

Mwanakatwe, J.M. (1975). Reflections on the Use of English as a Medium of Instruction in Schools. In *The Bulletin of the Zambia Language Group*. Volume 2, Number 2, University of Zambia, Lusaka.

Nkosha, D.C. (1995). *A Case for Zambian Languages in Our Schools*. A Paper submitted to the Ministry of Education Headquarters in Lusaka, University of Zambia.

Ohannessian, S. and Kashoki, M.E. (1978). *Language in Zambia*. International African Institute, London.

Richards, J.C. and Rodgers, T.S. (1986). *Approaches and Methods in Language Teaching*. Cambridge University Press, Cambridge.

Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research*. Sage Publications, London.

Tembo, L. (1975). The Medium of Instruction. In *The Bulletin of the Zambia Language Group*. Volume 1, Number 1, University of Zambia, Lusaka.

The Zambia Reading Appraisal Team (1996). *Report of the Zambia Reading Appraisal Team*, Submitted to the Ministry of Education, Lusaka.

Wilkins, D.A. (1972). *Linguistics in Language Teaching*. Edward Arnold, London.

Winterbottom, J.M. (1949). Some Problems of the Use of African Vernaculars. In *Human Problems in British Central Africa*. *The Rhodes-Livingstone Journal*, Volume VII, Number Seven, Manchester University Press, Manchester.

ATTITUDES OF GIRLS TOWARDS MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN LUSAKA AND MAZABUKA, ZAMBIA

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Abstract

The performance of boys and girls in Mathematics is generally poor at secondary school level, but of major concern are the differences between the two sexes. The performance of girls is far below that of boys. A number of factors have been suggested to explain girls poor performance. These have dwelt on school environment, community and household effects (socialisation process), biological factors and negative attitudes that girls have. Attitudes contribute to performance (Appleton, 1993). However, the question still remains: what attitudes do girls have towards Mathematics? Thus, this study explored the attitudes that girls have towards Mathematics. The circumstances and factors that condition these attitudes were investigated and recommendations and suggestions on possible remedies are given.

The research which was conducted in two towns in Zambia, Lusaka and Mazabuka, utilized a qualitative research approach. In-depth interviews with selected girls at junior and senior levels in each of the six schools visited were conducted. Two schools in Mazabuka and four in Lusaka were selected. The data collected through interviews were categorized into themes, and quotations were made from the transcribed tapes and interview notes.

The results of this study suggest that girls view mathematics as a difficult and masculine subject. A number of indicators revealed that there are some factors influencing these attitudes: some of these factors are lack of successful experiences in the subject, poor teaching in some cases and other indicators which appear to stem from the traditional notions of roles of men and women.

Among other recommendations, the report suggests that guidance and counselling of pupils in schools should be encouraged especially by role models in traditionally male careers to ensure positive attitudes towards, and full participation by girls in, the subject.

Introduction

The provision of nine years universal basic education for all as proposed by the Ministry of Education and Culture (now called the Ministry of Education) in its Educational Reform document, has faced a number of problems, including inadequate structures (i.e. buildings) and a shortage of educational materials (1977). As Kelly (1994, p. 33) has observed, "Zambia is educationally under-resourced". Also of great concern are the numbers of girls in these schools compared to that of the boys. The 1990 population census revealed that in the age-range 7-13 in Zambia, girls out-numbered boys by 10,000 and yet in terms of primary school enrolments boys out-numbered

girls by more than 55,000. 78.4% (585,961 out of 747,870) of the girls were enrolled as compared to 87.1% (642,798 out of 738,386) of the boys, (Central Statistics Office figures, 1990).

While this record of representation between the sexes raises questions of equity in terms of access, there is also a problem of progression rates in the school system. The drop out rate for the girls is higher and their performance is generally poorer than that of boys. For example, in 1990 there were 26,268 girls and 37,797 boys in grade 8. However, five years later (1994), there were 8,048 girls and 15,787 boys in Grade 12, representing a drop out rate of about 70% for girls compared to 58% for boys (Ministry of Education Statistical Bulletin, 1994). In terms of performance, Swainson (1995) reports that girls perform worse in all examined subjects in Zambia except in local languages and English.

The poor performance is more pronounced in Mathematics and Science subjects as exemplified by the Junior leaving Examination results in Mathematics (Grade 9) for 1990 and 1991. In 1990, 57.0% (26,023 out of 45,642) of the boys who sat for the examination passed compared to the girls record of 31.2% (9,686 out of 31,043). In 1991, 48.2% (22,354 out of 46,376) of the boys who sat for the examinations passed compared to 25.3% (8,150 out of 32,209) of the girls (Examinations Council of Zambia). Thus, less than a third of the girls did well in the two years compared to about half of the boys.

The problem of poor performance seems to continue even at School Certificate level. For example, the School Certificate performance for the years 1987 to 1989, and 1994 show no significant improvements in performance for both girls and boys.

School Certificate (Grade 12) Results in Mathematics

		No. of those who sat for the exam	Passes	
			No.	%
1987	Boys	10,444	6,742	64.6
	Girls	4,213	1,315	31.2
1988*	Boys	7,015	4,282	61.0
	Girls	1,223	467	38.2
1989	Boys	11,667	7,744	66.4
	Girls	5,286	1,829	34.6
1994	Boys	15,224	9,387	61.7
	Girls	7,475	2,815	37.7

Source: Examinations Council of Zambia (1994)

* results for candidates who were resitting the exams are not included.

These results show that about two-thirds of the girls failed Mathematics while only one third of the boys did so. Thus, these public examinations indicate that the girls' overall level of performance in Mathematics is lower than that of boys.

At higher institutions of learning, the imbalance between the sexes is carried further as the lower proportion of female students in Mathematics and Science-based programmes exemplified by the enrolment figures at the University of Zambia for the 1992 - 93 Academic year show. Of the 4,978 students enrolled, only 962 (19.3%) were female, only 279 (29.0%) and of these went into Mathematics and Science-based programmes compared to 1935 (48.2%) of the males. The situation obtaining in other tertiary level institutions of learning is not different from the case of the University of Zambia. For example, according to Kelly (1994) in the secondary teacher's colleges, little more than one-third of the 1993 trainees (35.5%) were female. In vocational and technical institutions, less than one-third of the total enrolment is female and almost all female students are training in such traditional female areas as secretarial and office work. Female participation in such areas as Plumbing, Mechanics, Electricity, Automotive Engineering or Air Support Services is almost non-existent (1994, p. 40).

The representation of females in key careers in our society also leaves much to be desired. This is particularly so in careers that require Mathematics and Science. As Hurlich (1986) and Zambia Association of Research and Development (ZARD, 1985) found in their studies of women's participation in various spheres of Zambian life, the opportunity structure in Zambia is gender-biased and that in almost all activities, Zambian women are marginally integrated, and of significantly lower status. This may be worsened by employers and higher institutions of learning demanding 'O' level passes in Mathematics among other subjects. Mathematics therefore becomes a filter to a number of key careers such as Engineering, Computer Science and the Construction Industry, to mention but a few areas.

Thus, this imbalance between the sexes needs to be addressed for an egalitarian society. The difficulties and problems hindering female participation and good performance in the Mathematics and Science subjects should be investigated. This study endeavours to investigate some of the causes of the girls' poor performance in Mathematics.

Statement of the Problem

A number of possible reasons have been suggested to explain why girls' performance in Mathematics is not as good as that of boys. Some of these relate to biological factors, child-rearing and social factors, others to factors within schools and to career expectations. While these factors generally explain the poor performance in many other secondary school subjects and amongst boys as well, the performance of girls in Mathematics tends to get worse as one progresses at school especially at secondary level. At primary school level minimal differences have been reported to exist. Thus, it becomes imperative to investigate how the girls themselves feel about the subject. What beliefs do they have about the subject? As Fishbein and Ajzen (1975) have explained, beliefs represent information that is known or perceived by the individual about a subject or an object. Thus, an individual's attitude towards any object is a function of that persons' beliefs about that object as well as the implicit evaluative responses associated with those beliefs. It could therefore be argued that beliefs affect attitudes and these attitudes then affect intentions and behaviours.

Thus, this study will attempt to explore the attitudes held by girls about Mathematics in a few selected schools in Lusaka and Mazabuka.

Objectives of the Study

The objectives of the research were the following:

1. To establish attitudes which girls have about Mathematics in selected secondary schools
2. To determine factors that condition these attitudes.
3. To establish whether these attitudes are related to the grade or location of the school.

Research Questions

Arising from the objectives stated above, the following research questions were posed.

- a) What beliefs do girls have about Mathematics as a subject?
- b) What circumstances/factors help shape these beliefs?
- c) Are there differences in the beliefs of girl pupils in grades 8 and 11 and their localities?

Significance of the Study

This study is significant for a number of reasons: Mathematics is a powerful means of communication in management, scientific development, modern technology, and in commerce and industry. Moreover, it is useful in terms of arithmetic skills needed in the home, the office or the workshop (Cockcroft, 1982). This means that gross inadequacies in the subject on the part of anyone, man or woman, may clearly disadvantage that person. A good result in the subject in the national examinations is increasingly being used as a pre-requisite for entry into many key careers, not to mention admittance to higher institutions of learning. Thus, poor performance in Mathematics will mean excluding such individuals from many opportunities in higher education and better jobs.

Also, the study is of importance to the teaching of the subject itself (Mathematics). Teaching needs to take into account the pupil's feelings and beliefs held, for it to be effective and meaningful. The Assessment and Performance Unit (APU) cited in Burton (1986) explained that information on attitudes is important because "the thoughts and feelings of pupils towards the activities they engage in at school are an important feature of their learning; and a positive approach to any school subject is an educational goal in itself, and data concerning any factors which may influence such an approach (attainment for example) are considered important" (p. 38). Further, teacher training institutions may be sensitised to the beliefs and hence attitudes of their female students towards Mathematics. This would probably enable them adopt appropriate teaching methods which could be of help to the girls.

The results of the study might provide the policy makers in the Government, through the Ministry of Education, with information which they might use to implement appropriate measures to curb the gender disparities in Mathematics and other related subjects.

Literature Review

In this section literature is reviewed thematically under the headings; 'Performance differences between girls and boys at secondary school level' and 'Causes of the poor performance by girls.

Performance Differences Between the Sexes

Performance differences between girls and boys at secondary school level in Mathematics have been well documented. Nkhata (1996) and Ndimbirwe (1995) all report in their studies, that the failure rate in Mathematics by girls is more than 60%. Sayers (1991) also found that there was a wide difference in the performance of the two sexes. He found that boys out-performed girls every year and that there was no sign of change. Kelly (1991) lamented the poor performance of girls in all subjects except in art subjects.

Further, statistical information from Central Statistics Offices (CSO), Examinations Council of Zambia, and Ministry of Education Statistical Bulletin reveal the poor performance of girls compared to boys at all levels of the education system.

The situation in the sub-region appears to be similar to the Zambian case. Phiri (1990) states that heads of schools in Malawi and Zambia pointed out that boys performed significantly better in Mathematics and Science and that this was especially so in secondary schools. This is confirmed by Mwanza (1990) in his study of the quality of girls Education in Malawi secondary schools. He found that in Mathematics and Science, the gap between girls and boys examination performance widened during the 1980s. In Zimbabwe a similar situation obtains as reported by Dorsey (1989) in who states that, in general girls did not do well in Mathematics and other Science subjects.

The situation elsewhere is the same as reported by Cockcroft (1982), Eccles & Blumenfeld (1988), Lender (1992), Fraser (1994). They all point to the fact that girls under-perform in Mathematics compared to boys.

It is comparatively easy to document the fact that girls under-perform in the major school examinations, but it is much more difficult to explain why. Let us now turn to how other scholars have dealt with this.

Possible Causes of Poor Performance by Girls

A number of factors have been suggested as causes of poor performance by girls in Mathematics. These have ranged from biological differences between boys and girls, the socialisation process of girls in society/communities, school policy related and general negative attitudes towards the subject by girls. But the theories explaining differences between girls and boys in biological terms have not been fully understood. Nevertheless, in view of the fact that differences between the sexes in mathematical attainment are more marked in some countries than in others, suggests that there are other factors at play (Cockcroft, 1982). However, the review of literature in this section will concentrate on attitudes as they pertain to achievement and Mathematics.

Some studies have been carried out in this area. Appleton carried out a study to find out the relationship between performance in the Kenya Certificate of Primary Education (KCPE) and those inputs which could influence it (1993). He found that attitudes influenced girls' examination performance, in situations where parental doubt over female ability and the students' traditional view of gender roles accounted for the observed gender differences in performance. "Taken together,

these simulations imply a large role for attitude in explaining girls' inferior performance" (p. 56). He also found that teachers' opinions were related to examination performance. Weinburgh and Englehand (1994) in their study of relationships between gender, prior academic performance, beliefs and student attitudes toward Biology Laboratory experiences found that gender had a significant effect on attitudes. Students who believed laboratory experiences were beneficial had more positive attitudes.

Cockcroft (1982) in his review of research reported that "there appears to be an identifiable (although small) correlation between attitude and achievement. It is not clear, however, in what way attitude and achievement affect one another" (p. 61). Meanwhile, Mathematical Association (1988) state that attitudes play a much more significant role in the outcome. Attitudes, they found become less positive with age and that the deterioration is more marked for girls than boys. Fraser (1994) investigated whether there were gender differences in Mathematics students' attitudes and the achievement of University students. He found that generally, women tended to view Mathematics more negatively than men, though the evidence was weak.

Further, the Assessment and Performance Unit (APU) (1981) in its research into pupil attitudes reported that "Whilst many boys probably have similar feelings to girls, girls were likely to express greater uncertainty about their mathematical abilities and performance whereas boys had greater expectations of success." (p. 5). Similarly Cope et al. (1988) also suggest that females have greater anxiety toward Mathematics than males.

Sayers (1991) found that females are underrepresented in Education, particularly in the area of Mathematics and Science. In the comparison between boys and girls attitudes he found that girls were less confident, more nervous, enjoyed Mathematics less and saw less use for their Mathematics than boys. This was a quantitative study which used an attitude questionnaire which was designed in the U.K for pupils there.

In another study by Nkhata (1996), which used the same instrument for data collection as Sayers (1991), a questionnaire was administered in six schools in Lusaka on attitudes of boys and girls towards Mathematics and a comparison was made between the two sexes. It was found that the girls tended to have more negative attitudes towards Mathematics than the boys.

The current research is not comparative in nature, but rather focuses on the girls themselves, and qualitatively explores the attitudes that they have towards Mathematics.

Methodology

This section looks at the methodology of the research and this is done under the sub-headings; research design, population and sampling techniques, data collection techniques, data collection implementation process and lastly data analysis.

Research Design

The study involved obtaining information on girls attitudes towards Mathematics through personal interviews. A survey method was chosen because it is suited to the study of individuals' attitudes.

Most of the research done in this area has employed the quantitative methods of data collection. Such research has used attitude scales or questionnaires, with pre-determined responses. This research employed qualitative methods of data collection and analysis. This approach was chosen because the study involved beliefs which are not easy to quantify. Thus, the nature of the topic of investigation required the utilisation of the qualitative methods.

Population and Sampling Techniques

The population comprised pupils in all secondary schools in Lusaka and Mazabuka. The two areas comprise an urban setting (Lusaka) and a rural setting (Mazabuka). Lusaka has the largest number of secondary schools in Zambia. The diverse ethnic background of the pupils in the schools also offered a good ground for this research and further, it was within reach. Mazabuka had been chosen to represent the rural setting because it has both co-education and single-sex schools. Further, it is in a rural setting and is near to Lusaka.

Purposive sampling was used to pick the six schools. This was done to be such that each type of school and locality attributes were represented in the research. Thus, Mazabuka Girls Secondary School was picked to represent a single sex (girls) school, David Kaunda Technical Secondary School was picked representing the best scoring pupils at Grade 9 level going into senior school. Further, this school used to select boys only until 1992 when Government through the Ministry of Education, changed policy to admit girls as well. Libala Secondary School was picked for similar reasons as David Kaunda except that this school is not technical and is a 'Day school'. Lusaka High School was picked to represent private schools and further, it was easily accessible. Kamwala Secondary School was selected because it is co-educational and easily accessible. The sixth school was Chikankata Secondary School which is a mission school in a rural setting. It was included in the sample for the features mentioned.

The numbers of girls interviewed by school, grade and totals are shown in the table below:

Table 1: Number of Interviewees by School and Grade

School	No. of Interviewees		Total
	Eight	Eleven	
Kamwala Secondary School	4	4	8
Chikankata Secondary School	1	3	4
Mazabuka girls secondary school	2	4	6
Lusaka High school	4	4	8
Libala secondary school	-	4	4
David Kaunda Technical school	-	4	4
Totals	11	23	34

There were six schools visited and in each school, Grade 8 and Grade 11 pupils were interviewed. Grade 8s were chosen because this is the group that has just joined secondary schooling and there is evidence that before this Grade, girls perform as well as boys. Nair and Mumbula (1995) confirmed this in their baseline study. They found that girls compete fairly well with boys at primary level and that the overall performance of boys and girls in Mathematics is good. Grade 11s were

chosen because these had been at secondary school for four years and were therefore thought suitable representatives for senior grades. This gave representation for both junior secondary school and senior secondary schools.

The numbers of girls interviewed; in each school varied depending on the circumstances at the school. In all 34 girls were interviewed, 23 grade 11s and eleven grade 8s as shown in the Table 1. Purposive sampling was used to pick the girls from each school, and criteria ranged from family background to performance in class.

Data Collection

In this study, data were collected through interviews with girls in each school. The researcher had semi-structured questions which were used as a general guide, otherwise questions were mostly follow-ups in a conversational manner. The questions posed addressed the objectives and research questions of this study. In other words, beliefs held about Mathematics were investigated and further, the circumstances and factors that led to such beliefs were pursued. In the interviews with the respondents. A tape recorder was used in some cases, but mostly, interview notes were taken down by the researcher.

Data Collection Implementation Process

Under this section we discuss the problems and constraints in the collection of data. Access to the schools was facilitated by letters of request written well in advance and the response from all the schools was positive. However, the constraints were on finding suitable time for the interviews. Study periods and break times were some of the times used but, these did not provide ample time to finish the interviews and these proceeded into lesson time. After school hours provided the best time, especially for boarders but, this was not the case in one instance with a day-scholar where the parents of the girl came early to pick her up and the interview had to be stopped.

The venue for the interviews also posed some problems in some schools. The use of a library, for example, in one school had one interview disrupted as a class walked in for their study. The interview continued nonetheless outside, under a tree. The use of departmental rooms for staff also proved problematic as teachers would come in to collect whatever things they had to pick. Their presence in the room made the interviewee uncomfortable. Thus, the best venues tended to be outside when there was less movement from other pupils, or the classrooms after school hours. Further, where the tape recorder was not used, the researcher had difficulties keeping up with responses from the interviewees in terms of taking down notes.

Data Analysis

The data collected were analysed qualitatively. The data were analysed through 'grounded theory' procedures; open coding, categorising, axial coding and selective coding. The concepts were labelled on the interview notes, and transcribed line by line. These concepts were later grouped together according to the various phenomena they represented. The categories so formed were then refined and linked in different ways. This benefited from the research memos written earlier after each set of interviews. In some instances, the researcher had to go back to the field to clarify certain concepts. The main categories were thus, developed from these sub-categories. The findings arising from this analysis are presented in the next section.

Findings and Discussion¹

The findings are presented and discussed in relation to the following aspects; attitudes which girls had about Mathematics, factors that conditioned these attitudes and whether these attitudes were related to the grade or location of the school. Examining positive attitudes and negative attitudes, the discussion highlights beliefs or misconceptions that girls had about Mathematics, the factors and circumstances that helped shape such beliefs and misconceptions, and lastly, whether there were any differences between the Grades (8 and 11) and between schools in the two areas.

Positive Attitudes

Girls with a positive outlook towards Mathematics had a number of reasons that made them have such a disposition.

The majority of the girls who indicated that they liked the subject were juniors (Grade 8s). The picture was the same between the rural and the urban schools. There were a number of reasons that girls revealed influenced their views towards liking the subject. Some of the reasons or sentiments expressed for liking the subject are presented under the following sub-themes:

Good Teachers

Many girls expressed that they liked the subject because of their teacher. Such teachers were described generally as being encouraging, cheerful, friendly, humorous and helpful. They were said, on average, to pay attention to weak as well as bright pupils. These teachers gave exercises with examples and related the subject matter to everyday life. Since teacher attributes were said to have enhanced the girls' liking of the subject, teachers are therefore a factor in influencing girls' attitudes towards the subject.

Utility of the Subject

The utility of Mathematics was another attribute that made it appealing to many girls. It would appear that most girls appreciated the importance of Mathematics for their careers in the future. On this aspect, many of the girls interviewed agreed that Mathematics was important. Namukolo put it this way,

"I want to be an engineer, so I need Mathematics."

24 other girls referred to its usefulness in other school subjects. This is an encouraging revelation as Mathematics is increasingly becoming a gateway to a number of key careers in the world of work. However, this is not followed up with action or positive attitudes towards the subject for many of the girls. The importance of the subject was acknowledged by girls in both urban and rural areas, regardless of whether they were in Grade 8 or 11. This does not tally with the finding by Sayers (1991) that girls generally saw less use of Mathematics. However, for many girls their knowledge of the utility of the subject did not persuade them to have a positive attitude, as later sections will reveal.

¹ Names of persons appearing in the text are pseudo ones, they are not real

Love of Numbers and Challenge

Four Grade 8 girls had a different reason for liking the subject. They said that they liked the subject because it was easy and that they liked playing with numbers. This was not common even amongst the Grade 8 themselves and no one in Grade 11 expressed such a reason, except two gifted ones who indicated that they liked the subject because of its competitive nature. One Grade 11 girl at David Kaunda Technical Secondary School revealed this view point when she stated:

"I like it here because of the competition. Where I was before, when I got 52% I was number one, (she was at a single-sex school) but here especially in Mathematics I study hard in order to come at the top. Mathematics is competitive and that's why I like it".

Many (10 out of 14) of the girls who indicated that they liked Mathematics, studied the subject at their own time without being asked to do so. They performed well in tests and examinations in the subject. Namukolo said, "I don't rest when there is a problem I have failed to solve. I consult until I find an answer". These girls tended to prefer questions that required extended answers as opposed to multiple choice type of questions. Almost all the nine Grade 8 girls interviewed expressed this sentiment and said that they did not experience any anxieties.

Further, those who liked the subject tended to do extra work during their spare time. They studied or practised Mathematics on their own without being asked to do so. In this regard, boys tended to be given more time especially in boarding schools. Evening study time in the boarding schools ends between 21:00 and 21:30 hours and girls have to retire to bed immediately. Boys are allowed to stay on till 22:00 hrs. Six (6) girls interviewed at two schools, one in Lusaka and the other in Mazabuka felt this was unfair to them because that's the time when boys practised Mathematics in groups.

Parental Support

Twenty-eight (28) [82.4%] of the girls interviewed in both Grades 8 and 11 revealed that parents, and to some extent uncles and aunts, were supportive of their education in general. They encouraged their children to do school work and to concentrate on education. However, where Mathematics was concerned, only those who were mathematically confident tended to assist. This was in 10 cases of girls living with their parents. These parents tended to be career parents holding high positions at their places of work. Also, if there were older children who had gone further in their education, these too assisted their sisters if they were themselves good in the subject. Girls coming from such backgrounds tended to look positively at the subject (Mathematics). As the conversation with Tonje reveals below;

Researcher: Why is Mathematics not your favourite subject?

Tonje: I like it, but it's not my favourite.

Researcher: Why do you like it?

Tonje:because it is important. My elder brother helps and encourages me to do well in Mathematics. Even my father helps me in Maths, but my mother is not good, but she found me a tutor to coach me.

Parents that are concerned about their children but, are not comfortable with the subject make efforts by arranging private lessons with tutors, for their children. This was confirmed by another girl, Namooobe who said;

"My mother couldn't help me, so she found a tutor (in Mathematics) for me."

This attitude of parents towards their children should be encouraged as pupils at this stage need such support and concern from their parents.

Peer Influence

The study found that girls tended to get assistance mostly from boys. Boys were described by many (19, 67.9%) girls from co-educational and even from one single-sex (girls) school (4 out of 6), as friendly. As Mbonyiwe put it,

"When I get stuck, I ask boys. I prefer to ask boys because girls tend to show off if they know something." While this is encouraging, many girls complained about the attitude of some boys. It appears girls get help from boys because they appear to be more confident than them. However, as much as boys like to assist girls, they do not like it if girls score higher than them in class. This is one aspect that needs to be addressed, otherwise boys' positive influence would go a long way in assisting girls to compete on an equal footing. Girls themselves need to be more supportive of each other".

Negative Attitudes

While a few girls were positive about Mathematics, a large number (16) 69.6% of Grades 11s we talked to, came out strongly against the subject. The picture was the same between the rural and the urban schools. The 16 girls interviewed, who generally disliked the subject, had varying reasons for their attitudes. These reasons are looked at under the sub-themes below.

Teachers

Eighteen (18) of the girls expressed misgivings about some of their teachers. Chileshe from Kamwala secondary school put it this way;

"Our teacher is boring and mostly in a hurry, he wants to finish the syllabus, he doesn't consider us that we are behind. We don't understand when he is teaching...they should be linking it to everyday life, that's why it is difficult".

These sentiments were expressed by girls in both rural and urban schools. This suggests that the teaching of Mathematics in general does not relate to everyday life. Its usefulness in some topics is not explained. Girls must be helped to see the usefulness of Mathematics as applied to daily living. The social context of problems must be exploited rather than teaching it as an abstract and a subject that is unrelated to life.

In other instances, the attitude of some teachers could have discouraged some girls from liking the subject. Some teachers were said to be re-enforcing stereo-typing by passing comments or statements to the effect that girls were not expected to do well. As Tonje said, "Our teacher also discourages us when he says 'girls are wasting our time, let's move on'." Though the teacher may have been unaware of the implications of his statement, it is this type of attitude that discourages girls

from participating fully in the classroom. The teachers' concentration on bright pupils may also contribute to pupils' interest in the subject. As Tinkhe explained, "My mathematics teacher is OK, he treats both boys and girls the same but, he concentrates on the bright ones."

This appears to be the case for many teachers, as 27 of the girls interviewed in both areas said that teachers concentrate on bright pupils regardless of sex. This state of affairs implies that the majority of girls are not attended to in their classes since many of them are not doing well especially at Grade 11 level. Thus, some girls may interpret this to mean that Mathematics is not for girls or that their teacher does not care.

Some teachers may have influenced or passed on their negative experiences of the subject to some pupils due to lack of confidence when teaching it. As Lusizi reveals;

"She reads from a book and she doesn't explain ... I don't feel confident because even our teacher is not confident. When you ask her a question, she won't answer. I don't think she knows the stuff".

Also nine girls revealed that they felt inhibited to follow a male teacher outside the classroom, in order to ask him a question. As Mbonyiwe explained,

Girls are not willing to follow a teacher in order to ask a question, we tend to restrict ourselves to the classroom only....others may think that you are interested in the teacher or the teacher may think that you fancy him, so we just ask in class.

These were all Grade 11 girls. Girls at junior level did not express such sentiments, perhaps because they are too young to think the way the senior girls were thinking about their teachers. Worth noting here is that, although teachers did not appear to be the major source of these beliefs, they did very little to change them or to provide information that could lead to pupils re-evaluating their sex-stereotyped beliefs.

Women Mathematics teachers offered poor models to most of the girls interviewed. Thirty (30) of the girls interviewed (88.2%) did not prefer to be taught by a woman teacher, let alone become Mathematics teachers themselves. They described women teachers as having petty jealousies. Lenganji expressed her opinion as follows;

"Women teachers in my experience tend to be moody, they have tempers and they talk too much. When you ask so many questions, they get annoyed".

Many of these girls, (bright, average or weak) felt that women teachers did not like them and gave that as a reason why they too did not like female teachers.

Nalonje, a pupil at David Kaunda Technical secondary school revealed that she would like to do more in Mathematics because a female teacher she had at her former school made her lose interest in the subject. Unfortunately the mother found a woman tutor for her, which made her dislike the subject further as she could not stand female teachers. She expressed her sentiments as follows;

"My mother found me a tutor for Maths, but it was a female teacher, so I stopped going there. I don't like female teachers, but my mother thinks my poor performance in Maths is because of bad company, but I know its not my friends".

This is unfortunate, and requires further investigation. The cry coming from educationists and women's groups has been that there are insufficient women models in Science and Mathematics subjects to inspire girls to achieve higher in the subjects. It has been believed that more female teachers in Mathematics would demystify the notion that Mathematics is for males. However, the revelation of this result where girls from both rural and urban, and whether they were bright, average or weak, have reservations about being taught by female teachers needs further research. Women teachers, especially Mathematics teachers, need to be interviewed to ascertain or verify these statements from girl pupils.

The teaching of Mathematics also requires investigations. A good number of the girls interviewed raised concerns on the way the subject was taught. In some cases, it is taught in a cold and impersonal way, and its utility is not explained, resulting in a number of girls getting discouraged and disliking the subject. Generally, the teachers whom pupils felt influenced them to dislike the subject were described as; not patient, not caring, too serious, not exciting, not jovial, not humorous, not confident, generally boring and not able to mark exercise books on time. Apart from improving on the poor qualities, teachers should use approaches that take into consideration that women are holistic learners, and therefore co-operative learning styles and group work should be fostered.

Perceptions of the Subject

Nineteen (19) of the Grade 11 girls interviewed expressed discomfort at the mention of the subject and expressed dislike of calculations, as a few of them quoted here reveal;

"I don't like calculations. In maths there is always some trick put in, even when you study, there will always be something you miss out".

Yet another girl Jane had this to say for disliking the subject:

"Mathematics is a discouraging subject, you miss a step and everything is wrong Even if I study it or practice, I easily forget, ... Its not easy to memorise, ... It is difficult and I think I am not naturally good at it, most boys are".

The school environment also contributed in some cases. Some girls in co-education schools, especially the seniors, complained of stiff competition coming from the boys. As Mukamba at David Kaunda Technical secondary school revealed,

"I don't like the competition here, it makes me lose confidence. I used to be good in maths at my former school, but here, no".

Her former school was a single-sex (girls) school and it was not a technical school.

Many other girls interviewed had a general view that Mathematics was broad and difficult to understand. Other girls considered the subject to be just tricky. They claimed that there were too many topics to be covered. Some topics were described as very hard and very difficult to comprehend. While many girls realised this, they did not make any deliberate attempt to tackle the prob-

lems or hurdles. They appeared to resign and accept that there was nothing they could do about it. Twenty (58.8%) of these girls appeared not to make any deliberate attempt to study or practice the subject on their own except in circumstances that a test or examination was in the offing. Though they tended to consider the subject important in life, they felt generally that to do well in Mathematics one had to be 'naturally good at it. Most of these girls were not members of the Mathematics Club, one other indicator that it was not a subject of their interest. Thus, many girls felt discouraged by their view of the nature of the subject and their perceived abilities in it.

The confidence of many of these girls appears to have been heavily eroded due to lack of successful experiences in the subjects tests and exercises not to mention major examinations.

Mbonyiwe put it this way:

"I failed it many times, I don't think I would ever pass in mathematics. There is a lot to be covered in the subject, I hate topics like, Cosine rule, Trigonometry, Vectors and Circle Theorems,... I am lazy, I have no one to practice Mathematics with".

This explains the lack of confidence by many senior girls in Mathematics. The poor performance and difficulties in grasping the concepts erodes the confidence that they might have in the subject. Further, this suggests that many seniors enjoy fewer successes in Mathematics questions that they encounter. It seems they have problems grasping the Mathematical concepts taught at their level. Could this be explained by the fact that the Mathematics taught at junior level is 'easy or less challenging, but as one progresses further, it becomes more challenging (difficult)? Though this sounds plausible, comparative research between boys and girls indicates that boys enjoy more successes than girls at senior level (Nkhata, 1996).

Thus, the question that arises is what happens to the girls in between their junior grades and senior grades? A longitudinal study needs to be conducted to ascertain difficulties. It would appear that girls at junior level believe that those that do well in Mathematics have 'a lot of brains. This was expressed by girls in the urban as well as the rural area. It would appear that junior girls who generally do well in Mathematics have a lot of confidence in themselves such that they believe that they are 'brainy. Also, this is the group that has just passed through a major examination (a selection examination to secondary school) from primary school. They feel that they must be good to have been able to qualify for admission to secondary school. There could be other reasons, in which case more investigations need to be carried out.

It would appear that many senior girls perform badly in Mathematics out of complacency. At junior level (Grade 8), girls and boys appear to perform almost at par. In fact, in some instances, some girls do better than most boys, especially where it appears girls believe that they are 'good and thus relax in the subject. Thus, they are not able to grasp some concepts taught at this level in depth, leading to lack of understanding of concepts taught later. As a result of them not being able to follow these later topics, they end up losing interest and withdrawing from the subject. While this may be true, there are other factors that could be at play. As Eccles and Blumenfeld (1985) explain,

"Students start school with sex-differentiated goals and attitudes. These attitudes appear to consolidate into sex-differentiated beliefs regarding Mathematics and Scientific abilities some time around early adolescence. (pg. 80). (Grade 8s are mostly of ages 12 - 14 years old, the puberty stage, while grade 11s are of ages 15 - 17 years).

Examinations Anxiety

Final examinations also contribute to anxieties experienced or lack of confidence. Fifteen (15) girls of those interviewed said that they felt nervous in the examinations, especially Mathematics papers. Chileshe said;

"In a Maths exam I panic. I feel nervous. ...it does affect my results. I make silly mistakes, I would prefer extended pieces of work, rather than final examinations".

Almost all conceded that in these circumstances, their performance is not as good as expected. Many preferred final examinations though, because they felt they were a fair way of determining who is good in the subject. They revealed that in exercises, homework and tasks done outside the classroom, a lot of pupils resorted to cheating by copying from friends. Though this appears valid, it says a lot about the modes of assessment that teachers generally employ. Thus, traditional examinations are another source of negative pressure exerted on the girls.

Peer Pressure

While girls consult boys when they are stuck, boys themselves were described as proud because they do not ask or consult girls as far as Mathematics is concerned. In fact, it appears they were less encouraging and made derogatory remarks against girls in their classes. This was especially the case with those boys who did extremely well in the subject. As Towela from Libala revealed;

"When a girl does better than boys, boys say there was a 'leakage' in the test paper".

The term 'leakage' refers to the showing of the test paper to some pupil(s) before the test date in order to aid them to do well, thus giving them undue advantage over others. Thus, boys did not expect girls to do well. If they did, they suspect dubious means to have been used. This was also the case in a rural setting as Hamweene from Chikankata secondary school revealed,

"Some boys do not want to be beaten by girls. When a girl achieves high marks, they murmur".

The derogatory remarks made to the bright girls could be very discouraging. As Tunjila revealed the terms used to describe girls who perform exceptionally well,

"They say that she has male hormones or *ni bwaume* [*ni bwaume* is a Bemba language term meaning *one is male*]".

This indicates the pressure that bright girls in general experience from their peers from co-education and single sex (girls) schools. This could mean that some of the failure experienced or dismal performance by some girls could be out of fear of succeeding at a subject that raises male overtones.

Girls feel that they are not expected to do well in Mathematics. At classroom level, it appears peer pressure is most significant. When they do better than boys, especially in co-education schools they appear to offend boys and some boys thus openly show displeasure and pass comments of discouragement. While in single-sex (girls) schools those that do extremely well are looked at in high esteem, those in mixed schools are regarded as displaying male qualities, thus, considered unfeminine. This peer pressure is not unique to Zambia. Studies conducted in the U.S.A. show that peer pressure is one of the main influences in girls attitudes towards Mathematics (Leder, 1992). Thus, girls lack of effort and zeal towards Mathematics may be stemming from the notion that the subject is regarded a male domain, which is re-inforced by their peers.

Further, it appears girls do not co-operate amongst themselves. They tend to look at each other with suspicion. As Tonge put it,

"Girls are jealous. If you ask, they might even tell you a wrong answer, but they concentrate on their `looks`".

Ironically, these sentiments were also expressed by girls from a single-sex (girls) school. The co-operative spirit which appears among boys (solving Mathematics in groups) was very weak among the girls. At the single-sex school, girls still tended to consult boys from near-by schools. They also expressed that boys were more helpful than fellow girls. Both Grade 8s and 11s in both areas agreed that they enjoyed working with friends. It appears, in general, girls prefer to work co-operatively with friends. However, which friends are these? Boys or fellow girls? Further investigations are required in this area. What was encouraging though, was that many girls demonstrated awareness of messages of defeating gender stereo-typing in schools, in particular that there are no differences between boys and girls academically. This was in both urban and rural areas. However, the situation existing in schools was such that boys were doing better than girls in Mathematics, a fact many girls admitted.

School Policies

Further, in some schools, pure sciences are not offered while other school subjects are assigned to pupils. In other schools especially co-education, it turned out that subjects like Physical Science and Pure Sciences were dominated by boys while most girls found themselves in the Biology or Science classes. Also, optional subjects such as Woodwork, Metalwork and Technical Drawing on one hand and Home Craft, Needlework on the other tended to be time-tabled together. This situation facilitates girls opting out of the traditionally boys subjects. The unfortunate part is that this pattern starts at primary school level (Maimbolwa-Sinyangwe and Chilangwa, 1995). This suggests that the socialisation at school appears to model the girls into traditionally female careers and boys into male careers. Thus, at school level there are limited subject choices available for girls, and girls are often `encouraged out of the Mathematics and Science fields and into the traditional `female subjects'. This re-inforces the societal stereo-typed view that Mathematics and the Pure Sciences are for boys. Thus, girls tend to resign to a situation of `natural inability'.

Parental Influence

The influence from parents, brothers or sisters was not always positive. For instance, at David Kaunda secondary school Susanna Sakala was influenced by her elder sister who performed badly in Mathematics at `O levels, but was doing well in her business. The elder sister was doing Com-

puter Marketing. This element has influenced her that she could do well in life without Mathematics, a source of her low interest in the subject.

Lack of confidence and the background of some parents was a source of negative influence for some girls, as Lenganji put it;

"My sister and my father were not good in Mathematics, ...I think it is natural for me, ...it is in the family, I am also like them".

In other words, some girls lack inspiration from their parents or guardians. They tend to seek solace in the general poor showing in Mathematics of their family members. This is further compounded by the `reality existing that most of the Mathematically confident groups appeared to be male dominated. Most girls revealed that they consulted males when they were stuck doing Mathematics so that most of the homes where these girls came from, the males were the Mathematically confident (able). Could this be re-enforcing the stereo-type view that Mathematics is for boys or males? It would appear so, as this is the immediate environment that pupils are in contact with everyday especially for day-scholars.

The lack of `suitable/appropriate' models seems to compound the problem in defeating this view that Mathematics is for boys. At school level too, the most senior girls, including those holding such positions as head girl, prefect, etc., provide models for the other girls coming behind them. Unfortunately, most of these girls have offered very poor models where Mathematics is concerned as one girl put it;

"Maths is difficult, most girls do not like it, even our head girl failed it".

As already pointed out, female teachers are yet another group that does not inspire, let alone attract girls to their careers.

Also of concern was the support being received from the guardians. Five (5) 14.7% of the girls interviewed revealed that their guardians did not provide a conducive environment for them to study at their homes. No time was set aside for them to study. They disturbed their children any time for household chores. Mbonyiwe complained thus;

"My aunt always says, I am lazy when I want to study at home. She says am running away from work and she threatens to deny me food".

This, it appears, was more during school holidays as parents thought their children were back from school to help them with work at home.

Career Preferences

This section does not fall under the general theme of factors that cause negative attitudes towards Mathematics. Nonetheless, it is included here to shade light on the career preferences of the girls and to reveal what these are based on, i.e. whether Mathematics plays a role in their choice of careers.

The career choices of many of the girls appear to have been influenced largely by two factors. One was the career of the parents or guardians and the other the main professional or industrial activity near the locality of the school. Mathematics as a subject did not appear to have any influence in the girls' choices of careers.

In Mazabuka at Chikankata secondary school, two (2) of the girls talked to indicated that they wanted to become nurses at a hospital. Anna put it this way;

"I would like to be a nurse, because I want to help people".

Chikankata is a mission community where there is a school, hospital and a vocational institution. The other two (2) girls at the same school said that they preferred to be sisters (nuns). This was also chosen by two (2) girls at Mazabuka Secondary School. Mazabuka girls secondary school is also a mission school with many 'sister' teachers (nuns).

At David Kaunda Secondary School, which is situated near a University Teaching Hospital, two (2) of the girls indicated that they wanted to become doctors. In other schools and even in the schools mentioned above the girls' career preferences could be traced to their parents or guardians professions or careers. Nanji at Lusaka High School preferred to be an air hostess because her cousin was one. And yet another girl at the same school indicated that she wanted to be an actress. Further probing revealed that she was usually alone at home and watched a lot of films on TV and videos.

Other professions or careers or jobs mentioned were beautician, accountant, banker, secretarial, engineering and computer programming. In almost all these careers or jobs, the interests appeared to stem from jobs or careers of parents or the prevalence of such jobs in the vicinity of the school or home. This suggests that role models or perceived opportunities play a significant part in shaping aspirations of pupils for their future.

Conclusions and Recommendations

Conclusions

This study has revealed that beliefs and views that girls hold appear deep rooted and are reinforced everyday at school, in class and in the communities and thus they continue to shape negative attitudes that most of them have. It appears the socio-cultural factors and the socialisation process still take on the same patterns at home and at school in subtle ways. Though the messages of discouraging gender stereo-typing appear to have filtered through to most girls and boys in the schools, its implications has not yet taken root. Many girls with positive or negative attitudes revealed awareness of the messages; in particular that there are no differences between boys and girls academically, and that all subjects are open and should be done by all.

Further, it has been established that teaching in some cases contributed to girls having negative attitudes and that a majority of the girls interviewed did not prefer to be taught by female teachers. Teachers teaching styles and personality could either inspire or hamper pupils' progress. Thus, teachers and schools have a role to play, but on their own cannot be expected to transform the attitudes and behaviour of children, since many of them start school with set cultural values. Thus, the community and the schools have to address the problem together, through counselling and talks as the recommendations below suggest.

Recommendations

In view of the findings and conclusions drawn in this study the researcher suggests the following recommendations:

There is need to strengthen the link between the schools and the communities through Parents Teachers Association (PTA) where girls' socialisation and performance can be discussed. Parents as well as teachers need to be sensitised about gender roles. These need to be broadened for both sexes at home and at school. Boys need to share equally, the responsibilities usually assigned to girls and vice-versa at home and school. Further, there is need to review the media messages that stereo-type gender roles, e.g. advertisements about washing detergents and kitchen utensils use women all the time. Men should also be used to sell these products, to break the cycle that associates washing and cooking with women only.

Girls should be guided and counselled. They should be encouraged to learn and understand the importance of Mathematics at all stages in their education. This should start at primary school and continue to tertiary levels. Full participation in the classroom should be encouraged, ensuring positive classroom dynamics with more pupil involvement. Gender equity in the classroom is essential and peer pressure and expectations should be closely monitored. Boys too need to be sensitised about their stereo-typed behaviour.

Time should be made available for girls to study and practice Mathematics. There is need to provide extra time at school for them to study.

Role models in Science, Mathematics and Technology careers and other male dominated sectors should be encouraged to visit schools and give talks to the pupils, especially girls. They could, in their talks, shed light on the problems that they encountered themselves and how they overcame them in pursuing careers that were traditionally male dominated. Also, their experiences at secondary school level could be shared to encourage the girls further. However, further research needs to be conducted to establish why girls do not prefer to be taught by female teachers in Mathematics, as this contradicts the idea of having role models in the subject.

Teachers should improve their teaching methods. Mathematics should be taught in a more concrete way through demonstrating its relevance to all aspects of life. Teachers must be gender sensitive. They should counsel girls and generally should spend more time with the less able pupils. Girls should be given opportunities to take on more active roles in Mathematics. Ways of supporting pupils in developing and understanding the beliefs and values which have characterised the present imbalances should be found. More in-service programmes for teachers in the field should be mounted. Would-be teachers in teacher training institutions should also be sensitised about gender issues before they join the service.

National contests, e.g. Junior Engineers and Technologists (JETS) Olympiads and Zambia Association of Mathematics Education Contests should involve girls and positive results should be published in national media.

Research needs to be carried out, especially longitudinal research to monitor girls' deteriorating interest in the subject from the start of late primary to secondary school sector. Further, this research could be replicated in other parts of Zambia and in other subjects at school level. It may also

be replicated in other countries in the sub-region as the underachievement of girls in Mathematics appears to be common.

References

- Appleton, S. (1993, May). Gender differences in Educational Attainment in Kenya: Exam performance and access to state secondary schools. Nairobi: *McNamara Fellowship Programme Final Report*.
- Burton L. (1986). *Girls Into Math Can Go*. London: Holt Rinehart and Winston Ltd.
- Cockcroft W.H.(1982). Mathematics Counts. *Report by the Committee of Inquiry Into the Teaching of Mathematics in Schools*, London:
- Corbin J. and Strauss A. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. London: SAGE publications
- Dale R.R.(1974). *Mixed or Single-Sex School? Attainment, Attitudes and Overview*. Routledge and Kegan Paul Ltd
- Dorsey, B.J. (1989). Socialisation, Gender, Academic Achievement and Aspirations of secondary school pupils in Zimbabwe. Human Resources Research Centre (HRRC), *Working Paper Number 3*, University of Zimbabwe, Harare.
- Eccles S.J and Blumenfeld P. (1988). Classroom Experiences and Student Gender: Are there differences and do they matter. In *Gender Influences in Classroom Interaction*. Wisconsin: University of Winscon. pp 79 - 113
- Ernest P. (1991). *The Philosophy of Mathematics Education*. Studies in Mathematics Education. The Falmer Press
- Fishbein M and Ajzen I (1975). *Belief, Attitude, Intention, Behaviour: An introduction to theory and research*. Addison-Wesley.
- Fraser E.J.P. (1994). Problems of Gender in University Mathematics. *British Educational Research Journal* Vol. 20 No. 2 pp 147 - 153
- Hurlich S. (1986). *Women in Zambia*. Canadian International Development Agency.
- Kapolyo K.(1994). Girls and Mathematics. *Zambia Association for Mathematics Education Bulletin* Vol. 22 no. 1. (December, 1994).
- Kelly A.(1986). The Development of Girls and Boys Attitudes to Science: A Longitudinal Study. *European Journal For Science Education* Vol. 8 no.4 pp. 399-412
- Kelly M.J (1994). *Below the Poverty line in Education. A situation Analysis of Girl Child Education in Zambia*. Lusaka: A report for UNICEF.

- Koballa, T.R (1988). Attitude and related concepts in Science Education, *Science Education*. 72(2), pp. 115 - 126.
- Leder, G.C. (1992). Mathematics and Gender: Changing perspectives. In *Handbook of research on mathematics teaching and learning*. Ed. Grouws, D.A pp 597 — 622 Toronto, Macmillan.
- Mathematical Association (1988). *Managing Mathematics*. Cheltenham. The Mathematical Association and Stanley.
- Maimbolwa-Sinyangwe, I. and Chilangwa B. (1995). *Learning from inside the classroom*. Lusaka: UNICEF and Ministry of Education (MOE).
- Mufune, P.O & Mwansa, L.K (1993). *Supervisory Women and Men in Zambian Work Organisations*. Gaborone: M & M Limited.
- Mumbula, Y. and Nair, A. (1995). Mathematics Education and Gender in Zambia: causes and strategies. Norway, Bergen. Paper presented at *The Conference on Political Dimensions of Mathematics Education* (pdme III).
- Mwanza, S.J. (1990). *The Quality of Girls Education in Malawi Secondary Schools*. Zomba. Malawi National Examinations Board.
- Narman, A. (Ed.) (1995). *Manual for Qualitative Research in Education*. Berlin: Germany Foundation for International Development (DSE).
- Ndimbirwe, B.J (1995). *Factors Causing Under-Achievement in Mathematics Among Secondary School Girls in Zambia*. Lusaka: A Research report.
- Nkhata, B. (1996). The relationship between the learning of Mathematics and the learning of Science and Technology amongst girls in Zambia. In Goel and Burton (1996, ed.). *Mathematics as a Barrier to the Learning of Science and Technology by Girls*. London: Commonwealth Secretariat. pp 106 - 115
- Odaga, A. and Heneveld W. (1995). *Girls and Schools in Sub-Saharan Africa: From Analysis to Action*. Washington, D.C.: World Bank Technical Paper Number 298.
- Phiri, C.C.M. (1990). *Women in Technical Education, Training and Jobs*. Africa: Southern/Central Regional Report. Geneva 22, International Labour Organisation (ILO). Discussion paper no. 53.
- Sayers, R. (1991). *Girls and Their Mathematics: The Case of Zambia*. M.Ed. thesis — unpublished. University of Leeds.
- Swainson, N. (1995). *Redressing Gender Inequalities in Education: A Review of Constraints and Priorities in Malawi, Zambia and Zimbabwe*. Report for The British Development Division in Central Africa (BDDCA) of the Overseas Development Administration (ODA).

Weinburgh, M.H. and Englehard G. Jr (1994). Gender, Prior Academic performance and Beliefs as predictors of Attitudes toward Biology Laboratory Experiences. *School Science and Mathematics Journal*. Vol. 94 (3), March. pp 118 - 123.

Zambia Association of Research and Development (ZARD) (1985). *An Annotated Bibliography of Research on Zambian Women*.

