



LUND UNIVERSITY
Commissioned Education

**A PROJECT REPORT OF PARTICIPATION OF GIRLS IN LEARNING
NATURAL SCIENCE SUBJECTS IN SECONDARY SCHOOLS IN TANZANIA**

PRESENTED TO

**THE DIVISION OF EDUCATION DEPARTMENT OF SOCIOLOGY IN PARTSIAL FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF THE ADVANCED INTERNATIONAL TRAINING
PROGRAMME ON
CHILD RIGHTS, CLASSROOM AND SCHOOL MANAGEMENT**

BY

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LIST OF ABBREVIATIONS

AAUW	American Association of University of Women
ACSEE	Advanced Certificate of Secondary Education Examination
CIA	Central Intelligence of America
CRC	Child Rights Conventions
FEMSA	Female Education Mathematics and Science in Africa
GoT	Government of Tanzania
MoEVT	Ministry of Education and Vocational Training
NECTA	National Examination Council of Tanzania
TIE	Tanzania Institute of Education
Sida	Swedish International development Cooperation Agency
STD's	Sexually Transmitted Diseases
UN	United Nations

Acknowledgments

We are very thankful to Sida for sponsoring this study at Lund University. We are very grateful to Richard Stannelo , director of studies of Child Rights Programme at Lund University and his assistant Emma Alfredson for making this project possible. Our sincere gratitude goes to our supervisor, Professor Agneta Wångdahl Flinck of Lund University for her throughout of this project and especially for her effort to come in Tanzania to check our progress. We thank our fellow international students of batch 11 for the exchange of information during our informal discussions. We are deeply indebted to the Permanent Secretary of Ministry of Education and Vocational Training, Professor Hamisi Dihenga and Deputy Permanent Secretary of Ministry of Education and Vocational Training Mr.Ngisimba forgiving us the chance to take parts in this program. We thank our retired Assistant Director Mr. Ndabise and the current Assistant Director Mr. Philemon for their entire support of this training, without the forgetting welcome dinner at his residence for our mentor Professor Agneta Wångdahl Flinck. Also, our thanks go the National Teachers Science Facilitators and Mrs. Dorothy Mwaluko, coordinator of Science National Science Girls Camp for their cooperation.

Also, special thanks to our families who supported us all the time when we were away from our homes in Sweden and Ethiopia.

Finally the other special thanks go to our colleagues at MoEVT for their support and the encouragement.

Executive Summary

This is a report by the Tanzania Team of Change Agent of Batch 11 on the subject of the CRC-project of participation of girls in learning science subjects in secondary schools in Tanzania as completion of the Advanced International Training Programme on Child Rights, Classroom and School Management. The training was from on 21st September - 9th October 2009 at Lund University Sweden, follow up seminar was on March 2010 in Awasa, Ethiopia, and the way forward of the implementation of project was in Tanzania.

The training was intended to facilitate the international participants on the Child Rights, Classroom and School Management. Tanzania was among the countries who attended this training. The Ministry of Education and Vocational Training endorsed three officers namely Elia Kibga, Adelard Saduka from the Secondary Education Department and Tumbana Shoo from Inspectorate Department after their admission into the course.

The project involved different education stakeholders including teachers who were national science facilitators, head of schools, and students from the selected schools. In Dar es Salaam, the project started with four schools namely Kibasila Secondary School; Jangwani Secondary School; Azania Secondary School; and Msimbazi Secondary School. The project has changed teachers' attitude towards the participation of girls in learning science subjects in secondary schools in Tanzania. Teachers have acquired new skills, knowledge and gained experiences on how to use the participatory teaching methods and techniques for the participation of girls in learning science subjects. The project developed guidelines on how to prepare participatory lesson plan which will be used by science teachers of secondary schools in Tanzania. The project is mainstreamed in on job training services provided by the Ministry to national science facilitators cascaded to district and school levels.

Introduction

Various research reports have revealed that girls' participation in learning Natural Science subjects such as Physics, Chemistry, Biology and Mathematics is low as compared to boys at secondary education level (Mwaluko, 1996; Kibga, 2004). It has been shown that girls and boys first enter Form one in secondary schools with similar abilities, but when they are in Form two, they begin to lag behind the boys in performance in the sciences and most of them decide to opt for arts subjects at Form three level. In the Form three, usually students have options to choose either the science or arts career. Some of the reasons revealed for poor participation of girls in learning science subjects are such as girls have the attitude that arts subjects are simpler than science subjects; lack of confidence in learning science subjects; lack of interest; girls are not encouraged to do psychomotor activities during the practical session as boys; most of the parents have the attitude that science is for masculine and arts for the feminine; and culture demoralizing participation of girls learning science subjects (Hansen, 1996; FEMSA, 2009).

This project has been considering the low participation of girls in learning science subjects in secondary schools until when the participation of girls in learning science subjects in secondary would improved. The project was also introducing the CRC components among the teachers who are national science facilitators who cascaded the CRC components to the districts and schools levels. This project is incorporating the element of CRC in girls' participation in learning science subjects in secondary schools in Tanzania to conscioutize girls' minds about their rights to participate in learning science subjects. Through the clubs, the project has been cascaded from national level to district and school levels. The participatory lesson plan for participation of girls in learning science subjects, were developed with the national team facilitators and pretested in some selected schools where the national facilitators were coming. The project developed the guidelines to encourage teachers to identify and use appropriate teaching methods as well as materials during the preparation and execution of the lessons that reflect on learners' daily life application of scientific knowledge learnt in class.

1.0. Country Profile

1.1. Country Background

Shortly after gaining its independence from Britain in 1961, Tanganyika and Zanzibar merged to Form the United Republic of Tanzania in 1964. One-party rule came to an end in 1995 when the first multi party democratic elections took place in the country.

1.2. Location

Tanzania is found in Eastern Africa, bordering the Indian Ocean, sharing border with Uganda in the north and Mozambique in the South.

It is found in the geographic coordinates of 6 00 S, 35 00 E. The country has a total area of 947,300 sq km of land; 885,800 sq km of water and 61,500 sq km *this of* include the islands of Mafia, Pemba, and Zanzibar. The county has land boundaries of 3,861 km. Border countries Burundi 451 km, Democratic Republic of the Congo 459 km, Kenya 769 km, Malawi 475 km, Mozambique 756 km, Rwanda 217 km, Uganda 396 km, Zambia 338 km. Tanzania has coastline of 1,424 km.



1.3. Weather

The current weather of Tanzania varies from the tropical along the coast to temperate in highlands

1.4. The Extreme Elevations

Lowest point: Indian Ocean 0.00 m

Highest point: Kilimanjaro 5,895 m

1.5. Geography - note:

Kilimanjaro mountain is highest point in Africa; bordered by three of the largest lakes on the continent: Lake Victoria (the world's second-largest freshwater lake) in the north, Lake Tanganyika (the world's second deepest) in the west, and Lake Nyasa in the southwest

1.6. Population:

41,892,895

1.7. Age structure:

0-14 years: 43% (male 8,853,529/female 8,805,810)

15-64 years: 54.1% (male 10,956,133/female 11,255,868)

65 years and over: 2.9% (male 513,959/female 663,233) (2010 est.)

1.8. Languages:

Kiswahili or Swahili (national and official), Kiunguja (name for Swahili in Zanzibar), English (official, primary language of commerce, administration, and higher education), Arabic (spoken a bit in Zanzibar), more than 120 local languages

note: Kiswahili (Swahili) is the mother tongue of the Bantu people living in Zanzibar and nearby coastal Tanzania; although Kiswahili is Bantu in structure and origin, its vocabulary draws on a variety of sources including Arabic and English; it has become the lingua franca of central and eastern Africa; the first language of most people is one of the local languages

1.9. Literacy:

Definition: age 15 and over can read and write Kiswahili (Swahili), English, or Arabic

Total population: 69.4%

Male: 77.5%

Female: 62.2% (2002 census)

2.0. Background of the project

For long time girls/women have been denied the opportunity to access education. According to Mbilinyi (1974) girls access to education was mostly affected by economic factors as well as social cultural environment and gender relations. Although girls/women play a major role in social economic development, they are rarely accorded the credit they deserve (Bendera et al, 1998). It should be noted that any barrier to girls' participation in Formal education directly interferes with their opportunity to access natural sciences subjects as well.

The poor participation and performance of girls in natural science subjects has been a growing issue all over the world; Tanzania being among the countries. A number of studies have been conducted and come up with factors pertaining to the problems. In Tanzania there are few girls in lower secondary schools that opt for sciences even though fewer perform well in natural science subjects. As a result fewer girls are being enrolled in natural science subjects' related combination at A level.

Research conducted by FEMSA (Female Mathematics and Science Association) in Tanzanian secondary schools revealed that parental attitudes and support have a great deal of influence on girls' participation and level of success attained in natural science subjects. Parents and community attitudes are mainly influenced by traditional beliefs regarding the ideal roles of women and girls in society. Traditionally, the only roles available to women were those of wives and mothers. Women were thus seen as nurturers and mainly as providing support for men who worked to provide for the family. Being physically weaker, women were therefore also perceived as being less capable and requiring the protection and guidance of men. These attitudes have prevailed even in current times when socio-economic changes have resulted into changes to roles women are now expected to undertake. However, traditional beliefs have been found to foster negative attitudes which limit family and community support for girls education. Identification and examination of these attitudes is necessary before any decision can be made on what should and can be done to bring about change.

Again, according to FEMSA there is low enrollment and high dropout rates of for girls at all levels of education. The main reason being the negative attitude that many parents and teachers have towards the education of girls which attributes to traditional socio-cultural beliefs regarding gender roles and

abilities. In African tradition and culture, women were expected to exclusively assume the roles of mothers and wives. Women were seen as nurturing beings and as such were expected to be the home makers and take care of the children. They were also expected to be obedient and subservient to the men. Women were seen as less capable, physically, mentally and in all areas outside their accepted roles, than men. As a result women were seen as requiring protection, guidance, supervision and leadership from men. Some parents were reported to be reluctant to send their daughters to school because they believe that co-education schools could be a corrupting influence.

In some communities, there was the view that in co-educational schools as most primary schools are; girls' morals would be corrupted because of the amount of time they would spend with boys. There was also fear for the physical and sexual safety of girls in schools due to cases of physical and sexual harassment as well as abuse from peers and teachers in the school. Where schools are situated long distances away, parents also worried about their daughters' safety while traveling to and from school.

Perceived gender role and characteristics influence the way children are expected to behave, the kind of work they do and even the way they play. Girls are, for example, rarely the ones sent to the shops to do shopping, neither are they allowed to play outside the home for long periods of time as boys often do. This denies girls the opportunity to explore and experiment with diverse activities and situations outside the home which could be useful to them within the natural science curriculum to actually investigate how knowledge learnt in the class can be applied in daily life. Being outside the home also allows them to develop their socializing skills to a better degree than girls, and they are therefore more at ease outside the home environment. Boys therefore develop the confidence to work with tools and to have an advantage in the use of exploratory and participatory methods advocated for in teaching natural science subjects. That is also seen in the teaching/learning process whereby in practical lessons, girls are given a role of recording the practical results while boys are working with the tools.

Mboya (2000) points out that in some Tanzanian cultures, after a certain age, girls are not expected to look at men directly in their eyes and are expected to appear humble and respectful before them. This attitude and the subsequent socialization of girls, has a number of effects. One is that it makes it difficult for girls to fully benefit from the participatory, discovery methods that are recommended because they will be reluctant to ask questions, participated fully in discussions or work in groups with members of the opposite sex. This has a negative effect on their performance in science subjects which needs working together with boys in performing science projects, practical as well as group discussion. Another issue is that of girls to feel that boys and men are in some ways their superiors as a result many are vulnerable to physical and sexual harassment; abuse and lack of confidence. In addition, they lack

skills and knowledge to solve immediate problems in their daily life which may need the application of science concepts and principals. This exposes them to the risk of early pregnancy; Sexually Transmitted Diseases (STD's) and the resulting consequences, such as school dropout.

It is also important to note here that as the girl becomes older, she is often expected to take on more responsibilities in the running of the home and this take more of her preparation time especially at the educational level where learning is more involving and intense to the extent that it requires more time, concentration and focus. This is likely to affect girls' performance leading to loss of morale, poor performance, repetition, frustration and the end point could be school dropout. It is also commonly viewed by teachers and parents that girls are academically less capable than boys. This attitude has a negative effect on girls' participation in education and science in particular in a number of ways. First, in a situation where parents have to make a choice due to lack of financial resources, those who uphold this belief would choose to educate boys at the expense of girls. Thus, girls are considered less capable and hence they often receive less encouragement and are rarely challenged at home or school to strive to succeed in natural science subjects. Because less is expected of them, they also in turn expect less of themselves because they are less confident of their academic abilities. Boys on the other hand were said to be "pushed" to succeed because more was expected of them.

In some areas of rural Tanzania, on reaching puberty (from upper primary), girls are expected to participated in initiation ceremonies aimed at preparing them for womanhood and marriage. Hence these girls regard themselves as adults and ready for marriage and no longer see the need to concentrate on their school work as they feel that it would be of little use to them in their future roles as mothers. In addition, these ceremonies are often held during the school term resulting in girls missing a considerable amount of school time. These ceremonies were said to affect girls' participation in education in general and science subjects in two particular ways. One was that the time spent at these ceremonies was at the expense of precious school time. When these girls eventually return to school, teachers find it difficult to get time for individual attention for them to match together with others. As mentioned before, science and mathematics are hierarchical subjects due to the fact that learning is based on building on previously learnt concepts and principals, Osaki (2000). Therefore it becomes even more difficult to catch up in these subjects and hence poor performance is inevitable.

It has been noted that parents were also of the opinion that there was a serious shortage of employment opportunities in science and that the majority of these careers, especially the technical ones, were poorly paid. They were therefore reluctant to encourage the girls to further their education in these subjects. Parents also believed that the Arts based careers paid more and therefore

encouraged their daughters to work harder and carry on with these subjects at higher levels of education.

3.0. Statement of the Problem

It follows from the discussion above that most girls in Secondary Schools in Tanzania think that they have low abilities in mastering mathematics, science and technical subjects. According to FEMSA (Female Educationists in Mathematics and Science Association), there is low enrolment and high dropout rates for girls at all levels of education. The main reasons for this low enrolment and high dropout is the negative attitude that the Community has towards the education for girls, where by women are regarded as less capable physically, mentally and in all areas outside their accepted roles. This situation has been noted even when girls and boys are in the same classroom, Teachers react differently to girls and this is because they don't expect much from them. This attitude resulted into a negative effect on girl's participation in education and natural sciences in particular.

It should be noted that any barrier to girls' participation in Formal education has a direct impact on the girls' access to natural Science subjects. Hence it is the intention of this study to investigate the reasons for poor participation of Girls in the natural Science subjects and the way CRC ideas could be applied to bring the existing gaps.

4.0. Rationale

Despite the support provided by the Government of Tanzania (GoT) in improving learning of natural sciences, participation of girls in these subjects is still low. In 2008 only 38% of Form three girls chose to continue with science subjects. Moreover, the performance of girls in national Form IV examination is still low as a result of which only a few girls continue with further education in science subjects, thus only a few women are undertaking technical and other science related careers.

Among other difficulties, it was revealed that girls lack competencies that will develop themselves in performing well in natural sciences and mathematics education. Some of the competencies include:

- Making use of scientific procedures and practical skills in all science subjects
- Demonstrating use of Biological knowledge, concepts, principles and skills.
- Demonstrating appropriate measures and precautions against accident, infections and other related problems.
- Applying of laboratory safety rules.

- Grouping organisms according to similarities and differences.
- Applying science concepts, processes knowledge and skills in daily life
- Taking appropriate measurements in daily life
- Handling Mathematics instruments in constructing and drawing geometrical figures.
- Converting one unit of measurement into the other.
- Changing repeating decimals into fractions.
- Graphing and interpreting linear equations
- Distinguish different type of numbers
- Estimating and computing numbers accurately

Thus, conducting a study in this area is inevitable in order to establish the reason(s) which hinders the girls to participate as equal as boys in natural science subjects. This is important because the education system in Tanzania needs an intervention for teachers to strategize on the ways which can motivate the girls to see to it that they are capable to compete with boys in natural science subjects.

The project will change parent attitude towards their daughters as some of parents think that science carriers like doctors, engineering, pilot, astronauts, and agriculture are mostly for men (Smarts and Rahman, 2008). In addition, it will provide the opportunity to challenge the perceptions that learning these subjects depends on masculine and natural ability and that they are not for girls (Smarts and Rahman, 2008). Moreover, the project will gadget more gender fairness in education system so as to improve education quality for all students (boys and girls), because CRC objectives in education will be achieved only if there will be no gender inequities in education system (AAUW;1992).

The project will assist in advising the senior education officers in MoEVT and Local government levels, like directors, Municipal Directors who run secondary schools in their Municipalities, Policy makers of Education at Ministry Level; Inspectorate departments; Heads of schools; science teachers and students. Others stakeholders who will benefit include; researchers and academicians who will be interested in further researches in areas which are not explored by this project. Moreover, the project will add more skills to project team on the design, running, and report writing about the project concerned with participation of a girl child in natural science education as well as provision of education to child as a child right.

5.0. Objectives

The Main Objective of the Project is to enhance Participation of Girls in Learning Natural Science Subjects at Secondary Schools in Tanzania. In order to achieve this, the following specific objectives were planned to be achieved:

- To find out the current status of girls participation in learning of natural science Subjects in Tanzania
- To find out the CRC gaps in the teaching and learning of natural science subjects in Secondary Schools in Tanzania
- To develop a Child Right Based Learning programme (i.e to establish a child gender balance oriented teaching / techniques among science teachers)

6.0. Research questions

1. What is the current status of girls' participation in the learning of natural science subjects in Tanzania?
2. What are the CRC gap in Teaching and learning of Natural Science in Secondary Schools in Tanzania?
3. What are the characteristics of child rights based learning programme in Tanzanian context?

7.0. Literature review

The section discusses the following: theoretical framework on which the project is based upon; the current status of girls in learning natural science subjects which comprises of factors affecting low participation of girls in learning science subjects; the performance of girls in science subjects; the enrollment of girls versus boys in learning science subjects; and the learning theory toward girls' participation in learning science subjects.

7.1. The Current Status of Girls in Learning Natural Science Subjects in Tanzania

Literature shows that most girls opt for art subjects as compared to science subject. This fact is due to several reasons as explained below:

7.1.1. Factors affecting low participation of girls in learning science subjects

One of the factors that affect girls in learning science subjects and mathematics in secondary schools is the low house hold income. The girls from the marginalized areas and from poor families are at greater risk of stereotypes.

Another factor is that there are few female role models like doctors, engineers, architects and science teachers in developing countries. Most of the women are doing jobs such as typists, personal secretary, waiters, and art teachers. This has made many young girls students not to opt for science subjects as they become discouraged by their young sisters and friends that science is for masculine and science is very difficult subjects (Shakeshaft 1995). Actually, the community regards girls as for home chores and should not study the science subjects and boys are prepared for hard tasks and science is for masculine only (Hansen, 1996, Mendez, Young, Mihalas, Cusumano & Hoffman, 2006).

In addition to that, there is also a poor learning environment at school. Most of the schools in developing countries have no friendly school environment. There is lack of teachers, poor school management and lack of political will toward education among the politicians (Mwetulundila, 2000, Arnold & Doctorff, 2000, Nyerere, 1968, Mwetulundila, 2000, Koirala and Acharya, 2005, MoEVT, 2009). These factors have led to poor participation of female student in learning science-based subject as compared to their male counterparts in secondary schools.

7.1.2. Poor Performance of Girls in Science Subjects

The results from the advanced certificate of Secondary Education Examinations (ACSEE- 1995) have revealed that the average percentage of girls failing in the science subjects was higher than the boys in natural science, included physics, chemistry and biology. This poor performance has affected the enrollment of girls' students in science subjects in the universities and teachers training colleges. For instance, statistics show that girls have continued to account for only 10% of the total admission in science at the University of Dar es salaam in Tanzania (Mushi, 1996).

Mushi (1996) added that there is a significant difference in performance of science subjects in Physics, Chemistry and Mathematics ranged between 5% to 8% higher failures in girls as compared to their counterparts boy students in Tanzania. In addition to that Mbilinyi and Mbughuni (1996) revealed that there is high significant difference in performance between girls and boys in Tanzania.

7.1.3. Enrollment of girls versus boys in science subjects

The enrolment of girls in science classes is very low as compared to their counterpart boys in secondary schools in Tanzania. This is due to negative community attitude towards girls' participation in learning science subjects. Science subjects are regarded as suitable for masculine and not for feminine (Mwaluko, 1996; Kibga, 2004). Moreover, the low enrollment of boys in technical secondary schools is 87% out of total. This fact has demoralized girls to continue with science carriers (Mushi, 1996).

7.1.4. The learning theory toward girls' participation in learning science

Boys and girls performances are affected by the environment on which they are subjected (Clark 1983; Teyler 1987; and Braun and Linder (1975). The environment can either cultivate or impede development of certain skills among children. Boys are always free to interact with the environment around them and thus they are likely to develop certain skills in learning science but girls are denied by community to interact with their environment most of their time. This has always made girls to lag behind to develop curiosity, investigation, observation, confidence, and design (Mushi, 1996).

8.0. Methodology

This chapter discusses the procedures and methods employed in conducting this project and data collection. It gives a brief explanation on the area of the study, population involved, sample and methods of data collection.

9.0. Area of the Project

This study was conducted in Dar es Salaam region, the region which is comprised of three districts namely Kinondoni, Ilala and Temeke District. The sample schools were selected from each district basing on the categories of schools in Tanzania. The existing categories include National schools, Community schools and Private schools. This project was purposely conducted in national schools and community schools. This is due to the fact that the schools are co-educational, accessible by the project team and hence easy to meet the teachers and students.

10.0. Project Implementation and its outcomes

10.1. Lobbying

The initiatives was taken to ensure that the science national team facilitators who meet in Morogoro for improving the science teaching methodology they become aware of the problem of low participation of girls in learning science subjects in secondary schools, as well as importance of CRC clubs in the schools. The science national team facilitators was facilitated by the change agents, Mr Elia Kibga and Mr. Adelard Saduka about the magnitude of problem of low participation of girls in learning science in Tanzania as well as the introduction of CRC concepts. The participants agreed to starts the CRC clubs in their schools and emphasized the importance of encouraging girls to opt for science subjects, that is, 'girls can learn science'. Also, they agreed to facilitate science teachers from their respectively regions. In addition to that the participants were agreed to design the lesson plan which has participatory approach to fully involve girls in participation of learning science. Therefore, the lobbying was trying to set the cascaded model which has influenced the implementation of the project.

10.2. The design of the participatory lesson and trial outs

The proto type participatory lesson plans were tried in different secondary schools by various teachers. The necessary corrections were made by the national coordinators in order to make sure teachers during the teaching they use different teaching techniques to enhance participation of girls in learning science subjects.

10.3. The guideline Formulation

The project has designed the guidelines which shall guide teachers on how to prepare the participatory lesson plan, selection of participatory teaching methods and techniques, sitting arrangement, teaching materials, as well as preparation of conducive learning environment. The guideline has suggested that teachers should use the gender materials which portrayed that girls also can learn science.

11.0. The starting of CRC clubs in schools

Among the objectives of starting CRC clubs was addressing the non discrimination on access education. Every child has right to access to education and opt whatever he/she wants regardless of her original ethnics, color, and sex. The slogan of 'CRC- Participation; Provision and Protection' was illustrating well by students in the school were the CRC clubs were started. It removes all kind of discrimination on access to the education such science is only for masculine and arts is only for feminine.



Picture 1: on 16th August, 2010 at William Mkapa Benjamin Secondary School Head Girl delivering a speech about the progress of CRC clubs and participation of girls in learning science in her school

11.1. Project execution

The project started by involving the national science teacher facilitators at Morogoro region. The guidelines of participatory lesson plan was Formulated by the national team and trials were made at selected co-secondary schools in Dar es Salaam region. The CRC clubs was started as pilot in following secondary schools: Azania Secondary Schools (boys' secondary school); Jangwani Secondary Schools (Girls Secondary School); Benjamin William Mkapa Secondary School (Co-education secondary school); and Kibasila Secondary School (Co-education secondary school). The clubs are aiming to educate students in understanding their rights, that is, participation, protection and provision- CRC).



Picture 2: 16th August, 2010, at Azania Secondary School Professor Agneta talking to boys students of about CRC clubs and Child Rights issues

11.2. Training Strategy

Dramas, simulation games, poetry, songs, as well as posters, students' speeches and teachers' speeches were using to make students to know the importance of learning the science subjects particularly the participation of girls in learning science subjects in secondary schools.

11.3. Training Materials

The Child Rights Guide by UN was elaborated during the facilitation process with the facilitators at Morogoro region.

The video scripts which showing the attitudes of students towards the science subjects was made known to participants and the magnitude of the problem of low participation of girls in learning science subjects was well illustrated to the participants by using the video script.

The flip charts, manila cards, and posters were illustrating the image of the problem of low participation of girls in learning science subjects in secondary schools in Tanzania.

11.4. Training Methods

The facilitation, discussion, and groups, presentation methods were used interchangeably. The national team facilitators were regarded as education experts and have well experiences. The methods used were trying to gain and give experiences from each other to reach the intended objectives of the project.

11.5. Training Contents

The change agents guided and controlled the development of the training contents; therefore, the training contents were developed by the facilitators according to the intended objectives. The guideline on how to prepare the participatory lesson plan for the participation of girls in learning the science subjects in the secondary schools was developed and tried at the classroom level.

11.6. Project implementation schedule

	Sept –Oct	November	December	January	February	March
1 st week	Lund University	At MoEVT	School holiday	Initiation of CRC clubs in Schools	Data collection	Data analysis
2 nd week	Attending class on Management of Child Rights, School and Classroom Management	Designing of the project	School holiday	Preparation of tools : questionnaires, Interviews and observations	Data collection	Data analysis

3 rd week	Attending class on Management of Child Rights, School and Classroom Management	Visiting schools	School holiday	Preparation of tools : questionnaires, Interviews and observations	Data collection	Writing forward way report
4 th week	Attending class on Management of Child Rights, School and Classroom Management	Visiting schools	School holiday	Preparation of tools : questionnaires, Interviews and observations	Data collection	Presentation of forward way report at AWASA (Ethiopia in the mid of March 2010)

	April	May	June	July	August	Sept	October to December
1 st week	Preparation of facilitation materials	Lobbying at MoEVT level	Meeting with National Science Facilitators	School holiday	Mentor visiting to Tanzania	Trial of lesson plan (prototype)	Report writing and editing of report
2 nd week	Preparation of facilitation materials	Lobbying at school level	Developing of Lesson Plan with National Science Facilitators	School holiday	Visiting to MoEVT	Trial of lesson plan (prototype)	Communication with Prof Agneta and final collection (submission of draft report)
3 rd week	Preparation of facilitation materials	Lobbying coordinator of national girls science camp	Developing of Lesson Plan with National Science Facilitators	Preparation for visiting of Mentor, Proff. Agneta	Visiting to school with Mentor	Trial of lesson plan (prototype)	Submission of final report
4 th week					Meeting With Mentor at TIE	Trial of lesson plan (prototype)	

11.7. Project outcomes

The increase of enrollment of girls in science subjects at secondary schools, high adoption rate of CRC clubs in the neighbors schools to the pilot project schools which conducting the CRC clubs.

There is changing of the attitude of some science teachers towards participation of girls in learning science subjects. Teachers are changing the teaching centered methods to participatory teaching method.

A grow quickly of parents attitudes to motivate their daughters to opt for science subject has taken a pace as compared before the implementation of the project.

The project is imparting the knowledge and skills of participating girls to learn science among teachers in cascaded fashion or snow ball fashion. Teachers are getting the training and improving their teaching methods.

12.0. Methodology of the project

This chapter discusses the procedures and methods employed in conducting this project and data collection. It gives a brief explanation on the area of the study, population involved, sample and methods of data collection.

12.1. Area of the Project

This study was conducted in Dar es Salaam region, the region which is comprised of three districts namely Kinondoni, Ilala and Temeke District. The sample schools were selected from each district basing on the categories of schools in Tanzania. The existing categories include National schools, Community schools and Private schools. This project was purposely conducted in national schools and community schools. This is due to the fact that the schools are co-educational, accessible by the project team and hence easy to meet the teachers and students.

12.2. Population and Sample

A research population also referred to as Universe of a research is a large group of people that has one or more characteristics in common on which a research study is focused. It is from the population such that the research sample is drawn from. Importance of the sample is its ability to represent the large population (Best and Kahn, 1986). The selection of the sample should be

in such a way that its findings should be able to reflect almost similar characteristics that would be obtained in case the whole universe was surveyed. The target population is usually a group about which a research is interested in gaining information and drawing conclusion.

In this study the target population involves six categories that are:-

- (i) secondary school teachers;
- (ii) secondary school students;
- (iii) head of schools;
- (iv) laboratory technicians;
- (v) zonal chief inspectors; and
- (vi) stake holders (director of secondary education, parents, secondary schools, district educational officers)

Two schools, one from national schools and another from community schools were selected from each district. Therefore a total of six schools were selected to represent the rest of the schools in Dar es Salaam region. The sampled schools were Jangwani and Turiani Secondary Schools from Kinondoni district; Benjamin Mkapa and Mchikichini from Ilala district as well as Miburani and Temeke secondary schools from Temeke district.

12.3. Data Gathering Techniques and Instruments

The choice of the techniques used in this study was dictated by the tasks and key questions for which data and answers were gathered by particular instrument. The most desirable approach with regard to the selection of appropriate techniques for data collection depends on the nature of the particular problem and on the time and resources available. The study employed both qualitative and quantitative data collection techniques. The Former dealt with opinions, beliefs and attitudes while the later dealt with analysis of data from the lesson observation checklists and questionnaire.

12.4. Questionnaire

There is a large range of types of questionnaire, although the main types as stipulated out by Cohen and others (2000) are structured, semi-structured and unstructured questionnaires, which may be closed-ended or open-ended. Questionnaires are useful in that they can generate

frequencies of responses amenable to statistical treatment and analysis (Best and Kahn, 1986). The other advantages of questionnaire data collection technique as summarized by Cohen and co-workers (2000) included that they are clear on the needs to be included or covered in order to meet the purposes of a research; exhaustive in its coverage of the elements to be included; asks the most appropriate kinds of questions; elicits the most appropriate kind of data to answer the research purposes as well as sub-questions; and asks for empirical data.

This technique was used to collect important information such as teachers and students' perception on the girls' participation in the teaching/learning of natural science subject in Tanzania. It was also used to collect data on the current practices in the teaching and learning of Physics in Tanzanian secondary schools. Thus, open-ended and closed - ended questionnaires were applied. The latter was used to collect written views and explanations about the research problem, while the Former was used to collect data that required answering short questions such as Yes/No, multiple choice or rating scales (Cohen, et. al., 2000).

12.5. Interview

An interview is a data collection technique that involves data collection through direct verbal interactions between the interviewer and interviewee (Masawe, 1995). It is an interchange of views between two or more people on a topic of mutual interest (Cohen, et. al., 2000; Best and Kahn, 1986). Some of the advantages of interviews as identified by Best and Kahn (1986) as well as Masawe (1995) include the fact that they provide immediate feedback, allowing the interviewer to follow-up by asking probing questions, thus obtaining more in-depth data of great clarity; they can be carried out successfully even with illiterate interviewees, let alone educated people; they allow direct interactions between individuals, giving room for the development as well as maintenance of rapport; and their capacity for adaptability such that there is a chance for seeking clarification and elaboration of points raised from either sides, that of the interviewer or interviewee.

According to Cohen and colleagues (2000), the purpose of the interview includes the following aspects:

- It makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (values and preferences) and what a person thinks (attitudes and beliefs);
- It is useful in getting deep into the motivation of respondents and their reasons for responding as they do; and
- It can be used to validate other methods or used in conjunction with other methods in a research undertaking.

However, interviews have some serious weaknesses that can influence the data obtained. Masawe (1995) as well as Cohen and others (2000) mention some of these weaknesses.

- (i) The one to one or interpersonal relationship existing between the interviewer and interviewee during the interview process may introduce subjectivity and hence, introducing biases in the data obtained;
- (ii) The biases may reduce the validity and reliability of the interview data;
- (iii) Interviews are expensive and time consuming to administer hence, may only be used to a relatively small sample; and
- (iv) The interviewer may decide to hold out sensitive but useful information or decide to give false information to please the interviewer.

In spite of these weaknesses, interview schedules were used in this study to elicit information from teachers, Education administrators and examination officers at NECTA. This was necessary for them to clarify and expand answers that were particularly important regardless of being in some cases shortly answered in the questionnaire and other instruments.

12.6. Observation

In observations, the researcher is given an opportunity to look at what is taking place in a real situation of the problem under study. It helps a researcher to see things that might otherwise be unconsciously missing or those ideas that participants might not freely talk about in an interview situation. Stressing on the use of observation instrument in data collection, Cohen and co-authors (2000:305) put it this way:

“Observational data are attractive as they afford the researcher the opportunity to gather ‘live’ data from ‘live’ situations...we cannot study the world without being parts of it”

Cohen and others (2000) described observational data to be essential since it enables the researcher to enter and understand the situation that is being described. However, the observation should be planned, structured and what is to be observed has to be clearly known in advance (Cohen, et. al., 2000).

In this study, the observation technique was used in practical lessons. The method was crucial in order to know whether practical or demonstrations were being integrated in Physics lessons or were taught separately as if theory and practical were two different subjects. The researcher also intended to act as a student in order to observe on the real situation in which teaching and learning of Physics was being practiced. The researcher also observed teachers as well as students’ teaching and learning attitudes in the class for those who were preparing for the alternative to practical examinations and those preparing for real practical national examinations separately. In this respect, classroom observation was conducted in 8 (80%) out of 10 sampled schools. Appendix J was used to collect the relevant data. Also the researcher used the observation data collection method to collect data on availability of laboratories, chemicals, equipment and other teaching as well as learning facilities in secondary schools. Lack of such resources is one of the factors, which contributed to the establishment of the alternative to practical mode of assessment.

12.7. Focus Group Discussion

Focus group discussion was also used in collecting data for this study. This technique resembles the interview technique for it involved face to face discussion. However, instead of interviewing respondents individually, normally, the focus group consists of a group of people discussing together (Saburi, 2002). In this study, Physics teachers in each sample school formed one focus group discussion.

The technique was used to supplement data collected from teachers and students concerning the ways they perceive real practical as well as the alternative to practical modes of Physics practical assessment. In addition, the technique acted as a means of cross-validating the information collected through interviews, questionnaire, observation and documentary review. Furthermore, the technique assisted the researcher and the respondents to talk freely about the problems facing teachers in teaching Physics practical, roles of practical assessment in enhancing the teaching as well as learning of Physics subject and suggestions for improving teaching and assessment of Practical work in Tanzanian secondary schools. Appendix H shows the structured focus group discussion questions used in the study.

12.8. Documentary Review

A document is a valuable source of information in education research. Information for this study was found from documents of various kinds. Some of these sources included circulars and directives on examinations from the MoEVT, NECTA, educational reports, reports from educational meetings, conference reports, O-level Physics syllabus, dissertations/theses on science education, policies, circulars, pamphlets, journals and text books. Some of these have contributed to the understanding of the background to the poor participation of girls in natural science subjects and others were consulted every time as the study went on. The rationale for using this method was that written documents had the straight forward function of providing facts and the indirect function of helping researchers project an understanding into the times and places (Cohen, et. al., 2000).

12.9. Data Analysis

In this study, both qualitative and quantitative research approaches to data analysis were employed. Qualitative methods data analysis was used to analyze data obtained from opinion and comments of respondents in the interviews. Quantitative data analysis was used to analyze data from questionnaires. After collecting relevant data, frequencies of the respondents and percentages were employed to analyze the existence of associations among research variables. In other cases, mean and percentages were used to find out the statistical measure that revealed the relationship between research variables.

13.0. FINDINGS, ANALYSIS, AND DISCUSSION

This section presents the findings, analysis and discussion of data in relation to the girls' participation in learning natural science subjects. The presentation of findings are summarized in table

13.1. Respondents' Views on the Current Status of Girls' Participation in Learning Natural Science Subjects in Secondary Schools (N=60)

S/ N	ITEMS	RESPONDE NTS	
		No	%
1	Science regarded as male domain	40	66
2	Boys are more intelligent than girls	30	50
3	Girls are not self confidence	40	66
4	Boys enjoy natural science practical work than girls	50	83
5	Girls have less times to do science because most of the time they are involved in home chores	55	92
6	Adolescences problems hit girls harder than boys	45	75
7	Girls who opt for natural science prefer biology than other natural science subjects	53	88
8	Poor sitting arrangement reduces sharing of knowledge and experiences between girls and boys	35	58
9	Science curriculum materials portray male image	47	78
10	Girls and boys are not treated equally in teaching and learning of natural science subjects	55	92
11	In case of scarcity of funds parents are likely to pay school fees for boys	45	75
12	Science teachers are not well motivated	25	42
13	There is shortage of laboratories and laboratory requirements in most of community secondary schools	58	97
14	There is critical shortage of science teachers	52	84

15	Girls have less concentration in science lesson than boys	36	60
16	Peer group can influence girls either to participate or not participate in learning science	32	53

Table 12.1 shows views of various education stakeholders who were interviewed in relation to the current status of girls' participation in learning natural science subjects in secondary schools in Tanzania.

Teachers, heads of schools and school inspectors' respondents argue that girls are low enrolled in natural science subjects as compared to their counterparts' boys. The reasons pointed out were critical shortage of laboratories and laboratory requirements (97%), which makes the teaching and learning of natural science subjects too theoretical. This discourages the girls' students to opt for natural science subjects because they don't understand the content of the subjects and consequently perform poorly in the national examination. The situation aggravated by the critical shortage of science teachers which is experienced in secondary schools in Tanzania (84%). Another reason which was mentioned was that girls and boys are not treated equally in the teaching and learning process (92%), with this regard teachers do not involve girls students in classroom activities such as answering questions , asking questions , performing particular tasks, volunteering for tasks, expecting to be asked a question, and who is asked difficult questions. In addition, girls' students are less rewarded by the teachers when they perform better than teachers do for boys.

The other reason which was pointed out was the involvement of girls in home chores which reduces their time for studying natural science subjects (92%). Natural science subjects need ample time for studying, practicing and reviewing. Therefore boys enjoy science learning as they have enough time to study and enjoy practical work which is important for verification of principles, laws, and theories (83%). So community discourages the girls to opt for science subjects so that they can continue assisting family activities. Even the few girls who opt for science subjects, most of them are taking biology only and leave chemistry and physics (88%) due to the fact that biology equips them with hygienically skills, balance diet and knowledge on

how to protect themselves from various diseases. However, in case of scarcity of funds, parents are likely to pay school fees for boys and leave the girls at home regardless who is more intelligent than the other.

Moreover, it was also pointed out that other factors which contribute to poor girls participation in learning natural science subjects were that science was regarded as male domain (66%); boys are more intelligent than girls (50%); adolescence problems hit girls harder than boys (75%); poor sitting arrangement which separate boys from girls (58%); science curriculum materials portrays male image (78%); science teachers are not well motivated (42%); girls have less concentration in science lesson than boys(60%); and peer groups can influence of girls to participate in learning (53%).

S/N	ITEMS	RESPONDENTS	
		NUMBER	%
1	Poor teaching approaches, techniques, methods, and questioning techniques	56	93
2	Poor teaching and learning environment	53	88
3	Poor guidance and counseling of girls by both parents and teachers as far as teaching and learning of natural science subjects are concerned	45	75
4	School time table does not treat girls and boys equally as science subjects are studied early in the morning	43	72
5	Distance from home to a school	57	95
6	Syllabus is too long to cover in four years	43	72
7	Science curriculum materials portrays male image	41	68

Table 13.2: The views of respondents on CRC gaps in the teaching and learning of natural science subjects in Secondary Schools in Tanzania (N=60)

13.1. The CRC Gaps in the Teaching and Learning of Natural Science Subjects in Secondary Schools in Tanzania

Table 12.2 indicates that 93% of the respondents point out that the critical factors which contributes to girls poor participation in teaching and learning natural science subjects is the poor teaching and learning approaches, methods, and techniques. In most cases when girls perform better they are less motivated comparing to boys this is due to cultural beliefs that little from the girls. Teachers are not sensitized enough to teach the gender balanced class to the extent that most of the classroom activities devoted to the boys. For example, during the practical work girls are asked to record the data while the boys are performing actual practical activities. This denies girls right to developed skills in psychomotor domain which is important parts in learning of science.

Most of secondary students in Tanzania study in Community Day Based Secondary Schools. The community based schools are constructed by community and managed by the government. Every community based secondary school is supposed to be at distance of seven kilometers from the residence of the children. But some of the students are living as far as 15 kilometers away from their homes (95%). In rural areas students are either walking in long or rent a room. Such situation forces girls to early marriages/pregnancies, HIV/AIDS, STD's which results to school dropout. Mean while in urban areas transport for students is not reliable. Thus girls' students are likely to get to school late because they are less capable of fighting for transport as compared to boys. Also due to the fact that science subjects are conducted in morning the late comers are likely to lose science lessons which result to lose interests in opting for natural science (72%).

Poor guidance and counseling of girls by both parents and teachers as far as science concerned was also mentioned as one of the factors affecting the girls' participation in learning natural science subjects (75%). Many girls are not guided by their parents/ guardians and teachers about right subjects to opt; they were left to choose on their own and they end up selecting wrong combination.

Other factors contributing to poor participation of girls in learning natural science subjects are such as poor teaching and learning environment (88%); syllabus is too long to cover in four years (72%) ; and science curriculum materials portrays male image (68%).

Regarding this gap, the team is planning to design an intervention which will reduce the gap. The design procedures are well stipulated in methodology section.

14.0. Challenges

This part highlights some of the challenges which were met during the project implementation. The uncertainty whether there will be change of attitude among parents, teachers, and some of the education officers toward the participation of girls in learning science subjects; the low adoption rate of CRC concept among school administrators and some teachers; the traditions and culture still hinder girls to pursue studies further in science: tradition customs such as traditional drama which prepares girls for early marriage; female genital mutilation (FGM) and payment of dowry for girls students to their parents.

15.0. Recommendations

- a) There is a need for a change agent of batch 11 to be empowered in terms of finance and logistic to cascade the project of participation of girls in learning science subject at secondary schools especially at disadvantageous areas like in rural areas.
- b) There should be a follow up to see whether the teachers are use the participatory methods of teaching. This method would help girls participate in science subjects.
- c) There shall be a need for a change agent to build the rapport to community on change of attitude toward girls in learning science subjects and continue with science carrier at higher studies
- d) There is a need to conscietize the community to change their negative attitude towards girls learning of science.

- e) Mentors of CRC should conduct post evaluation about the progress of the implementation of CRC project of the participation of girls in learning science subjects at secondary school level in Tanzania.
- f) Educational experts in Tanzania should come together and come up with the best package for science teachers methods which are friendly to girls.

Conclusion

In view of the findings revealed that by this study. It is hoped that there will be a positive change in learning of the natural science subjects in secondary schools in Tanzania. However, it is also hoped that there will be a positive change for the community towards the participation of girls in science education.

The Way Forward

MINISTRY OF EDUCATION AND VOCATIONAL TRAINING

PROJECT OF PARTICIPATION OF GIRLS IN LEARNING NATURAL SCIENCE

SUBJECTS IN SECONDARY SCHOOLS IN TANZANIA

CRC - WAY FORWARD REPORT



By

Adelard Nhunde Saduka, Elia Kibga, and Tumbana Shoo
(CHILD RIGHT PROGRAMME IN SECONDARY SCHOOLS IN TANZANIA)

Tips on CRC

The selected Team of 40 facilitators who are science teachers from different parts of the country and other invited academicians from University of Dar es salaam has been facilitated on CRC concepts as well as CRC articles



Map of Tanzania showing regions

The selected team also has been facilitated on the project of participation of girls in learning science subjects at secondary school



Facilitation of CRC project at Kilakala Secondary School in Morogoro Region

Teachers on Information of Participation of Girls Students in Learning Science

The CRC change agents Mr Elia Kibga and Mr. Adelard Saduka who went for CRC training in Sweden and Ethiopia facilitated well the concept of CRC and its articles and the way forward of CRC project titled Participation of Girls in Learning Science Subjects at Secondary Schools in Tanzania.



The Science Teachers who selected to be the national facilitators discussed and contribute on how to empower the girls' students to be enroll in science subjects at level of secondary school and encourage them to continue with science carriers at university level



Science Teacher facilitates discussion about girls students in learning Natural Science Subjects

Training model for Participation of Girls in Learning Science Subjects at Secondary Schools

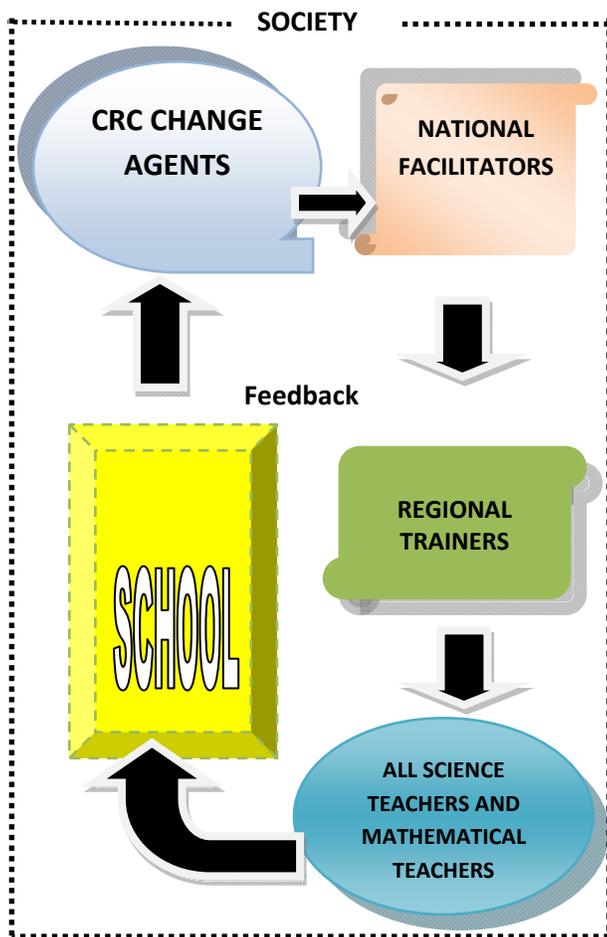
The Regional Trainers

The CRC change agents have facilitated the Regional facilitators who will affect the change in participating the girls' students in learning science subjects at school and classroom level. More the facilitators will use the different techniques acquired like Formation of CRC clubs in schools, drama, posters and school media as well as calling the parent meeting for empowering the girls' students to learn science subjects.

The forum of National and Regional Facilitators for the participation of girls in learning science subjects in secondary school

The participants play a drama, and wrote their ideas on the groups.

Group one played a drama to demonstrate the low participation of girls in learning science subjects in the classroom situation. The play showed how factors such as culture affect the participation of girls in learning science subjects. The drama uncovered the feelings of the community that sciences subjects are mostly are boys and not for girls. Even the few girls who took science are tomb girls.





Facilitators play drama

Group highlighted on the factors which affect the participation of girls in learning science subjects in secondary schools such as

- Cultural beliefs which emphasize that girls cannot perform difficult tasks
- Religious beliefs that a woman are there to help men
- Historical background that portrayed man as the only strong person who was able to fight hazardous wild animals and physical wars
- Negative attitudes towards girls' ability to pursue science subjects at secondary school level. This also results in a small number of girls who pursue B.Sc. Degree at University level.

The group three provided a rationale for science clubs which would help girls to learn more science particularly girls such as:

- Bringing children together to be friends; encouraging originality and creativity in the design development and implementation of club science activities;

- Encourage self expression and communication skills among the club members ;
- Identify of gaps and problems in society and how to solve them ;
- Self concept– What I am best at or “what I am worse at”; self-esteem; I can do it better”.



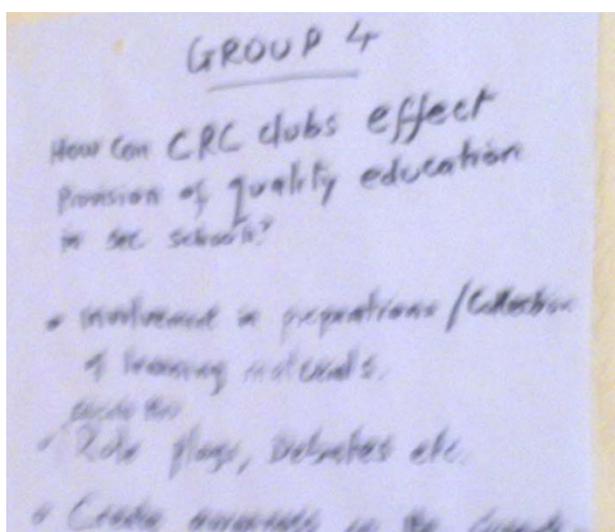
Facilitator explaining the rationale for science clubs for students in secondary schools

The rationale for science clubs in our schools is also inclusive for removing barriers to girls in participating in girls learning of science in secondary schools in Tanzania and the whole world at large particularly in developing countries.

The last group presented on how CRC clubs can effect the provision of quality education in secondary schools. It highlighted important points such as involvement in the preparation /collection of learning materials; role plays debates, etc; creation of awareness on the importance of

assessing and evaluating the lesson and full participation in school assembly.

Therefore, the participation agreed to go back to their respective regions and schools and starts the CRC clubs as well as the mainstreaming of Scheme of Works and Lesson Plans in order to participate well and enroll more girls in learning science subjects in secondary schools.



The presentation of group four in wall paper

The participants were well facilitated on how to the model in order to encourage the society; and schools to empower the girls' students to be enrolled to learn science subjects. The model is shown in page one.

Benjamin Mkapa and Kibasila Secondary Schools have been selected as Project Centre for running the Project of Participating Girls in Learning Science Subjects in Secondary Schools in Tanzania. The Change Agents of CRC will be visiting the centre frequently to motivate other regions to participate

in order to manage well of the replicated projects in their regions and schools. This will enable the Innovation of Project of Participating Girls in Learning Science Subjects to spread faster throughout the schools across the country.

Conclusion: The change agents of batch eleven from Tanzania laid the sustainable foundation for participating girls in learning science subjects in secondary schools in Tanzania, first by facilitating the Science Teachers who are science facilitators from different corners of the country about the participating of girls in learning science subjects, second by mainstreaming the participating of girls in learning science subjects in the programme of national science subjects whereby science facilitators as science teachers meet every year under MoEVT to discuss the problems and challenge in teaching science subjects in secondary schools, and third by starting of CRC clubs in secondary schools in the country.

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Appendixes

LESSON PLAN: ARCHIMEDES PRINCIPLE AND LAW OF FLOATATION

TOPIC: ARCHIMEDES PRINCIPLE AND LAW OF FLOATATION

SUB TOPIC: Sinking and floating of an object (the issue of density)

GENDER SENSITIVE LESSON- (Total time - 80minutes (2 periods))

Main objective:

To enable the learners understand the Archimedes' principle and the law of floatation

Specific objectives:

At the end of the lesson the learners should be able to have acquired the following skills;

- Differentiate the effects of different densities of liquids to the floating and sinking of an object.
- State the law of floatation
- Explain and apply the concept of floating and sinking of objects in fluids in real life situation

Introduction: (Time 10 minutes)

A TEACHER, should ask the learners to explain briefly on the concept of floating and sinking of an object before carrying out a lesson.

Question: *why do objects float? Why do other objects sink?*

When an object is immersed in fluid, it either sinks or floats. There is a relationship between the density of an object and that of a fluid.

Aim:

To demonstrate sinking and floating of an object (e.g an egg in this case)

Requirements

Apparatus

Beaker / Measuring cylinder-1000cc

Materials

Fresh egg, pure water, salt 50gm, stirrer

References;

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Statement of the problem:

There is a relationship between the variation of density of water and floating and sinking of an egg. How this situation occurs?

Hypothesis:

When the density of water is high, egg floats in water, and sinks when the density of water is less than that of an egg.

Procedures and Observation: (40 minutes)

In groups of 4-6 students with equal number of girls and boys

1. Pour some pure water in a container of about $\frac{3}{4}$ full.(**done by a girl**)
2. Release an egg slowly on the surface of water and then observe its position
(**done by a boy**)
3. Add some amount of salt while stirring until the egg rises up automatically
(**done by a girl**)
4. Continue adding the salt until the egg rises up and floats on the surface of water.(done by the same girl in 3 above)

Analysis and Discussion: (20 minutes)

Let each group make a short discussion and conclude on what was happening during the process of adding salt and stirring.(while a teacher goes around and checking the discussion)

If in the first group, the conclusion was **done by a boy** then, the second group the conclusion should be **done by a girl**.

NB: The conclusion can be done when one learner explains before the class.

Conclusion :(10 minutes)

By the teacher and exercise to the students.

Before adding salt, the egg sinks since its density is greater than that of water. After adding salt the density of water becomes higher than that of egg hence floating.

Conclusion:

An object floats in water if its density is less than that of water, and sinks if it is higher.

An object floats in water if its density is less than that of water, and sinks if it is high.

NB:

Any object floats, if and only if the density of fluid is greater than that of a floating object and vice versa.

Reflection question

Why there is a difference in height of immersion between a ship in fresh water and in salty water? Explain the logic behind.

LESSON PLAN: ALGEBRA

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND VOCATION TRAINING

LESSON PLAN

School: Azania Secondary School

Name of the teacher: Twaha A.Twaha

Subject	Date	Class	Duration	No. Of Learners	
				Present	Absent
Basic Maths	15/08/2010	Form II	80 minutes		

COMPETENCE: Ability to compute numbers efficiently.

Main Objective: Learners will be able to factorise and solve problems in algebra.

Main Topic: ALGRBRA

Sub-topic: Factorization

Rationale: In life things are grouped according to their resemblance and for ease computation. The ability to perform efficiently operations in mathematics requires one to be able to relate things, put them together and work out the numbers.

Specific Objectives: By the end of the lesson each student should be able to:

- i. Write down all the factors of an algebraic term.
- ii. Find common factors of two or more algebraic expression.
- iii. Use factorization to simplify calculations.

Teaching Materials: Manila Card, Marker pen and masking tape.

References: TIE (2002) Secondary Basic Mathematics Book 2, Nessoro, S (2005) New General Mathematics.

Prerequisite knowledge: Operations with real numbers, Learners should know how to find factors of a given number, highest common factors (HCF) and LCM of real numbers.

STAGE	TEACHING ACTIVITIES	LEARNING ACTIVITIES	ASSESSMENT
INTRODUCTION (10 Minutes) Revise how to find factors	Through FQQ's: Ask the Learners to mention factors of 10, 8 and 12 [Choose boys and girls to respond to the questions]	<ul style="list-style-type: none"> - Learners will give responses. - Expected responses: <ul style="list-style-type: none"> (i) 10 factors are 1,2,5 and 10 (ii) 8 factors are 1, 2, 4 and 8 (iii) 12 factors are 1,2,3,4,6 and 12 	Can the Learners list out all the factors of a given real numbers?
	Find factors of $2a^3$ [give the learners 2 minutes to think individually, 2 minutes to discuss in pair and then let them present]	Learners discuss using Think Pair Share technique. The expected responses: Factors are $1, 2, a, a^2, 2a, 2a^2, a^3, 2a^3$	
Knowledge (40minutes) Step 1 [20 minutes] [to consider gender in selecting Learners to present]	Lead Learners to define Factorization [group the learners in groups of 4 – 2girls and 2 boys]	Learners brainstorm on the meaning of factorization. Learners in group of 4 discuss and take notes on the meaning of factorization. Thereafter make the presentation. Expected responses: Factorization means: <ul style="list-style-type: none"> - Writing an expression in terms of its factors. - Finding the factors of the expression. 	<ul style="list-style-type: none"> • Do the learners understand the meaning of Factorization? • Can the Learners identify the common factor?

<p>Step 2: [20 minutes]</p>	<p>[While learners are in their respective groups]</p> <p>Display the worked example (written on the manila card) and ask them: What they think has been done?</p> <p>The Teacher have to go around and assist the Learners in their groups</p> <p>The worked example:</p> $15ax + 10a = 5a(3x + 5a(2) = 5a(3x + 2)$ <p>Three or 4 groups present [select 2 girls and 2 boys]</p> <p>Write the following expressions on the bb:</p> <ol style="list-style-type: none"> 1. $2xm - 3ym$ 2. $2d^3 + d^2(3d - 1)$ 3. $2x(5a + 2) - 3y(5a + 2)$ <p>[give the Learners 3 minutes to think about the expressions Individually]</p> <p>Then ask the Learners:</p>	<ul style="list-style-type: none"> - A way of removing brackets <p>Learners will discuss and come out with:</p> <p>Thinking from LHS to RHS:</p> <ul style="list-style-type: none"> - The HCF (i.e $5a$) have been taken away from each term [$5a$ has been divide throughout] - Then HCF have to multiply each term - Hence inserted the brackets <p>Thinking from RHS to LHS:</p> <ul style="list-style-type: none"> • The terms in the brackets have been multiplied by $5a$. <p>The Learners individually will brainstorm and respond.</p> <p>Expected response:</p> <ol style="list-style-type: none"> 1. m is common to both terms 2. d^2 is common to both terms 3. $5a + 2$ is common. 	<ul style="list-style-type: none"> • Can Learners find the factors of the given expression?
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	<p>What is common on each expression?</p> <p>[select 3 boys and 3 girls to present, write their views on the bb] then let the Learners discuss the views (some Learners might have differing opinion)</p> <p>Then write the expression on bb:</p> $cx + 2dy + cy + 2dx$ <ol style="list-style-type: none"> What terms have common coefficients? If it is to factorize, what do you think should it be done? Learners in groups of 4 work on it (find factors) 	<p>The Learners using Think Pair Share technique brain storm in (i) and (ii)</p> <p>The expected response:</p> <ol style="list-style-type: none"> The terms in cx and cy and $2dx$ and $2dy$ Rearrange the expression (correct the like terms) The Learners to present their work in the bb [boys and girls should be given equal chance to present]. $cx + cy + 2dx + 2dy$ $= (cx + cy) + (2dx + 2dy)$ $= c(x + y) + 2d(x + y)$ <p>Note: $(x + y)$ is common to both the products.</p> $\therefore (x + y) + (c + 2d)$	
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Reinforcement [10 minutes]	<p>Write the expression on the bb:</p> $79 \times 37 + 21 \times 37.$ <p>Then ask the Learners to find the product (simplify)</p> <p>NOTE:</p> <ul style="list-style-type: none"> • The expression should be simplified by factorization method. • The Learners should show all the 3 steps: <ul style="list-style-type: none"> (i) Identifying the common factor (ii) Grouping (putting the brackets) (iii) Simplify [using BODMAS] 	<p>In groups of 2, the Learners to work on the given expression. [the group to comprise a boy and a girl]</p> <p>Expected response:</p> <p>1stly: Learners will identify the common factor, i.e 37</p> <p>2ndly: introduce the brackets in the expression.</p> $(79 \times 37) + (21 \times 37)$ <p>3rdly: simplify</p> $(79 \times 37) + (21 \times 37)$ $= 37(79 + 21)$ $= 37(100)$ $= 3700$	<ul style="list-style-type: none"> • Can the Learners factorize any given expression? • Can the Learners use factorization to simplify the calculation?
Reflection [05 minutes]	<p>Ask the Learners the following questions:</p> <ul style="list-style-type: none"> (i) Explain how to factorize the expression: $\pi r^2 + 2\pi r h$ (ii) What did you learn from this lesson 	<p>The Learners will brainstorm individually and then give response:</p> <p>Expected response:</p> <ul style="list-style-type: none"> i. The expression can be factorized by taking out the common factor from both terms. ii. Learners make a summary of what have been taught. 	<p>Can the Learners explain the process of factorization?</p> <p>(Have Learners acquired the intended goals?)</p>
Consolidation [15 minutes]	<p>Provide the exercise from New General Mathematics,</p>	<p>The Learners will do the exercise (individually).</p>	<p>How well the Learners are utilising the skills taught?</p>

	<p>Book 2, Nessoro pg 33 qns 21 and 22.</p> <p>1. Use factorization to calculate: $\frac{3}{4} \times 133 - \frac{3}{4} \times 93$</p> <p>2. Factorize the expression $\pi r^2 h + \frac{1}{3}\pi r^2 H$. Hence find the value of the expression when $\pi = \frac{22}{7}$, $r = 7$, $h = 10$ and $H = 12$</p>	<p>The expect response:</p> <p>1. $\frac{3}{4} \times 133 - \frac{3}{4} \times 93$ $= (\frac{3}{4} \times 133) - (\frac{3}{4} \times 93)$ $= \frac{3}{4}(133 - 93)$ $= \frac{3}{4} \times 40$ $= 3 \times 10$ $= 30.$</p> <p>2. $\pi r^2 h + \frac{1}{3}\pi r^2 H$. [factor out πr^2] $= \pi r^2 (h + \frac{1}{3} rH)$ Substituting: $\frac{22}{7} \times 7^2 [10 + \frac{1}{3} \times 12]$ $\frac{22}{7} \times 49 [10 + 12]$ $= 22 \times 7 \times 22$ $= 3388.$</p>	
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Note: The seating arrangement of the class should be gender sensitivity. Where it is possible a girl and a boy.

Learners Evaluation: -----

Note: The Teacher will ask the Learners:

1. How did you see the lesson?
2. How can the lesson be taught better?

Teacher's evaluation: -----

[The evaluation will base on how well did the lesson reach the intended objectives, i.e the specific objectives?]

Remarks:

.....
.....

[What you think is supposed to be done if the intended objectives where not achieved? If attained, what do you think made the lesson successful?]

OBSERVATION SCHEDULE

Introduction: This is observation schedule for the Project of Girl Participation in Learning Science at Secondary School Level. The aim of this project is to develop the package recommendation for science teachers on how to encourage girls to participate in learning science at secondary level and to continue with science carriers. The confidentiality of individuality when filling this checklist has been considered. No personal opinions will be exposed outside the Ministry of Education and Vocational Training and Lund University of Sweden.

Section A: A structured observation schedule on posing a question during the learning process

Instruction: An observer should check the box by putting (/) for every event that will occur during the learning process in the classroom

	1	2	3	4	5	6	7
Teacher pose a question to girl student							
Teacher pose a question to boy student							
Girl student ask a question to teacher							
Boy student ask a question to girl							

Section B: Rating scale on behaviors during the learning process of science in the classroom. The observer should record the girl v/s boy behavior towards seeking attention from teacher as well as teacher's response back by praising girl v/s boy. Please, check in the box by putting number from least 1 to most 5 as ranked below:

1= not at all; 2=very little; 3=a little; 4= a lot; 5= a very great deal

	1	2	3	4	5
Girl students seeks teachers` attention					
Teacher praises student girl					
Boy students seeks teachers attention					
Teacher praises boy student					
Girls responds to work with Boy in group/pair					
Girls responds to work with Girls in group/pair					
Boy responds to work with Girl in group/pair					
Boy responds to work with Boy in group/pair					
Teacher praises the group work of mixed boy and girl					
Teacher praises the group work of boy only					
Teacher praises the group work of girl only					

C: Instruction: An observer should check the box by putting (/) for every event that will occur during the learning process in the classroom

	1	2	3	4	5
Teachers explain the importance of topic relevant to occupancy					
Teachers give the example of female scientist model in our community from point view of topic					
Teachers give the example of male scientist model in our community from point view of topic					
Boy students give interest in scientist model mentioned					
Girl students give interest in scientist model mentioned					

QUESTIONNAIRES FOR GIRL STUDENTS

This is questionnaire for girls students in the Project of Girls Participation in Learning Science at Secondary School Level. The aim of this project is to develop the package recommendation for science teachers on how to encourage girls to participate in learning science at secondary level and to continue with science carriers. The confidentiality of individuality when filling this checklist has been considered. No personal opinions will be exposed outside the Ministry of Education and Vocational Training and Lund University of Sweden.

Attitude of Girls on Natural Science Subjects

School NameForm.....Stream: Science Option or Not Science Option

Instructions:

The following statements states how you think and feel about science. Please read each item carefully, and put an X in the box which best describes you.

SA = Strongly Agree; A = Agree; D = Disagree

	SA	A	D
I have a lot of self-esteem when it comes to science.			
For some reason even though I study, science seems usually hard for me.			
I'm not the type to do well in science.			
Generally I have felt secure about attempting science.			
I can get good grades in science.			
I don't think I could opt for natural science subjects' combinations at Advanced level.			
I think I will opt for science stream when I enter Form three			
Science subjects can mainly be done better by boys than girls			
Science helps women to take care of the children			
Natural Sciences have been my worst subjects.			
Females are good as males in science.			
It is hard to believe a female could be a genius in science.			
Studying science is just as appropriate for women as for men.			

When a woman has to solve a mathematics problem, it is shame to ask a man for help.			
I would have more faith in a male doctor than female			
I would trust a woman just as much as I would trust a man to figure out important science calculations.			
Girls who enjoy studying science are a bit peculiar.			
Women certainly are logical enough to do well in science.			
I would expect a woman scientist to be a masculine type of person.			
I would need science for my future work.			
Knowing science will help me earn a living.			
Natural Sciences which I learn are of no relevance to my life.			
Teachers are bias to boys when teaching natural science subjects			

THANK YOU VERY MUCH

Note: Personal Opinion: Are you interest to get copy of this recommendation upon the completion of this Research Project on Participation of Girls in Learning Science Subjects in Secondary School in Tanzania?

No.....

YES.....

If YES, please enter your email address below e.g. normal @yahoo.com or normal@hotmail.com

.....@.....

QUESTIONNAIRES FOR TEACHERS, SCHOOL INSPECTORS AND HEADS OF SCHOOLS

This is questionnaire for teachers, school inspectors and heads of schools in the Project of Girls Participation in Learning Science at Secondary School Level. The aim of this project is to develop the package recommendation for science teachers on how to encourage girls to participate in learning science at secondary level and to continue with science carriers. The privacy of individual when filling this checklist has been considered. No personal opinions will be exposed outside the Ministry of Education and Vocational Training and Lund University of Sweden.

Section A: Correspondent particular: Age: less than 30 ; 31-40 ; 41- 45 ; 46 -50 ; above 51

Job Experience Years: more 5 ; 6-10 ; 11-15 ; 15-20 ; 21-25 ; above 26

Section B: The attitude of respondents toward the status of participation of Girls in learning science subject in secondary school

1. Do you have enough girls participating in natural science subjects
Yes
No
If No, please explain.....
2. Explain how you are trying to encourage girls to study natural science subjects.....
3. Which technique can the community apply so as to make girls participate in natural science subjects?.....
Does the school (government) provide girls with teaching and learning materials to assist them?
Yes
No
If No, please explain.....
4. Mention appropriate material supplied to girls in school which may encourage them to participate in natural science subjects.....
5. What criteria did you use selecting girls who participate in natural science subjects?.....
6. Do you guide them before they are selected to join science subjects.....
7. Are the teachers suitable or qualified to teach science subjects
Yes
No
8. If no what do you see to be the problem?.....
(a) Is it true that poor teaching and learning methods and techniques are the reason for poor participation of girls in natural science subjects
Yes

No

If No, please
explain.....

9. Do you think that boys and girls are treated equally in the class particularly in the natural science subjects?

Yes

No

If No, please, explain.....

10. What are your comments regarding the relevance of natural science subjects curriculum to the Tanzanian real life of a girl student?.....

THANK YOU VERY MUCH

Note: Personal Opinion: Are you interest to get copy of this recommendation upon the completion of this Research Project on Participation of Girls in Learning Science Subjects in Secondary School in Tanzania?

No.....

YES.....

If YES, please enter your email address below e.g. normal @yahoo.com or normal@hotmail.com

.....@.....

FOCUS GROUP DISCUSSION FOR STUDENTS

These are the interview questions for focus group in the Project of Girl Participation in Learning Science at Secondary School Level. The aim of this project is to develop the package recommendation for science teachers on how to encourage girls to participate in learning science at secondary level and to continue with science carriers. The confidentiality of individuality when filling this checklist has been considered. No personal opinions will be exposed outside the Ministry of Education and Vocational Training and Lund University of Sweden.

Focus Group Discussion (5 Form two Boys; 5 Form two Girls; and 5 Form three girls from Artss stream)

1. Do you think that boys and girls are treated equally in the class particularly in the natural science subjects?
2. What are the reasons for not opting for science stream when you entered Form three?
3. Do you think that studying natural science subjects have better future life than studying artss subjects? Why?
4. Does the studying of natural science subjects enable the learners to apply the gained knowledge to solve problems in the day to day life of the society?