards gender is found at the infancy stage. Cultural factors such as early marriage, social and family gender role expectations, family and community low commitment to children's education etc. have affecting students' learning (Teklu, 2013). Because, the long-standing cultural misconception of the community and the family more specifically forced marriage, verbal insult, beating up, insecurity, rape, etc. persist unresolved until now (MoE, 2010). Molteno, et al. (2000, cited in Karim, Z., and Shahidul,S. 2015) stated that when girls reach puberty, parents consider it is a time for them to be married and tend to arrange the marriage instead of continuing their schooling.

Parents also prefer to send girls to Arab counters as home servant than males by considering them as the source of financial income especially in the North Wollo Zone. Karippai, R., and Belay (2010) put their witness by saying that many school going girls from Wollo and other parts of Amhara move towards Metema to go to Sudan illegally with the help of illegal agents. On the way, according to them, they have waited for one or for two months or more in Gondar or Bahir Dar cities, have worked in hotels or bars to meet daily living costs, and have get trapped into sexual exploitations.

This sexual harassment has far reaching implications for the teaching and learning processes which hamper girls' learning (Mlama P., Dioum M., Makoye H., Murage L., Wagah M., and Washia R., 2005). As the research output has demonstrated, according to them, a sexually harassed student does not feel safe and cannot perform to his/her fullest potential.

Some secondary school teachers as well felt that science has always been a male subject and that female students do not have role models to look up to, and their support status of females is poor (FAWE, 2011). For instance, in Ethiopia, teachers viewed boys positively than girls because they usually expect girls to quit school early (Colclough et al., 2000, cited in Karim, Z., and Shahidul,S. 2015). Lawernz, et al. (2009, cited in Tesfaye, 2010) added by arguing that teachers believed that males and females have considerably different prior understandings of sciences subjects, especially physics and mathematics, with females less likely to take high school physics and making more negative shifts in attitude towards physics.

Furthermore, inadequate numbers of teachers, textbooks, and other education inputs; low-level of awareness on the special support for girls; lack of curriculum design for promoting gender equality; sexual harassment in school, and housing problems at secondary level in particular continue to hinder the performance of girls' schooling (MoE, 2010). There is also a strong government commitment to gender issues; but, implementing bodies at different levels do not pay attention due to the absence of accountability (MoE, 2010).

As a result, commitments on women's and girls' access to and participation in science and technology have been made by governments at the international and national levels (UNESCO, 2010). The collective efforts of nations to address the situation of gender inequalities in education and occupations have been undertaken as far back as the 1940's both at global and at country level (Grace, 2010). As to UNESCO (2010), the Beijing platform for action, adopted at the fourth world conference on women (1995), calls on governments and all stakeholders to increase women's access to and retention in science and technology, including by adapting curricula and teaching materials and by increasing the share of women teachers in scientific and technological disciplines at all levels of education.

Consequently, the Ethiopian government has committed to address the gender disparity in various sectors by introducing various initiatives, policy directions, and institutionalizing ministerial offices (Teklu, 2013). It is very evident that gender issues have received high priority in the education policy of Ethiopia since the new government came to power in the early 1990s. A specific objective of the policy was to use education to change attitudes towards the role of women in development. This included giving attention to gender issues in curriculum design, placing special emphasis upon the recruitment, training and assignment of female teachers, and giving financial support to raising the participation of women in education (Rose, P., 2003).

To minimize and get rid of biased attitudes on girls and factors that influence the participation of girls in education, and address the equity aspect of education services to citizens, the first, second, and third education sector development programs have been realized within the framework of the Education and Training Policy (MoE, 2010). In these programs, gender issue was a strategic direction with a special focus given to balancing the rates of enrollment and achievement of girls and boys at all levels of the education system.

Further, the government has enacted and issued the national women's policy in 1993. It is one of the many developmental policies that the government has issued to improve the living standards of the population at large. This policy ensures equality between men and women (Bosena, 2004). The initiative, according to Teklu (2013), also illustrated through the establishment of the Ministry of Women's Affairs, its commitment on Millennium Development Goals, and the various affirmative actions taken in education and employment aspects.

In order to ensure integrated gender equality in the education sector, laying out and implementing a strategy has been necessary and indispensable (MoE, 2010). To this effect, as the ministry stated, the national girls' education strategy has been adopted in 2005 and realized since then. This national girls' education strategy document focuses on the current status of girls' participation in education, obstacles to the education of girls, real change processes, analyzing lessons of what constitutes good practice for girls' education, and initiates strategic directions to ensure girls enrolment and achievement in education. Without bringing advancement in girls' and women's education, progresses are less likely to be attained in any of these prioritized issues.

To add more, Ethiopia has played similar initiatives to increase females' participation in science education. For example, science, technology, and innovation policy (STIP) lunched in 2012 to increase the number of engineers and natural scientists in manufacturing and service providing enterprises. It explicitly calls for increasing "the number of females enrolling in engineering, science and TVET institutions." (Federal Democratic Republic of Ethiopia, FDRE, 2012, cited in Helina, 2015).

To realize this, gender responsive pedagogy (GRP) has taken as major strategy by FAWE which can treat both girls and boys equally in the instructional process (FAWE, 2005). The GRP refers to teaching and learning processes that pay attention to the specific learning needs of girls and boys. It calls for teachers to take an all-encompassing gender approach in the processes of lesson planning, teaching, classroom management and performance evaluation (MoE, 2014).

The FAWE was launched in 1992 to increase access, improve retention and enhance the quality of education for girls and women in Africa (Mlama, P., et al., 2005). And the pedagogy was initiated in 2005 and has been introduced in Burkina Faso, Chad, Ethiopia, Gambia, Guinea, Kenya, Malawi, Namibia, Rwanda, Senegal, Tanzania, Uganda, and Zambia (David, H., 2011).

To achieve its intended objective, FAWE developed a teacher's handbook on gender responsive pedagogy

as a contribution to the on-going debate on how to improve quality in education provision. The handbook has been designed as a practical guide to make teaching and learning processes gender responsive (FAWE, 2006). It is intended to be the teacher's practical guide for making day-to-day teaching more gender responsive. It will also assist teachers to acquire deeper insights into gender responsive pedagogy (GRP) and develop classroom practices that are gender friendly (Mlama, P., et al., 2005). Specifically, according to them, the handbook has objectives such as equip teachers with knowledge, skills and attitudes for GRP; enable teachers to develop and use gender responsive methodologies that ensure equal participation of both girls and boys in teaching and learning processes, and to assist school management to mainstream gender issues at the school level.

By realizing this fact, Ethiopia has implemented the GRP by adopting its own manual in October 2014, and by considering it as a national policy since then (Girl Power Alliance, GPA, 2015).

This manual, in particular, focuses on how to create a gender responsive academic environment; it explores the various ways of making learning and teaching processes responsive to the specific needs and interests of students at both primary and secondary levels (MoE, 2014). The Ministry also added by arguing that the manual can assist teachers to acquire deeper insights into GRP and develop classroom practices that are gender friendly. It is expected that the wider use of this manual will contribute to the improvement of the quality of the provision of education in Ethiopia.

GPA (2015) argued that with the collaboration of FAWE, CTEs of the nation, Hawassa and Gondar for example, have implemented the GRP manual. To do so, as GPA asserted, the CTEs' management became more supportive to their gender offices and the gender focal individuals provide more support to girls by using the tutorial from the handbook. The CTEs also adopted guidelines to reduce sexual harassment at several colleges that put in place clear and consistent procedures. Accordingly, the scale of the progress made so far is shown by the fact that in 2015 Gondar CTE has more female than male students for the first time ever.

The ministry of education in collaboration with FAWE Ethiopia has also mainstreamed FAWE's GRP model in pre-service training. For example, David and Lucile Packard foundation partners in Ethiopia have committed to integrate GRP in more than 300 schools in which they are currently working (Njambi, L., and Wanjiru,F., 2015). Correspondingly, the nation has worked towards integrating GRP in pre-and in-service teacher training courses of higher education. According to Demissew (2017), five Key courses are reviewed and updated in pre-service and in-service teacher training programs in the three higher learning institutions (HLIs):

> In Bahir Dar University, secondary education curriculum and instruction for PGDT (post graduate diploma in teaching) program is reviewed. In Hawasa teacher training college, courses such as cross cutting issues in education, and child development and learning are reviewed. In addition, courses of primary school curriculum and instruction, and application of learning theories in primary school are also reviewed and updated in Kotebe Metropolitan University.

Similarly, based on his further reading, the researcher perceived the GRP as an important strategy which enables teachers, school leaders, counsellors, and the school in general to involve both male and female students in the instructional activities, as much as possible, equally. Predominantly, the pedagogy indicates how teachers prepare their lesson plan; design and select the required teaching materials; how they can employ language and teaching methodologies in the instructional process; how they also evaluate their students' performance, interact with their students, and manage the classroom. Moreover, it also shows how school leaders address sexual harassment, how they aware teachers about gender issues, and how school counsellors help students particularly females in the time of menstruation. So, if the manual is implemented as it argued, as to the researcher, there is an opportunity to get initiation from students, mainly females to participate in the instructional activities enthusiastically.

Generally, gender sensitive school environments help promote gender equality and address the barriers to girls' education. Hence, is important to create a gender sensitive school environment through the practice of gender responsive learning and teaching processes. Where gender awareness and GRP are not practiced at school level, female and male student may not enjoy equal learning opportunities (MoE, 2014).

Related to getting scientifically and technologically oriented citizens, Ethiopia has worked hard in the areas by designed and signed different policies and conventions respectively which enable females to participate more in education. These indicate how Ethiopia is familiar and has strived to achieve gender equality in the education sector.

Therefore, assessing to what extent this commitment (getting gender equality in science education) has enabled female students to perform science instructional activities as male in the general secondary school of North Wollo Zone is vital.

1.2. Statement of the Problem

To solve the gender inequality problem, as stated before in background section above, the FAWE project is taken GRP as an appropriate strategy. Because, as Mlama, P., et al. (2005), FAWE (2006), and MoE (2014) argued, it helps teachers to attain detail insights to involve both boys and girls in the instructional activities. Particularly,

according to them, the project has worked to equip teachers with knowledge, skill, and attitude to support girls; to enable teachers develop and use gender responsive methodologies that ensure equal participation of both girls and boys in the teaching and learning processes, and to assist school management to mainstream gender issues at the school level etc. Similarly, Ethiopia has also taken GRP as a national policy since 2014, and has worked towards gender equality (GPA, 2015).

However, the researcher couldn't get any conducted researches which can assess how this GRP has enabled girls to be competent with their counterparts in science academic performance though many researchers have administered their studies in line with gender equality in Ethiopian educational institutions.

For example, Kassahun (2006) carried out a study to assess how socio-economic and political factors affect gender equality in private higher institutions of North Gondar; Ogato, G.S. (2013) also conducted a study to explore the quest for gender equality and women's empowerment in least developed countries to achieve MDGs and identify policy and strategy implications for Ethiopia**.** Getnet (2010) was administered a research to investigate the current status and challenges of females to participate in the primary education of Dessie Zuria District. Furthermore, Tadesse (2009) also administered a study on female students' academic achievement in SNNPR.

There are also others who have conducted studies in line with gender equality. Haftu, et al. (2015) administered a study on sexual abuse and associated factors among female students in Woldiya High School, North Wollo; the research conducted by Eshetu (2015, cited in Teodros, 2016) in Ambo University concludes that there is high-level of sexual harassment on the university campus; the conducted study in high schools of Gondar town by Kelemu (2013, in Haftu, et al., 2015) also showed that the prevalence of sexual abuse among female high school students was 49.6%. A similar research by Gemechu and Meleku (2012, in Teodros, 2016) confirms a high pervasiveness of sexual harassment against female students at Hawassa University.

Most research outputs of Haftu, et al., Eshetu, Kelemu, Gemechu and Meleku above have taken male teachers as perpetrators of sexual harassment. A study by Alemayehu, et al. (2010, cited in Jones, N., et al., and 2014) also found that girls with lower educational attainment were more likely to become pregnant during adolescence than their better educated counterparts, especially if they were from rural areas.

So, it is possible to say that both sexual harassment and pregnancy are regarded as factors by these stated researchers which can affect female students' schooling. But, the findings were not indicated to what extent girls' science academic performance has improved by the implementation of GRP. Generally, researches' output identified from different literatures as contributing factor in access to girls' education cannot take to be uniform across space and time. In addition, since this world is dynamic (changeable time to time), factors which have mentioned in the previous as challenges for gender equality may not appear as they are for today's context, i.e., another new obstacles may be also grown. Therefore, the researcher was inspired to conduct the study to assess how the GRP has improved the academic performance of female students in the general secondary schools of North Wollo Zone.

1.3. Objectives of the Study

In Ethiopia, as in other parts of the world, especially as a southern - Saharan African countries, it is mostly women who continue to experience the greatest disadvantages resulting from gender inequalities and entrenched discrimination in the instructional process, most importantly in science and technology aspects (World Economic Forum, cited in Helina, 2015).

To this effect, as GPA (2015) noted, GRP has taken by Ethiopian government as an effective intervention to improve the quality of teaching and learning processes and increase enrolment, access, retention, and performance of girls in schools. Specifically, as stated before, the pedagogy equips teachers with knowledge, skills and attitudes for GRP; enables teachers to develop and use gender responsive methodologies that ensure equal participation of both girls and boys in teaching and learning processes, and to assist school management to mainstream gender issues at the school level (Mlam P. et al., 2005). Therefore, the study was aimed to evaluate male and female students' status in their instructional practices, particularly in science education under the GSSs of North Wollo Zone.

1.4. Research Question

To achieve the objective of the study, the following research questions are entertained in this study based on the review of related literature:

1. How far grade ten male and female students of North Wollo Zone are being performed the national examinations under the four years (2013-2016)?
2. Is there any statistically significant difference between the male and female students in the national examination achievement within the four years?
3. How far grade ten male and female students of North Wollo Zone are being performed the science national examinations under the four years (2013-2016)?

4. Is there any statistically significant difference between the male and female students in terms of scoring in the science national examinations?

1.5. Significance of the Study

The finding of the study may scale up the teaching - learning endeavor status of science and other subjects by employing gender responsive pedagogy. Accordingly, the study may:

- assist teachers to create conducive teaching-learning environment in the light of treating girls and boys equally
- stimulate interests of the zone education experts in conducting training for their teachers to enhance the application of GRP
- help school directors to manage their schools by considering equal treatment of both boys and girls

1.6. Delimitations of the study

This study was delimited to assess to what extent GRP is being helped GSS students of the North Wollo Zone particularly females to be competent with their counterparts in the science learning.

1.7. Operational Definition of Terms

Following are the definitions of terms used in this study:

Gender – is socially constructed roles and experiences which are given to males and females

Gender responsive pedagogy –refers to teaching and learning processes which pay attention to the specific learning needs of girls and boys (FAWE, 2006).

Practice – the process of carrying out the essences of FAWE's GRP manual

Science - is a field of study which includes physics, chemistry, and biology

Sex - is a word that refers to the biological differences between male and female: the visible difference in genitalia, the related difference in procreative function (Oakley 1972, in Freedman,J., 2001).

1.8. Theoretical and Conceptual Frameworks of the Study

1.8.1. Theoretical Framework of the Study

Under this topic, theories of educational feminism such as liberal, Marxist, and radical feminism are stated.

1.8.1.1. Theories of Educational Feminism

Currently, feminism can be taken as a social movement whose objective is to strive for equality of rights, status, and power for both women and men. As a movement, it seeks to change the traditional roles and images of women, to end sexism and attain for women equal rights with men (Mackenzie 1993, cited in Gamaliel, S., 2004).

As Chege, F., and Sifuna, D. (2006), and Gul,S. (2011) argued, it has been possible to characterize three distinct types of feminist approach to education such as liberal, radical, and Marxist. These theories generally agree with the presence of oppression and inequality between males and females based on gender. They differ on the approaches they advocate to solve the gender inequality within society (Samkange, W., 2015).

As the researcher's points of view, liberal feminism is preferable than radical and Marxist feminist theories in terms of showing how gender equality is achieved in the instructional process. Because, Marxist feminism does not take education as positive, instead school is considered to reproduce the current unfair situation. It is viewed as a regressive organization rather than progressive, and as fostering a sexist culture; the school curriculum incorporates sexist assumptions, and sexual divisions of labour are built into the context of education (Barrett 1980, cited in Yokozeki, Y., n.d).

Moreover, this approach is not agreed with the stated context of Ethiopian education system. It is documented that most of the activities of Marxist feminists are aimed at educating people about the relationship between women's oppression and economic class oppression (Basow 1993, in Gamaliel,S., 2004). Marxist feminists also see women as a distinct economic class, rather than as individuals, analyzing the connections between women's work status and their self-image (Thompson, A., 2003). Consequently, women's experience, under Marxist's view, became a non issue, perhaps irrelevant. The role of education in a patriarchal society is, therefore, to transmit a dominant ideology, i.e., masculine superiority over feminine (Francis and Skelton, 2001, 2005, cited in Gul,S., 2011).

In the contrary, as World Bank (2004) announced, Ethiopia has ratified the UN charter on human rights and more importantly the convention on the elimination of all forms of discrimination against women, which outlines a variety of political, social, economic, and legislative issues that countries have to work on to eliminate discrimination against women and create equality between men and women.

In another way, radical feminists explore the nature of oppression through the personal experiences of women and centralize sexuality as a major site of men's domination over women through the social institutionalization of heterosexuality (Scraton,S., and Flintoff,A, 2013). The origins of patriarchy and the subordination of women therein, are seen by radical feminists to rest in male aggression and control of women's sexuality. Men are inherently more aggressive than women, who, because of their relative size disadvantages and

dependency on men during child-bearing years, are easy to dominate and control (Simpson, S., 1989). The other strand of the radical feminist argument is that schooling is part of a process by which the ideas and experiences of girls and women are trivialized by male pupils and male members of staff (Acker, 1984, and Gul, S., 2011).

As a result, while liberal feminism aims at improving the existing system of education, both the Marxist and radical feminist perspectives aim at much more fundamental transformation. Thus, according to Marxist feminism, girls are allowed to learn with males in schools, but are also encouraged to take additional subjects such as home economics to instil in them their future roles as wives and mothers (Gul,S., 2011). And as Gul added, for radical feminists, the only solution is separatist approach where men and women maintain detach institutions and relationships. In other words, women must make their own education, and their own rules in society (Scraton,S., and Flintoff,A., 2013).This means, curriculum should be developed to accommodate girls' interests and ways of learning/knowing; female friendly teaching materials need to be developed; teachers should be responsive to girls' interests, and sensitized on how girls learn (Sinnes, A., 2004).

However, these Marxist and radical feminism theories are not practicable in real context of school environments because, as the researcher's points of view, treating females by separating them from males may aggravate societal perception on academic incapability of girls. This special treatment of females also may strengthen the inverse saying of Tong "society has a false belief that women are by nature less intellectually and physically capable than men" (Tong, 2009, p. 2).

In addition, as suggested by Gamaliel, S., (2004), liberal feminists use the following strategies to change attitudes of teachers and learners towards gender equality:

- Analyze curriculum materials to document gender stereotypes in textbooks in order to produce materials that are free from gender bias
- Provide training for pre-service student teachers and practicing teachers to assist them to combat sexism in schools

Sinnes, A.(2004) also added by arguing that gender neutral curriculum equally relevant to boys and girls should be prepared; gender neutral education material need to be developed; teachers are expected to sensitized not to discriminate against girls; and if possible, equal number of female and male teachers need to be assigned in schools.

Generally, liberal feminist theory is quite applicable to the school in terms of the acts that are generated to support equality, justice and fairness in education than Marxist and radical feminists. Acker (1987), Stromquist (1990a), Phillips (1987), and others cited in Yokozeki, y., (n.d) strengthen the idea by saying that liberal feminism is the oldest and probably the most conventional perspective of the three. It stems from the idea that women must obtain equal opportunities and equal rights in society. As Haralambos and Holborn (2008, cited in Samkange,W., 2015) out lined, liberal feminists have moderate aims, their views do not radically challenge the existing values and as such they aim for gradual change in the political, economic, and social system. Thus, liberal approaches assume that inequity is a consequence of ignorance or prejudice and thus something can be modified gradually through enlightened educational programs and gender responsive policies (Thompson, A., 2003).

1.8.2. Conceptual Framework of the Study

The conceptual framework that guided this study was gender equality which considers teachers' practice as a central component which GRP might be helped them to get equal participation in science instructional process from both sexes. So, this study was set to examine whether or not academic performance equality is found between male and female students of North Wollo Zone general secondary schools.

Chapter Two

2. Review of Related Literature

Introduction

Under this chapter, initiatives of Ethiopian government to improve gender equality in GSS science education; and the issues of gender responsive pedagogy are elaborated.

2.1. Status of Ethiopian Male and Female Students' Participation in General Secondary School Science Education

Recent history has demonstrated the potential of science and technology (S&T) for improving the quality of people's lives. Indeed, during the last few decades especially, developments in various fields of S&T have had a profound impact on the quality of life of the major part of the human population, eliciting there by significant societal changes (Maria, et al. (n.d). As a result, according to them, it is now widely accepted that socio-economic and cultural development is largely dependent on the harnessing and application of S&T achievements.

UNESCO (2010) reported that the potential of science and technology to advance development and contribute to people's well-being has been well-recognized. This means, according to the organization, science and technology is vital for the achievement of internationally agreed development goals, for instance by

facilitating efforts to eradicate poverty, achieve food security, fight diseases, improve education, and respond to the challenges of climate change. It has also emerged as an important means for countries to improve productivity, competitiveness, and to create decent work opportunities.

This development of a modern civilization has a lot to do with advancement of science and technology. The quality, relevance, methods of teaching, human resource, scientific literacy, science process skills, higher order thinking, science-technology-society, teachers quality, textbooks of science education etc. directly impact on the extent of growth and development of science and technology(Tilahun, Sileshi, and Anteneh, 2010). Consequently, according to them, it becomes evident that the amount of resources a nation or region puts into science teaching and research determines, to a fair extent, the level of scientific and technological advancement.

Thus, no nation has ever recorded phenomena development without credence to educational advancement and inputs of its human population (Idowu, O., Ogunlade, I., Olatundun, O., and Afolabi, C.(2015). According to their belief, the scientific and technological development pursued through equal participation of males and females, reduction of gender inequalities in access and control of resources, gender awareness and gender responsiveness. Globally, it is proved that exclusion of women in development has rendered their development efforts futile (Doepke and Tertilt 2010, cited in Mulatu, 2016). If a country is successful in minimizing or closing the gender gap, according to them, it will have a better chance to develop through alleviating poverty. As Idowu, O., et al., (2015) underlined, the vast technological development and innovations recorded in the western world has been chiefly the products of relentless research efforts and innovative discoveries of great female and male scholars in higher institutions of learning.

Even though it has been widely understood that realizing the goal of development cannot be attained without the very significant component of gender, the issues of equity in education between male and female groups have been a serious problem in Ethiopian education system at all levels in general, and of secondary education in particular (Habtamu, 2004, cited in Amogne, 2015). Improvement in secondary school will be necessary to ensure a skilled workforce, consisting of both males and females, is available for the future but the net enrolment rate of female remains low than males in the nation (Rose, P., 2003). The number of admission, retention, and graduates has not been proportional to the size of population when compared to male and female students (Habtamu, 2004). The literacy rate of women with age of 15-24 years in Ethiopia during 2005 and 2011 survey period was 41.6% and 56.9% correspondingly. The rate for men with the same age interval during the two survey periods was 67.2% and 75% respectively-considerably higher than women's rate (Amogne, 2015).

Compared to men, women in Ethiopia are clearly in a disadvantageous position in all respects; they benefit less from social services and hold inferior positions in all economic, political, social, and cultural affairs. For example, statistics show the existence of more illiterate women than men (51% men and 66% women) and women are less represented at all levels of education, especially in higher education (MoE, 2007).

Enrolment in Ethiopia has increased dramatically for both boys and girls since the early 1990s, but the gender gap has not narrowed (Rose,P., 2003). As to MoE (2010), in 2008/09, the Gross Enrollment Rate (GER) at secondary first cycle education (Grades 9-10) has grown to 38.1% out of which the share for boys is 43.7% and that of girls is 32.4%. In this same year the GER at preparatory program second cycle (Grades 11-12) jumped to 6% out of which the share for boys is 8.5% and that of girls is 3.5%.

Moreover, the share of Ethiopian women in science and technology programs in higher education has been low, but the government's policy to stream 70% of all university entrants into the science and technology track is beginning to increase their entry into these fields (Helina, 2015). In 2013, according to her, females accounted for 27% of students enrolled in science and technology studies. Science particularly 'hard science' is still also seen by many as a historically male dominated profession to which women have only relatively recently been admitted (Helen, 2010).

Correspondingly, in spite of the fact that increased importance has been placed to the study of science (MoE, 2008), a most recent study (Shibeshi, Mekonnen, Semela, & Endawoke, 2009) show that the quality of science education has been seriously compromised and competence of applicants in physics is alarmingly declining (Tesfaye, 2010). Little is also known about the share of women scientists and engineers. Some studies suggest that women scientists and engineers are few in the country, however; in 2013, men accounted for 80% of the staff in science and engineering departments at the 13 new public universities (Helina, 2015).

United nations economic and social council (UNESC) (2011) generalize by arguing that despite several positive initiatives undertaken through legal enactments, policies and programs in place in East African Community member States, the level of women's participation in science and technology from primary through tertiary education, to the career level, is low compared to that of men (Ahmed, et al, 2001, cited in Mulatu, 2016).

Accordingly, UNESC (2011) recommended that achievement of gender parity in science and technology (education) should rely on an appropriate mix of strategies based on lessons learnt from best practises and experiences at national, regional, and international levels. In the same manner, as elaborated in the following section, Ethiopia as a nation has tried her best to improve students particularly females' participation in the instructional process by playing different initiatives such as GRP.

2.2. Roles of FAWE's Gender Responsive Pedagogy in science teaching

It has observed how the imperative of girls' education is understood and accepted by all stakeholders throughout the world, because without them development in terms of political, economical, social, educational etc. is not expected. This requires teachers to play a crucial role in the teaching and learning processes because their understanding and awareness of gender responsiveness is the key to effective participation of the girls and boys in learning processes (MoE, 2014).

However, according to Mlama, P., et al. (2005), observations of classroom practices show that teaching and learning is largely gender biased. Many teachers apply teaching methodologies that do not give girls and boys equal opportunities to participate, and they also use teaching and learning materials that perpetuate gender stereotypes. FAWE (2006) argued that from FAWE's review, the majority of the schools in Sub-Saharan Africa are not gender responsive. For example, school management systems do not sufficiently address gender constraints such as sexual harassment and bullying; and many schools do not have adequate or separate toilets for girls and boys. As a result, as Mlama, P., et al. (2005), the schools do not provide a gender responsive environment for effective teaching and learning to take place.

By considering this gender imbalance trained, gender responsive pedagogy has taken as major strategy by FAWE which can treat both girls and boys equally in the instructional process (FAWE, 2005). Gender responsive pedagogy (GRP) refers to teaching and learning processes that pay attention to the specific learning needs of girls and boys. It calls for teachers to take an all- encompassing gender approach in the processes of lesson plan preparation, classroom management, and performance evaluation (MoE, 2014). To do so, GRP is initiated in 2005 and has been introduced in Burkina Faso, Chad, Ethiopia, Gambia, Guinea, Kenya, Malawi, Namibia, Rwanda, Senegal, Tanzania, Uganda, and Zambia (David,H., 2011).

The approach, according to Njambi, L., and Wanjiru,F. (2015), is designed to equip teachers with knowledge, skills, and attitudes to empower them to respond adequately to the learning needs of girls and boys by using gender-aware classroom processes and practices. They also asserted as "GRP also targets the school management to sensitize them on gender and to support their ability to create a conducive learning environment". Mlama, P., et al. (2005) added by saying that the GRP model aimed to create a gender-sensitive teaching environment that would enhance and facilitate equal participation of both boys and girls. To do so, according to David, H. (2011), over 6,600 teachers have been trained in line with GRP since 2005.

As an in-service training, the model is continued to be implemented in colleges of education (COEs) and schools. As a pre-service training, it was implemented in teacher training colleges (TTCs) in Burkina Faso, Ethiopia, and Senegal. In 2009, the GRP model was implemented in TTCs in Ethiopia, Kenya, Malawi, Tanzania, and Zimbabwe. Since then, the model has been replicated in 19 other countries in Africa (FAWE Final Report 2009, cited in Njambi, L., and Wanjiru, F., 2015).

MoE (2014) of Ethiopia also argued that the manual can assist teachers to acquire deeper insights into GRP and develop classroom practices that are gender friendly. It is expected that the wider use of this manual can also contribute to the improvement of the quality of the provision of education in Ethiopia. Accordingly, with the help of FAWE, the MoE has improved performance of girls in school through the GRP project at Kotebe College of Teacher Education. According to KCTEE (n.d), since 2009, Kotebe College of Teacher Education has been conducted the two-year GRP in Teacher Education Project up on total of 464 trainees comprising students, academic staff, support staff and community members have been trained. As the college argued, language usage, methods used and sitting arrangement at the test school is gender-responsive, Classroom management and set-up has been altered to be more gender-responsive, and increased pass rates for female and male students.

By continuing its effort, as MoE (2014) noted, the gender directorate of the MoE organized a meeting in Bishoftuto in 2013 where instructors from colleges of teacher education and universities were invited. In this meeting, the participants agreed to adapt the FAWE Handbook to a manual that would be used by teacher trainers at college of teacher educations (CTEs) in the training of teachers on the implementation of GRP. The Bishoftuto meeting, and FAWE's encouragement in its revision of the gender equality strategy for the education sector were initiated the MoE to adopt the manual in October 2014 as a national policy (GPA, 2015). And at the start of the same year, 2014, the MoE is started training deans and module writers with FAWE's support.

To assess the impacts of GRP, according to FAWERS (2011), FAWE was conducted a case study in the African countries such as Tanzania, Uganda, Ethiopia, Malawi, Gambia, and Zambia. The study, as Njambi,L., and Wanjiru,F. (2015) announced, found that the GRP model had impacts such as there was a change in teachers' attitudes and practices, behavioural and attitudinal change, and increase in access of students etc. Moreover, they also added by saying that the two African countries - Malawi and Ethiopia - where GRP was fully embraced, the Ministries of Education made mainstreaming GRP in teacher training colleges (TTCs) a policy of girls and boys in the classroom. This has improved learning, as girls and boys no longer have unhealthy competition but support each other to learn.

Generally, gender sensitive school environments help promote gender equality and address the barriers to

girls' education. Hence, is important to create a gender sensitive school environment through the practice of gender responsive learning and teaching processes. Where gender awareness and gender responsive pedagogy are not practiced at school level, female and male student may not enjoy equal learning opportunities (MoE, 2014).

Chapter Three

3. Research Methodology

Introduction

This part of the study describes the research design, sources of data, population, and sampling techniques. Moreover, data collection instruments, data collection procedures, and data analysis techniques are also elaborated.

3.1. Research Design of the Study

In order to achieve the stated objectives, evaluative research was used. It enabled the researcher to assess systematically the operation and/or the outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the program or policy (Weiss, C. H., 1998).

3.2. Sources of Data

To gather the required information, grade ten national examination achievements were considered as data sources for the study. National examination results are preferred than the school based examination results because standardized admissions tests are good predictors of students achievement. And it can also measure students' academic performance more consistently than examinations prepared at school level (Lauzon, 2001, and EACEA, 2010, cited in Amogne, 2015). According to them, sex differences identified in the school based tests may reflect the effects and biases of the instrument. As a result, standardized national grade ten examination result was used to examine the impact of GRP on academic achievement of both sexes.

3.3. Population and Sampling Technique

The North Wollo Zone national examination results of grade ten were taken as the research pool. North Wollo zone was selected purposively from the nine zones of the Amhara regional state. Thus, the researcher is acquainted with the language, culture, and psychological make-up of the people. Moreover, the researcher's place of work is there and, hence, follow-up plans and participation in future interventions would be easily attained (Reda, 2014).

Accordingly, the four years' (2013-2016) grade ten national examination results were selected purposively. There were 41,514 (M=21,777, and F=19,737) students who were involved in the four national examinations. The researcher believed how these recent documents can show him to what extent both boys and girls would perform science instructional activities.

3.4. Data Collection Instruments

In order to collect data from the national examination results of grade ten, document analysis was applied, because it does not need much cost and time (Bryman 2008: 297), and (Bryman 2008: 54, cited in Korcho, 2013).

3.5. Data Collection Procedures

To collect data from the sources, first the researcher was asked the North Wollo Education department's consent by explaining objective of the study. After getting an agreement, he found the four year's grade ten national examination results from the zone. Then, he also identified students' obtained score in each year from the document. Thus, students' score from the entire nine courses (Amharic, English, Mathematics, Geography, History, Civics, Biology, Chemistry, and Physics) collected based on students' sex. In addition, students' science subject (Biology, Chemistry, and Physics) scores also identified from the four years' document in terms of their sex, and in terms of the two extreme scoring levels (scoring "A" and scoring "F").

3.6. Validity and Reliability of the study

For the purposes of research, documentary sources should never be accepted at face value. Their validity is something that needs to be established rather than being taken for granted. As Platt (1981) and Scott (1990,) cited in Denscombe (2007) have argued, documents need to be evaluated in relation to their authenticity, credibility, and representativeness.

Since national examination is conducted and facilitated by national examination agency, the researcher believed that documents which found from the agency were authentic and genuine. They were also Credible, accurate, or free from bias and errors. In another way, the documents were representative, i.e., they could show exactly how both boys and girls have achieved scores (A, B, C, D, or F) in each courses.

Equally, Lauzon (2001), and EACEA (2010) cited in Amogne, (2015) noted that standardized admissions tests enable to measure students' academic performance more consistently than examinations prepared at school level.Therefore, the documents which the researcher used were authentic, credible, and representative.

3.7. Data Analysis

To analyze data, the researcher was used frequency, percentage, and mean simple statistics to verify students' promotion status in to preparatory school, and to determine their scoring status in the science national examinations of the four years. The researcher also conducted Chi-Square test: 1) to check availability of significant difference between male and female students in reference to promote to preparatory school; 2) to investigate whether male and female students different or not in their scoring position in the science subjects. Sex (male & female), and the two extreme scoring levels ("A" score & "F" score) were taken as unit analysis.

3.8. Ethical Consideration

To achieve the stated objectives of the study, the researcher was asked the North Wollo Education Department's consent to partake in the study. He also briefed objectives of the study to the department, and made it to be aware how the researcher uses information which obtained from the zone only for the research purpose. Taking this reality in mind, any interaction with the concerned individuals of the zone was facilitated based on their free will. In addition, all the materials used for this research would be acknowledged.

Chapter Four

4. Data Analysis and Interpretation

The purpose of the study was to investigate the status of male and female students in their instructional practices, particularly in science education under the GSSs of North Wollo Zone. To achieve this objective, evaluative research was conducted, the data was collected by employing document analysis, and the researcher as well analyzed the gathered data quantitatively as follow.

4.1. Male and female students' promotion status in to preparatory school

To evaluate the promotion status of students, the researcher investigated the four years (2013-2016) secondary schools students' national exam results of the North Wollo Zone. And he analyzed the obtained outcomes of the entire nine courses such as Amharic, English, mathematics, physics, chemistry, biology, geography, history, and civics subjects. This helps him to see the promotion status of females and boys in to the preparatory school. The output of the analysis displayed as follow.

Table 1: Grade ten students' promotion status in to preparatory school under the four years national examinations

Year	Students who had taken national exam			Students who promoted to preparatory school				
	Male	Female	Total	Male	%	Female	%	Total
2013	4,428	3,284	7,712	2,055	54	1,744	46	3794
2014	5901	5,389	11290	2421	50	2469	50	4890
2015	5,615	5,235	10,850	2,632	54	2,257	46	4,889
2016	5,833	5,829	11,662	1,662	50	1,665	50	3,329
Total	21,777	19,737	41,514	8,770 (51.88%)		8,135(48.13%)		16,902

As stated in the table "1" above, secondary school students' performance of the zone indicated how females were academically less performer than males. Of 16,902 students who were promoted to preparatory school, 8,770 (51.88%) and 8,135(48.13%) were males and females respectively. From the cumulative results of nine courses, females were passed to preparatory school less by 3.75% (51.88% - 48.13%) than males. To know specifically how both male and female students are statistically different, as stated below, further analysis was conducted.

4.1.1. The statistical difference of the male and female students in the national examination achievement within the four years (2013-2016)

To check the availability of significant difference between grade ten male and female students' academic achievement in the four years national examinations, the researcher was analyzed the data by applying Chi-Square test, and the output looks like the following.

Table 2:Chi-Square test Analysis of Students' National Examination Results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.368[a]	3	.000
Likelihood Ratio	31.376	3	.000
Linear-by-Linear Association	3.142	1	.076
N of Valid Cases	16902		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1601.47.

Based on the stated output above, the critical value of x^2 with 3 degrees of freedom at 0.05 level of significance is 9.35. Since the calculated x^2 value (31.368) exceeds the critical value of x^2 (9.35), the researcher concluded by saying that the male and female students are not the same in their national examination performances. To verify the particular performance which is being observed differently, extra analysis of standardized residual test was conducted, and the result is presented as follow.

Table 3: Standardized residual test analysis of students' performance variation under the four years national examination

Student	Year			
	2013	**2014**	**2015**	**2016**
Male	2.0	-2.3	2.0	-1.6
Female	-2.0	2.4	-2.0	1.6

As displayed above, the absolute values of "R" indicate that male and female students are significantly different in terms of promoting in to preparatory school. This means, females were over promoted on boys in to preparatory school in 2014, and in 2016, because the "R" values of the two years have positive sign. And, male students also over promoted on females in 2013, and 2015, since the "R" values are marked positively.

This is also confirmed by table 1, which indicates how female students promoted in to preparatory school than males with slight difference in 2014 (F=2,469, M=2,421, the difference is 48), and in 2016 (F=1,665, M=1,662, the difference is 3). The total variation is "51". Inversely, the data also indicated that great number of male students promoted than females in 2013 (M=2,055, F=1,744, the difference is 311) and in 2015 (M=2,632, F=2,257, the difference is 373). The total difference is "686".

Generally, based on the analysis, female students lag behind males to promote in to the preparatory school. From the cumulative results of the nine courses, females were passed to preparatory school less by 3.75% (51.88% - 48.13%) than males under the four years (2013-2016) national examinations.

4.2. Male and female students' scoring status in the three science subjects

The researcher analyzed both the male and the female students' scoring status in the science subjects (scoring "A and F" grades) such as physics, chemistry, and biology. To do so, he used the four years (2013-2016) grade ten national examinations results of the North Wollo Zone, and the finding is stated as follow.

Table 4: Grade ten students' scoring status in the science subjects under the four years national examination

Year	Subject	"A" Score					"F" Score				
		Male	%	Female	%	Total	Male	%	Female	%	Total
2013	Physics	31	75	10	25	41	330	49	335	51	645
	Chemistry	784		261		1045	35		27		62
	Biology	805		267		1072	15		33		48
Total		**1620**		**538**		**2158**	**380**		**395**		**775**
2014	Physics	110	74	45	26	155	217	43	230	57	447
	Chemistry	789		280		1069	182		227		409
	Biology	880		308		1188	95		202		297
Total		**1779**		**633**		**2412**	**494**		**659**		**1153**
2015	Physics	410	75	149	25	559	222	44	247	56	469
	Chemistry	598		173		771	231		283		514
	Biology	716		259		975	171		250		421
Total		**1724**		**581**		**2305**	**624**		**780**		**1404**
2016	Physics	284	70	161	30	445	117	39	181	61	298
	Chemistry	141		55		196	117		206		323
	Biology	396		131		527	128		180		308
Total		**821**		**347**		**1168**	**362**		**567**		**929**
Grand Total		**5944(73.90%)**		**2099(26.09%**		**8043**	**1860(43.63%**		**2401(56.34%)**		**4261**

As displayed in the table "2" above, of 8,043 students who have scored "A", 5,944 (73.90%) and 2,099 (26.09%) were males and females respectively. Inversely, of 4,261 students who have achieved "F" grade, 1,860 (43.63%) were males, and 2,401(56.34%) were also females. Thus, female students were performed less than

males by 47.81% (73.90% - 26.09%) in terms of scoring "A". And they also remained higher than males by 12.71% (56.34% - 43.63%) in terms of scoring "F".

4.2.1. Male and female students scoring variation in the science subjects

To examine whether male and female students are significantly different or not in the reference to score "A" and score "F" in the science national examinations, the researcher was analyzed the data by using the Chi-Square test.

Table 5:Chi-Square test Analysis of Students' performance in science subjects

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1098.821[a]	1	.000		
Continuity Correction[b]	1097.517	1	.000		
Likelihood Ratio	1086.119	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	1098.732	1	.000		
N of Valid Cases	12304				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1558.40.
b. Computed only for a 2x2 table

As to the stated finding above, the critical value of the chi square with df =1, and $\propto = 0.05$ is 5.02. Since the calculated x^2 value (1098.8) greater than the critical value of x^2 (5.02), it is possible to say that both male and female students are being scored differently in the science national examinations. To determine their scoring variation specifically, the researcher also conducted the standardized residual test.

Table6: Standardise Residual test Analysis of students' scoring variation in the science national examination

Student	**Score**	
	A	**F**
Male	11.8	-16.2
Female	-15.5	21.3

All the four values of "R", such as 11.8, -15.5, -16.2, and 21.3 indicate that males and females are significantly different in their "A & F" scoring under the science subjects. Specifically, according to the data, females are over weighted by males, and males also over weighted by females in terms of achieving "A" and "F" grades respectively, because the scoring status of students is indicated by the positive and the negative signs in the standardize residual test values.

This is also confirmed by table 4, which indicates how "F" grade scorer female students increase throughout the four years national examination:2013 (51%), 2014 (57%), 2015 (56%), and in 2016 (61%). Inversely, the number of male students also decreases to score "F" under the same years: 2013 (49%), 2014 (43%), 2015 (44%), and in 2016 (39%).

Generally, based on the analyzed data above, the variation which is observed between the male and female students in terms of passing in to preparatory school by considering all nine courses, in terms of scoring "A", and scoring "F" in the three science subjects were 3.75%, 47.81%, and 12.71% respectively. The data shows how male and female students are inversely related in their science academic performances. This also confirmed by the analysis of the Chi-Square test: in terms of students' promotion to preparatory school, x^2 value (31.368) > its critical value (9.35); and in terms of students' scoring status in science subjects, x^2 value (1098.8) >its critical value (5.02). And in both cases, the p-value for the chi-square statistic is .000, which is smaller than the alpha level of .05. From this analysis, it is possible to understand that female students were poor performer than males especially in the science subjects.

As to the Ethiopian national agency report (ENAR) (2001, cited in Tadesse, 2009), at the beginning of the twenty first century, one of the main problems challenging Ethiopia in education is the gender gap in enrolment and performance between male and female particularly at the secondary and tertiary levels. This indicates that the traditional patriarchy of Ethiopia which remains buttressed by religion and culture, which has been causing gender differentials in access, participation, and service provision across the education, health, economic systems and sectors still remain prevalent (Solomon and Memar, 2014). Therefore, it is important to assess how the GRP is being practiced in the general secondary schools of North Wollo Zone.

Chapter Five

5. Summary, Conclusion, and Recommendation

5.1. Summary

The study was aimed to examine male and female students' instructional involvement, particularly in science practices under the GSSs of North Wollo Zone. To achieve the objective, Evaluative research was used. Documents of grade 10 national examination results were taken as the pool of the study. Of these, the researcher

was selected the four year's (2013-2016) national exam result documents purposively.

Accordingly, the required data was collected, and analyzed quantitatively (percentage, mean, Chi-Square and Standardize Residual tests were used). Sex (male and female), and the two extreme student scores (A and F grades) also used as units of analysis. The findings of the analysis indicated that females were remained poor academically than their counter parts.

Females were passed to preparatory school less by 3.75% than males by all the cumulative results of nine courses. This also supported by the analysis of the Chi-Square test, because the x^2 value (31.368) exceeds the critical value of x^2 (9.35) which shows how the male and female students are not the same in their national examination achievements. Female students also performed less than males by 47.81% in terms of scoring "A", and they remained higher than males by 12.71% in terms of scoring "F". In line with this, the calculated x^2 value (1098.8) found as greater than the critical value of x^2 (5.02), which shows both male and female students were scored differently in the science national examinations.

This variation is observed consistently under the four years national examinations of science subjects. Thus, number of "F" scorer girls has increased from year to year: 2013 (51%), 2014 (57%), 2015 (56%), and in 2016 (61%). And inversely, the number of male students also decreases to score "F" under the same years: 2013 (49%), 2014 (43%), 2015 (44%), and in 2016 (39%). This finding also directly aligned with what Oli's study revealed. Oli (2014) conducted a study to investigate status of students' academic achievement in science education across selected preparatory schools of Ethiopia. And the overall academic attainment in science for male was 47.58% and for female was 39.70%. In all the cases, according to him, the mean scores of female were less than that of males.

Generally, based on analyzed data of this study, anyone can disclose by saying that female students were poor performer than males above all in the science subjects.

5.2. Conclusion

Although, the FAWE's GRP is regarded as an important strategy to achieve gender equality in the instructional process, GSS female students of North Wollo Zone did not perform academically as males in the national examinations, particularly in the science subjects. Therefore, teachers' GRP practices of the zone need to be assessed and evaluated.

5.3. Recommendations

Policies and strategies for supporting out-of-school children in Ethiopia and closing the remaining net enrolment gaps will require making hard decisions by policy makers, particularly given the current context of inequity and inefficiencies.

Hence, MoE and Regional Education Bureaus of Ethiopia, in collaboration with other stakeholders, should make a concerted effort and take appropriate actions in order to solve the observed inequality. The GSSs GRP practices should be investigated; the overall outlooks of teachers, students, and schools in general towards GRP should be evaluated.

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