TEACHERS' PERCEPTIONS OF THE ALGEBRA SECTION OF THE PRESCRIBED ERITREAN GRADE TEN MATHEMATICS TEXTBOOK

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UNIVERSITY *of the* **WESTERN CAPE**

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DEDICATION

This mini-thesis is dedicated to my brothers who were martyred during the war for liberation.

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ACKNOWLEDGMENTS

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DECLARATION

I declare that *Teachers' perceptions of the algebra section in the prescribed Eritrean grade ten Mathematics Textbook* is my own work, that it has not been submitted for any degree or examination in any other university, and that all sources I have used or quoted have been indicated and acknowledged by complete references.

ARAIA HAGOS TEDLA

Signature: _____

JUNE 2000

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ABSTRACT

I taught mathematics for thirteen years at different secondary schools of Eritrea. During this period I observed that students in secondary schools perform poorly in mathematics. In many workshops and departmental meetings teachers were frequently complaining about the drawbacks of mathematics textbooks, particularly about the contents and presentations in the grade ten mathematics textbook. This motivated me to make a study of the described textbook, and to forward some recommendations for the development of the textbook.

In this mini-thesis, I investigated the perceptions of the Eritrean grade ten mathematics teachers of the algebra section of the prescribed Eritrean grade ten mathematics textbook. To get their perceptions, interviews were conducted with sixteen grade ten mathematics teachers in five secondary schools of Eritrea.

Themes were developed concerning the relevance and appropriateness of the textbook. Literature was used to interrogate the empirical data. To concretize these things I investigated the accessability of the textbook and relevance of the contents. I investigated whether the subject matter of the topics, and the sequential order of the topics and the concepts within the topics are fitting for the students. In addition, I investigated whether the examples, exercises and word problems in the topics are sufficient and satisfactorily arranged.

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The analysis reveals that there are inappropriate and irrelevant topics in the algebra section of the textbook, and that teachers do not believe that the textbook serves its purpose.

Hoping to serve its purpose, some of the drawbacks are illuminated and recommendations for the improvement of the prescribed textbook are forwarded.

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CHAPTER ONE

BACKGROUND AND MOTIVATION

1.1   Introduction

It is a well known fact that mathematics has occupied a prominent place in the curricula of schools in all countries. As it was indicated in *a paper on mathematics education in Eritrea*(1993:1), mathematics is one of the four basic academic subjects. The others are science, social studies and language. Mathematics will continue to be an important subject in the Eritrean school curriculum at all levels in different streams in the schools. This being the case, however, mathematics is regarded by many as a system of abstract ideas and relationships and many people, including students, have a deeply rooted fear of mathematics. The opinion is also prevalent that the learning of mathematics requires special ability, the vast majority being totally incapable of really understanding mathematical ideas, that it is separated from the real world and can be mastered by a very few. This is believed in many parts of the world. Hence, unless school learning becomes more relevant and approachable to the majority, it will be impossible for the school to generate favorable attitudes toward mathematics.

For school learning to be more relevant and approachable, the availability of accessible, in quality and quantity, teaching materials is very important. As in any developing country, textbooks are the main source of information in the teaching

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and learning process in Eritrean secondary schools. In a study made in Nigeria, Ogunniyi (1982:111) points out that in elementary and secondary schools, teachers and students are heavily dependent on a textbook as their source of information. He also explains that this dependency on a textbook is more serious in developing countries where other resources are scarce, teaching is confined to a given syllabus or centralized examination, and where teachers have not learned to explore much more of their immediate environment in teaching science and mathematics.

Provision of mathematics textbooks has always been priority in Eritrean schools, but they do not seem to be effective. It however appears that they are not accessible to the students. One of the reasons could be the diverse needs of the authors and users (teachers as well as students) of the mathematics textbooks in the country. This study looks specifically at Eritrean teachers' perceptions of mathematics textbooks. In order to get a handle on this, the background of the study situated in the Eritrean context is given in the next section.

1.2 Background of the study

1.2.1   Curriculum of the colonial period

During the colonial period, authors of mathematics textbooks were very rarely reflecting the relevance of Eritrean situations. According to *a paper on mathematics education in Eritrea*, especially during the Dergue regime (1974 - 1991), the educational system was deteriorating. It was suggested

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that the mathematics textbooks have drawbacks.

Drawbacks of the old curriculum

A paper on mathematics education in Eritrea (1993:2) indicates that, the colonial curriculum had the following drawbacks:

- Laying too much stress on memorization of mechanical processes without giving enough attention to developing understanding.

- A failure to bring out the relationship between sections within mathematics such as those between arithmetic and algebra, and those between algebra and plane geometry, as well as mathematics taught in schools and mathematics in real life.

- Too much emphasis on rigorous proofs, a high level of formality in the treatment of topics and a neglect of training the basic skills of algebra and geometry.

- Too much stress on topics which provide little motivation for students (for example, domain and range of relations not related to mathematical problems) and little improvements based on research.

- Too little emphasis on group work and self instruction.

- Little concern for individual differences in rate of learning.

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- Too limited on the content and scope. For example, even in poor countries of the world the computer is already making an impact. This impact is small to start with, but in the long run it is bound to increase. Since some of the secondary school leavers will go into this field, it is logical that modern mathematics which provide an insight into the fundamentals of a computer must be taught.

- The failure to provide adequately for the mathematical needs of students who will follow courses such as physics and economics.

1.2.2   Source of the current curriculum

As the paper presented on a *General Orientation of the Eritrean Curriculum* (June 1997) indicates, the current curriculum was started in 1976. It was started in a narrow liberated area in a model school, the Revolutionary School, under circumstances of war. It has been revised three times until 1981. However, the Eritrean People Liberation Front (E.P.L.F.) has succeeded in preparing a curriculum that reflects at least the political, social, historical, psychological and economic background of Eritrean people in general.

As soon as independence was realized, the government of the State of Eritrea took the initiative and commitment to reconstruct the existing educational system which was deteriorating due to thirty years of war for independence. The Ministry of Education of the State of Eritrea structured the

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educational system in four phases: Elementary School, from grade 1 to grade 5, Junior Secondary School, grades 6 and 7, Senior Secondary School from grade 8 to grade 11, and Higher Education. There are also Technical Schools that enroll students after completing a two-year course at the senior secondary level.

Educational guidelines were stated and the educational policies that were adopted, consisted of amongst others the following goals:

- To provide equal opportunity in terms of access, equity, relevance and continuity of education.

- Enhance the relevance and appropriateness of all curricula.

- Introduce relevant technology at all levels and in all areas of education.

- Enhance capacity building at the national level through the training of Eritrean professionals and experts(Ministry of Education of the State of Eritrea, 1998:2).

Hence, based on the above educational policies, secondary school mathematics textbooks were expected:

- To be accessible to all Eritrean students.

- To equally serve all students at their grade levels, and

within the corresponding field of studies (to all streams).

- To be related to the students' environment, so that students can apply mathematics in their daily lives.

- To provide the required knowledge and skills, so that students can have a good foundation for their further studies.

1.3 Statement of the problem

During the transitional period the Ministry of Education made some rearrangement of the curriculum. According to the paper presented in *Orientation in Eritrean Education*(June, 1997), especially in Junior and Senior Secondary level, the curriculum presented in the field (the curriculum of the armed struggle) was not appropriate to the students, and it was not a fulfilled curriculum in respect to the content expected to be taught. The curriculum of secondary schools was not fully implemented. Firstly, the curriculum was practiced in a very limited area and for a very short period of time. Secondly, there was a confusion between the curriculum which was taught in the unliberated area (the Ethiopian curriculum) and the current curriculum (E.P.L.Fs' curriculum). So after conducting a survey and consulting secondary school teachers through questionnaires and workshops some rearrangement of the topics as well as elimination of some topics from the proposed curriculum were done. Hence a new syllabus outline and guidelines were prepared in 1992. Based on the syllabus guideline, pilot textbooks were prepared in 1995. Since then,

a curriculum process has been going on to improve this current curriculum to meet the required standards set by the Ministry of Education of the State of Eritrea.

I worked for the Ministry of Education of Eritrea as a secondary school teacher for thirteen years. From my experience I observed that students in secondary schools perform poorly in mathematics. There was a high rate of failure in mathematics in the examinations given nation wide. Teachers in Eritrea who were attending workshops and departmental meetings frequently complained about the mathematics textbooks. They suggested that there are drawbacks in the textbooks. In particular, there was a high complaint concerning the relevance and appropriateness of the grade ten mathematics textbook. We had a lot of discussion about this issue. After a long discussion we came to a conclusion: Every teacher should assess the textbook and send his/her comments to the curriculum panel of the Ministry of Education of the State of Eritrea.

1.4 Purpose of the study

I believe that there can be a change in the contents and presentation of mathematics in the textbooks used in Eritrean schools. Textbooks must not be used to impede the students educational progress, but to enhance their educational opportunities. The content of mathematics and their explanations in the textbook appear not be relevant and appropriate in relation to Eritrean students.

As Aichele, et al (1977:363) explain, the selection of a

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textbook is likely to satisfy the needs of the school if the opinions of the teachers who are to use the textbook is considered in its selection. Furthermore, Young (1989:3) points out that since teachers possess professional knowledge, their opinion in curriculum development should be accepted.

This study is aimed at investigating teachers' perceptions of the algebra section of the prescribed Eritrean grade ten mathematics textbook. An analysis of different teachers' perceptions of the topics will help me to get a sense of their perceptions on the relevance and appropriateness of the topics. To concretize these things I investigated whether the sequential order of the topics and the concepts within the topics are fitting for the students, and the examples, exercises and the word problems in the topics are sufficient and satisfactorily arranged. Hence, the teachers' perceptions can help me make some recommendations for the further development of the textbook.

1.5 Significance of the study

Having the above general aim, this mini-thesis will have the following objectives:

- To investigate the strengths and drawbacks of the textbook.

- To obtain an up-to-date perspective of the teachers' views on the textbook and to make some recommendations for the development of teaching and learning material.

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- To make textbook authors aware about the limitations of the textbook.

- To initiate further research in the field.

1.6 Scope of the study

The research will be confined to the Zoba Maekel (Central Zone) and Zoba Debub (Southern Zone) of Eritrea. The research attempts to answer the question about teachers' perceptions of the relevance and appropriateness of the algebra section in the prescribed Eritrean grade ten mathematics textbook. In order to do this, I have approached grade ten mathematics teachers in the selected secondary schools of these areas. I have worked as a mathematics teacher in four of the secondary schools. And I am familiar with the fifth selected secondary school in which I have associated with mathematics teachers in that school. In addition, I was a student of that school. These relations helped me to effect easy and continuous communication with the interviewed teachers.

To investigate the issues alluded to I have focused on answering the questions in the next section.

1.7 Research questions

- What are teachers' perceptions of the relevance of the algebra section in the prescribed Eritrean grade ten mathematics textbook?

- What are teachers' perceptions of the sequence of the

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algebra section in the prescribed Eritrean grade ten mathematics textbook?

- What are teachers' perceptions of the appropriateness of the contents of the algebra section in the prescribed Eritrean grade ten mathematics textbook?

- What are teachers' perceptions of the examples, exercises and word problems of the algebra section in the prescribed Eritrean grade ten mathematics textbook?

- What are teachers' perceptions of the accessibility of the algebra section in the prescribed Eritrean grade ten mathematics textbook?

Even though I will attempt to answer the above questions, the study has some limitations.

1.8 Limitation of the study

- The study was conducted in specific schools with specific teachers, and this sample may not be an indication of the situation of the whole nation.

- The study is limited to teachers' perceptions of the textbook on the relevance and appropriateness of the topics. It doesn't investigate other issues such as the mathematical correctness and the depth of treatment of the topics.

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1.9 Organization of the study

For a sake of simplicity I have divided this mini-thesis into five chapters.

In this chapter, I have sketched out the background in which this study should be seen.

In Chapter two, the literature review on mathematics teachers and textbooks are dealt with.

The method of research, the techniques used for the collection of data, and the methods to present and analyze the collected data are explained in chapter three.

In chapter four, the collected data are presented and analyzed against the review of literature and the research questions.

Chapter five is a discussion of the study based on the literature and the findings of the study. Conclusions of the research will be given, and some recommendations are pointed out.
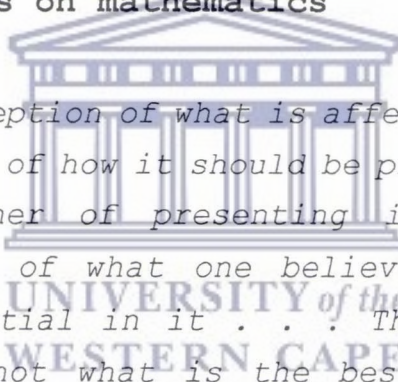
CHAPTER TWO

A REVIEW OF LITERATURE ON MATHEMATICS TEACHERS AND TEXTBOOKS

As mentioned in the previous chapter, this chapter deals with some literature on teachers' views on mathematics, textbooks and more specifically mathematics textbooks. Teachers' views on mathematics has an impact on their perceptions of the contents in mathematics textbooks. This literature review will help to investigate teachers' perceptions of the algebra section in the prescribed Eritrean grade ten mathematics textbook being a reference to interrogate the empirical data.

2.1 Teachers' views on mathematics

> *One's conception of what is affects one's conception of how it should be presented. One's manner of presenting it is an indication of what one believes to be most essential in it . . . The issue, then, is not what is the best way to teach but, what is mathematics really about (Hersh, 1986:13, cited by Thompson, 1992:129).*

Teachers have certain conceptions with regard to mathematics. As Thompson(1984:109) explains, some teachers view mathematics as a coherent collection of interrelated facts, and others as a subject that allows for discovery properties and

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relationships through personal inquiry. Their views seem to underlie their instructional approaches.

However, teachers must decide how much and what part of the content should be learned as knowledge and skills at certain levels. Tranver, et al (1977:51) indicate that teachers are important in selecting which mathematical content should be learned as knowledge and skills. Teacher' decisions on the selection of content is also an essential process for selecting mathematical facts and procedures which are essential to the students. They also explain that different teachers have different approaches for teaching the content of mathematics for the item of knowledge and skill. Some focuses on teaching the content through exposition and their students are expected to memorize the facts and procedures. Others, select problems and guide the students by approaching the needed knowledge and facts. This varies according to their beliefs. However, Tranver, et al (1977:55) assert that since mathematics teachers have accumulated background of the subject through their studies and their profession of teaching, they may affect the achievement level and needs of their students. That is, teachers know what content and the way in which knowledge can be presented to their students.

Furthermore, mathematics teachers also have some common aims with regard to the achievement of their students. Cornelius(1982:38) explains that secondary mathematics teachers are concerned with what content to teach and how to teach the content. Based on this point, they try to realize their aims for teaching mathematics. Through their various discussions teachers have suggested certain aims of their

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teaching mathematics, such as,

> *to provide tools and skills necessary for*
> *use in the real world, every day life and*
> *other subjects.*
> *To develop creative ability* (Cornelius, 1982:38).

To achieve their aims, the content which they intend to teach should be relevant to the students. The need to make mathematics interesting and relevant to the students, is an important goal of mathematics teachers. Askew and Millet (1994:5) stated that teachers frequently refer to the relevance of mathematics in the daily lives of students as an aim. For many teachers, relevance appears to come about through the focus on everyday applications.

If school mathematics lacks relevance to the daily lives of the students, it is important to assess, and make changes to the curriculum in order to move toward the goal of more appropriate and productive mathematics.

Trafton (1981:18) explains that even though there is a need to accept the necessity of basic mathematical concepts, school mathematics should also prepare students for dealing with mathematics that can help them to deal with diverse situations in daily life. There is also a need for school mathematics to be a base for studying higher mathematics and to qualify for various careers. The mathematical content given in schools should be relevant and appropriate to the students. Trafton(1981:20) also explains that teachers face problems when they are working with one textbook and large class sizes.

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Mostly, students do not cope with the mathematical concepts of the contents that are proposed for the grade level. In order to have successful learning processes, Trafton suggests that some important aspects need to be considered. Some of these are:

- There is a need to recognize that most students can learn, want to learn, and will learn when appropriate programs are provided.

- The content has to be selected carefully. It is better to focus on those concepts and skills that are applicable in the students' situational activities.

- Curriculum materials that are specifically designed for use with the specific students are needed.

Furthermore, Bottino, et al (1996:112), who made a study in Italy on the teachers' perceptions of the new topics inserted in a mathematics program, asserted that an increase in content creates difficulty in the development degree of reasoning, so that, it requires teachers to choose between different proposed topics in order to build their effective interaction in classroom activities. Mostly, classroom activities will be effective if the concept of the content is related to the environment of the students.

Trafton (1981:21) explains that historically, real-world problems are sources of mathematics. He also indicates that mathematics should be applied in different social situations that are drawn from all branches of science and social

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science. However, many adults consider that mathematics is a subject that has no application, but it is a full of rigid and abstract rules.

In order to have students clearly understand the usefulness of mathematics and to motivate the learning of mathematics, Trafton (1981:22) suggests steps to be followed by mathematics teachers. Some of these steps are:

> *Use a real world situation to introduce the new content. This help motivating an integral part of the content itself.*
> *Use applications, including word problems, on a daily basis, so that students view them as a normal part of the study of mathematics and gain confidence in working with them.*
> *Emphasize those areas of mathematics that are rich in application.*

Teachers' conceptions of mathematics greatly influences the teaching and learning of the subject, because teachers decide which content and how they can present it at a certain level for specific students. That is, teachers have some understanding of the appropriateness and relevance of content of mathematics and their presentation to the intended students. Their view of understanding the subject can be reflected through their perceptions of the mathematics textbooks.

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2.2 Textbooks

2.2.1   Definition and the Role of textbook

According to Love and Pimm (1996:373), a textbook is a very essential printed object, that dominates features of the students' work throughout the year. Furthermore, Stray (1994:1) explains that textbooks are essential materials for teachers and students in their teaching and learning process. He points out that textbooks do not only describe what mathematics should be taught but also guide how it should be taught and learned.

In most elementary and secondary schools around the world, teachers and students are dependent on textbooks as resource materials for teaching and learning. Oliveira (1995:482) explains that it is a global reality that the main tools used to deliver education and to shape the daily classroom activities is a textbook. Even in advanced countries such as the USA, where schools have diverse instructional resources, textbooks are still the most important tools for teachers and students. Hence, textbooks are a major concern for the research community and for a nation as a whole.

However, all textbooks are not assumed to be effective. According to Piacock (1997:428), even though it is apparent that textbooks are focal points to teaching and learning, most of them are not accessible to the students and hence there is little evidence of their effectiveness.

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2.2.2   The need for Selection of a Textbook

Since textbooks differ in their content and presentation, Graham (1978:545) explains that it is important for teachers to choose materials that are appropriate to their students. Appropriate teaching material means that it is material that students can read and understand the concepts and ideas that are being conveyed.

Muther (1985:5) explains that defining a textbook in a specific subject for specific students is more helpful for selecting a textbook. He also states that to analyze a textbook one has to see if the directions of the lessons are clear, lesson format is workable, or how teachers and students interact with the material.

To know how teachers and students interact with the textbook, teachers' and students' perceptions of the textbook are vital. Bay, et al (1999:182) states that students' perceptions of their mathematics classes are affected by various factors including their teachers, class atmosphere, and the curriculum materials. Any change of these factors is likely to have a change on the students.

Eisner (1987) cited by Chondler (1995:118), points out that textbooks are the most important factor influencing what is taught in schools. He also states that most teachers rely on a textbook as their primary curriculum guide. Hence, teachers' perceptions of the textbook could influence the classroom interaction. Furthermore, Forbes (1970:89) stated that the

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fact that most elementary and secondary school teachers depend so heavily upon the basic textbook in their class underscores the extreme importance in the process of selecting the textbook to be used. It is also implying the necessity of clear understanding of what a text is and how it can and should be used during classroom interaction. Forbes (1970:92) also points out that there are textbooks written to present the curriculum for a particular school or a set of schools. He also explains that, like an extensive menu of a balanced meal designed for individuals or a group of persons, a textbook should have to be designed in such away that it can have a maximum impact on the students who will be using it.

In Eritrea there is no chance for selecting a textbook, because there is only one textbook for a specific subject and for a specific grade. The textbooks are prepared by the curriculum Department of the Ministry of Education of the State of Eritrea. The only means of choosing appropriate and relevant content of knowledge is assessing different ways of designing content presentation in the textbook or developing the existing textbooks. Analyzing a textbook through teachers' perceptions of the textbook is a way of selecting relevant and appropriate concepts and presentations of contents in a textbook.

According to Niss (1996:20) the goals of mathematics education are reflected in a way the curriculum has been designed and organized and the textbook written and produced.

2.3 Mathematics textbooks

A mathematics textbook is a typical way of preserving mathematical knowledge. Thus, it is an essential document about teaching and learning in school mathematics. Hence, mathematics textbooks are embedded with content that students are expected to know at their level (Kilpatrick and Kang, 1992:3). Furthermore, mathematics textbooks play a dominant role in determining what is taught in mathematics courses (Willoughby, 1984, cited by, Pizzini, et al 1992:74).

Forbes (1970:89) indicates that generally, basic mathematics textbooks today invariably contain the following:

> *A presentation of basic contents of the course for which they are presented or, at least, the content the author has determined to be basic.*
> *Examples illustrating the type of problem solving (or exercise working) skills that they are to be expected of the students.*
> *Exercises for students to develop these skills.*

However, mathematics textbooks differ in their contents and presentation from one context to another and between grade levels. Hence, it is necessary to analyze whether the material is appropriate for the students or not.

A useful tool for evaluating textbooks and other curriculum materials is content analysis (Curriculum Department, Ministry of Education of the State of Eritrea, 1997:1). Regardless of the styles and formats, mathematics textbook can be assessed

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through their contents, and the way they present the needed contents. Gerald (2000:537) explains that the analysis of a mathematics textbook is capable of revealing the mathematical content and instructional design of the material. Instead of simply having a look at the table of contents, presentation of the context or the list of topics on the surface level, the analysis procedure should be effective to determine whether the content in the textbook covers or explores the needed concepts and ideas sufficiently.

Forbes (1970:89)explains that there are different criteria for selecting a textbook when the objectives of the textbook are specified. Some of the criteria set by the National Council of Teachers of Mathematics (1965) are given in the form of questions, such as:

> *Is the content of the textbook appropriate to the students at the grade level?*
> *Are there sufficient examples, exercises and word problems? Are they satisfactorily arranged?*
> *Is the sequence of the topics appropriate?* (Forbes, 1970:90).
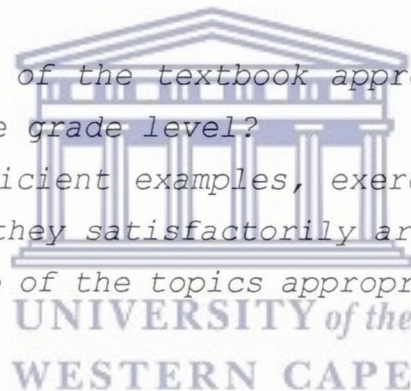
The above questions focus on the appropriateness of content and the sequential order in which the topics are presented. Hence, examining its content and the way it is learned it is helpful to assess whether the content is organized in sequential order and systematically. Furthermore, to examine a particular topic there should be an assessment on the background of the topic and its application.

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The analysis of relevance, and sequence of subject matter provide a helpful basis for making decisions about the suitability of the textbook for classroom use (Curriculum Department, Ministry of Education of the State of Eritrea, 1997:1).

2.3.1   Content of a mathematics textbook

There are several factors to be considered in assessing the quality of a textbook. For example, teachers have to evaluate whether the content in the textbook is up-to-date or not, and whether the level of the content in the textbook is suitable for the students or not. In addition to these, there is a need of assessing to what extend the content is familiar and relevant to students' life situations. Relevant material to the lives of student is meaningful and also more interesting to them. This increases motivation towards the content of the textbook (Doidge, 1990:15).

Doidge also explains that the collaborated work of authors of the textbook, experts on the subject covered by the textbook and experienced teachers could provide for both accurate information and appropriate levels of presentation of the content. Furthermore, Harrison (1980:11) points out that the opinions of teachers are of great value in assessing the quality of a textbook. He describes that a number of studies have indicated that although individual teachers may vary in their assessment of suitability of particular texts, their judgements are reliable and consistent if pooled. To analyze the content of a textbook there are several things to be taken into consideration. Some of these are, the relevance and

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appropriateness of the subject matter, examples and exercises (including the word problems) that are embedded in the textbook.

Subject matter

The concepts and skills of the subject matter in the textbook should be appropriate to the students. That is, one has to assess whether the content matches the capacity of students at a particular grade level. It is also true that to assess whether the subject matter in the topics of the textbook is:

> *Understandable, convey the purpose of each activity and its relationships to others, present practical applications that provide students with meaningful learning experiences, help teachers to improve their understanding mathematics and its application. In addition to these, it is advisable to assess if the textbook has an interdisciplinary content, that is, mathematics through work in sciences and other disciplines, and focus on application, such as, using application to present problem-based presentations and posing problems that leads to the development of concepts and skills (National Council of Teachers of Mathematics's standard document 1989, cited by Gerald, 2000:537-540).*

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Examples

In all mathematics textbooks examples are vital to illustrate the types of behaviours expected of students. They are used to clarify the concepts that are embedded in the topics.

It has a long been recognized that examples are "potent teachers" and the skill acquisition depends on the way examples are presented in the textbook (Robertson and Kahney, 1996:93). However, in some mathematics textbooks there are abbreviated versions of solutions of examples, liberally sprinkled with phrases such as, "it is easily followed that", "It is well known", "clearly", "obviously", and so on. Even though some of the abbreviations are necessary, the abbreviations used in the solution of examples should not be an obstacle to the students' own solution procedures. Therefore, students should have to know the full pattern that enables them to achieve the accurate solution of their work (Forbes, 1970:101).

Examples are used to link the explanation of the mathematical concepts embedded in the topics of the textbook and the exercises that enable students to have clear ideas about the content. Examples in the textbook should have the standard format of the exercises. It is not necessary to have only simple examples, or vague examples (examples that do not clarify the concepts or examples that mislead the students), because there can be negative effects on the students' attitude towards themselves or the textbook (Forbes, 1970:101).

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Exercises

One of the major factors in learning mathematics is the availability of an appropriate list of exercises. The dominant use of mathematics textbook questions is to provide students with the opportunity to practice the exercises on the concepts and to solve problems (National Advisory Committee on Mathematics Education, 1975; cited by Pizzini, et al, 1992:74). Hence, in order to involve students actively in the learning process of mathematics, there is a need for well-organized exercise lists and well-placed questions in the content section of the textbook.

To have students employ a discovery strategy and to upgrade the individual's discovery experience, the nature of the exercises in the content section is vital (Forbes, 1981:101). He also points out that for effective teaching and learning it is necessary that textbooks include varied type of questions in the list of exercises. That is, exercise lists should be a representation of all the behaviours that are expected from students.

In order for textbooks to be appropriate there should be a variety of type and a logical list of exercises. That is, there should be various levels of questions in order for students to have more experience from these variety of types of exercises. Some of the mathematics questions in the textbook should be at a low cognitive level and others at the higher cognitive level (Conlon and Nicel, 1988, Nicel, Fibre and Bobango, 1986; cited by Pizzini, et al, 1992:74). There should not only be easy or difficult questions in the list

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of exercises of a textbook.

The arrangement of exercises should begin with easy questions then progress going to difficult ones, because there can be an effect on the students' achievement (Forbes, 1970:102). Forbes also explained that besides the internal arrangement of the list, the placement of exercises in the list is also important. That is, old concepts can be a background to new ones, and the isolation of similar exercises may not give a clear understanding about the concepts. Hence, in addition to the appropriateness of the exercises, teachers have to see objectively the placement of the exercises.

The kinds of exercises plays a great role in the students' application of the content. As was mentioned earlier, word problems are part of exercises that have an influence on the applications of mathematics.

Word problems

As explained by Verschaffel and De Corte (1997:69), word problems are an important part of a mathematical program. At elementary level, arithmetic word problems are the tools most used to train children to apply their mathematical knowledge and skills in real-world situations. Word problem exercises serve to make mathematical concepts pleasant and motivating. In addition to these, word problems are used to develop students' problem-solving capacity, and to understand the details of the content.

However, some students at secondary school level have some

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deficiencies in the application of their knowledge to a real-world situation. They are not able to learn by themselves to use their knowledge of mathematics and to apply it to real-life situations. They need more exercises on word problems to experience applications of mathematics in real life. Otherwise, they tend to dislike mathematics in general (Nesher, 1980; Van Essen, 1991; De Corte, 1992; Greer, 1992; and Mc Leod, 1992; cited by Verschaffel, L. and De Corte, 1997:94).

Besides textbooks having appropriate and relevant contents, the logical sequential order of the topics and the concepts within the topics are necessary.

2.3.2   Sequence in a mathematics textbook

There are several things to be considered when dealing with the sequential order of the subject matter and the concepts of the content within one textbook. Forbes (1970:95) indicates that the sequence of contents in a textbook must take into account the teachers' teaching experience, their training, and the particular strategies and tactics they intend to use to present the concepts of the content. This presentation is based on the content itself. It is also important to see the sequence of the concepts in relation to the students. That is, teachers have to assess which sequence is meaningful and interesting to the students in order to get a true feeling of progress and growth of the students. They have to examine whether the sequence gives the students the required mathematical skills and abilities. Hence, teachers are one of the participants to comment on sequencing mathematical lessons

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in a textbook.

Breetike (1997:15) explains that teachers are familiar with the problems that can happen if basic concepts are missing from the students experience at the early stage of the content. This can cause advanced contents to be meaningless in the process of learning. In this way students can develop negative attitudes towards mathematics.

A learning theorists, Robert Gagne suggests that since knowledge is organized in the mind, lower level skills and principles should be learned before higher order structure can be understood (Bell, 1981:69).

To teach meaningful mathematics there is a need for studying the resources from a variety of dimensions. This includes the sequence of the concepts within the topics and the logical nature of subject matter.

2.3.2.1 Sequence of concepts within the topics

Teaching involves the planning of meaningful learning experiences, and as cited by Breetike (1997:12), Ausubel (1968) pointed out that " . . . new contents become meaningful to the extent that it is substantively (non arbitrarily) related to the ideas already existing in the cognitive structure of the students." If this is not the case then students could be learning meaningless concepts and the concepts will be barriers for their future development. Furthermore, Skemp (1971:32) identifies two principles on intelligent learning which he defines as "the formulation of

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concept structures communicated and manipulated by means of symbols". These are:

> *Concepts of higher order than those which a person already has cannot be communicated to him by definition, but only by arranging for him to encounter a suitable collection of examples.*

> *Since in mathematics these examples are almost invariably other concepts, it must first be ensured that these are already formed in the mind of the students.*

With regard to the first, it is sometimes tempting to present new topics by theoretical definitions. However, for the teachers it might be easier than trying to find examples for each abstract concept. For the students, it is simply a recalling of knowledge without developing mathematical understanding.
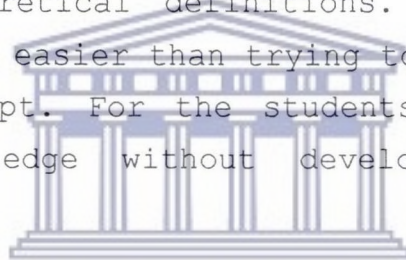
With regard to the second principle which underlines that every concept should be taught to the students must be related to the logical sequence of the mathematical concepts, each which contributes to the understanding the next. For example, the concepts of algebra are dependent on the understanding of the concept of arithmetic or things that can be related to the students' environment.

2.3.2.2 Sequence of the subject matter of the topics

Planning the appropriate sequence of the subject matter one needs to know the students' mathematical background and future topics to be discussed. This is due to the fact that primarily in school mathematics, one is attempting to lay a structured foundation of basic knowledge and as students move to the higher mathematics they can apply this fundamental knowledge.

As is mentioned by Breetike (1997:17), in planning for mathematical instruction the teacher should be aware of the difficulties inherent in the subject matter. There are obvious difficulties that arise from the abstract nature and the complexity of the subject matter. Having cleared understanding of this complexity there is a need of arranging the content so that learning obstacles can be prevented.

According to Macnob and Cummine (1986) cited by Breetike (1997:18) one of the reasons that create difficulties can be the students' prerequisite skills or knowledge. That is, the students may not have encountered the foundation of the new concepts in their lessons for some time. The authors have also suggested three strategies to reduce the consequence of sequential order of mathematics:

- Looking ahead: Beginning the study of a topic with the type of problems that students will be required to solve ultimately.

- Topic switching: Teachers should feel free to switch the topic in order for students to understand the subject

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matter of the content easily.

- Starting afresh. In order to have clear ideas of the given concepts, it is helpful to start with the concepts of the last topic that are related to the new concepts to be learned.

All the above procedures of teaching are depending on the teacher's attitude and his/her views on teaching.

> *It is part of the professionalism of the good teacher of mathematics to have sufficient insight into both mathematics and the thought processes of children to know when the content hierarchy of the subject must be respected and when it may be ignored or side-stepped. As a general working rule, if the mathematics being taught does not require a particular sequencing of content, then the learning programme should be determined by consideration of the pupils' receptiveness* (Macnab and Cummine, 1986 cited by Breetike, 1997:19).

In addition to these, textbooks should also be concerned with the context in which they will be implemented and the grade level at which they are supposed to be taught.

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2.4 The prescribed Eritrean grade ten mathematics textbook

- As was mentioned in the introduction to this study, the prescribed Eritrean grade ten mathematics textbook is a pilot textbook. The authors are looking for comments on the textbook for its further development.

The textbook has algebra and geometry parts. The statistical data of the study on content analysis of textbooks and curriculum materials by the Ministry of Education of the State of Eritrea indicate that 56% of the total coverage of the grade ten mathematics textbook is embedded with the contents of algebra (Curriculum Department, Ministry of Education of the State of Eritrea, 1997:20).

Algebra

Sutherland (1990:154) argues that algebra is a language of mathematics which can be used to express ideas within mathematics itself, or within other disciplines. She also explains that in modern mathematics, algebra is a language that assists in the understanding of the structural similarities between different mathematical systems.

Furthermore, Fawcett and Cummins (1970:149) also explain that algebra is a reference of arithmetic, and it is a collection of skills and methods to solve equations and to find unknowns. They also point out that algebra, being a set of algorithms for working out problems and solving for X, provides for

creativity and devising of methods. According to these
authors, students become more skillful in assigning letters
to unknown quantities that are acting on them as if they are
numbers, through an algebra course.

In the algebra section of the prescribed Eritrean grade ten
mathematics textbook, the topics are:

>*Relation and Function,*
>*Rational Function,*
>*Sequence and Series, and*
>*Exponential and Logarithmic Function (Ministry*
of Education of the State of Eritrea, 1995:1).

Hence, I would like to assess whether the textbook is
accessible to the students to gain the required knowledge and
skill of the above topics.

2.5 Conclusion

Finally, I would like to conclude the chapter with a quote on
textbook analysis of the Curriculum Department, Ministry of
Education of the State of Eritrea (1997:1), which I believe
summarizes this chapter.

>*The quality of materials provided by the*
>*textbook is more usefully assessed by*
>*applying criteria such as accuracy and*
>*up-to datedness of information, relevance*
>*and sequence of subject matter and use of*
>*appropriate concepts.*

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This chapter has discussed how the quality of a textbook can be assessed. The next chapter will focus on the methods of research that were used to investigate the problem stated.

CHAPTER THREE

METHODOLOGY

This chapter deals with the research method within which the study falls and the techniques used to collect data for the study. After discussing the background to the study, it describes the sample of the population used in the study and the characteristics of the participants. This is followed by the description of the process on how the subjects participated in the study. Finally, this chapter explains the method of data presentation and data analysis of the study.

3.1 Research method

The nature of research inquiry and the type of information required, influences both the approach the researcher adopts and the method of data collection (Bell, 1993:6).

This research falls within the descriptive primary research paradigm. It is descriptive (Gay, 1981:12), in that it describes conditions that exist and events and processes as they occur. It is also primary research (Gay, 1981:11), in that data are gathered from a primary source namely, teachers who are teaching mathematics.

This research gives attention to the symbolic science, emphasizing the communication embedded within the interaction of a textbook, students and a teacher. This type of research

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is considered to be qualitative in nature. Research studies that investigate the quality of relationships, activities, situations, or materials are frequently referred to as a qualitative research (Fraenkel and Wallen, 1993:381). Qualitative research emphasizes observer participation in the unfolding events. This is the rationale for using qualitative research in this study.

In addition to this, the qualitative method of research was used in this study because I was more concerned with an in-depth understanding of the respondents' perceptions of the algebra section in the prescribed Eritrean grade ten mathematics textbook. These perceptions are more difficult to establish through other forms of research.

Qualitative research has as its aim understanding experience as approximately as possible as its participants feel it.

Qualitative data are collected in the form of words or pictures rather than numbers. The kind of data collected in qualitative research includes interview transcripts, fieldnotes, photographs and others that can convey the actual words or actions of people (Fraenkel and Wallen, 1993:381). Hence, I have used an interview as the only data collection technique to investigate the perceptions of teachers of the algebra section in the prescribed Eritrean grade ten mathematics textbook.

3.2 Research technique

3.2.1 Interview as a research technique

Interviewing is a well-established method for the collection of data (Ary et al, 1979:174).

The research interview has been defined as "a two - person conversation initiated by the interviewer for the specific purpose of obtaining research relevant information, and focused by him on content specified by research objectives of systematic description, prediction and explanation" (Cohen and Manion, 1989:307).

As a distinctive research technique, the interview is used as a principal means of gathering information having direct bearing on research objectives. As Takman cited by Cohen and Manion (1989:309) describes, it gathers information, " by providing access to what is inside a person's head", [it] "makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (value or preferences), and what a person thinks (attitudes and beliefs)." This is the rationale for using the interview as a research technique.

3.2.2 Advantages and disadvantages of an interview

It has been pointed out that the direct interaction of the interview is the source of both its advantages and disadvantages as a research technique. Gay(1981:166) suggests

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the following advantages and disadvantages of an interview:

Advantages of an interview:

- When properly used it can produce in-depth data not possible with a questionnaire.

- It is appropriate for asking questions that cannot be effectively structured in multiple choice format.

- It is flexible, so that the interviewer can adapt the situation to each subject.

- By establishing rapport and a trust relationship, the interviewer can obtain information that subjects would not give on a questionnaire.

- More accurate and honest response can be obtained since the interview can explain and clarify the questions.

- An interviewer can follow up on incomplete or unclear responses.

Disadvantages of an interview

- It is expensive and time consuming.

- It generally involves small samples.

- The response given by a subject may be biased and affected by his/her reaction to the interviewer.

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- An interview requires a level of skill usually beyond that of a beginning researcher.

- The respondent is restricted by the interviewer to a specific time and place of interview.

There are two types of interviews namely: structured and semi-structured. In the structured interview, pre specified questions are rigidly followed whilst in a semi-structured interview respondents are more free to express their views spontaneously.

3.2.3   Semi-Structured Interview

The type of interview that was used in this study was the semi-structured interview. The questions were so designed that they seek information on the part of interviewer and supply information on the part of the interviewee.

Reason for selecting the semi-structured interview

In view of the fact that the present study was qualitative in nature, the most appropriate form of an interview invited open-ended response.

In open questions respondents are expected to provide answers in their own words. The type of question that one selects is dependent upon the nature of the problem that is being investigated (Bester and Oliver, 1992:35). The interview respondents reveal their own thoughts, provide answers that

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fall within the parameters of their paradigms and, if requested to do so, are invariably in a position to provide reasons for their responses.

The rationale behind choosing a semi-structured interview as an instrument for data collection was that since I am a beginning researcher, a semi-structured interview will give me more control over the situation.

3.3 Background of the study

I was interested to study the topic of the dilemmas of the algebra section in the prescribed Eritrean grade ten mathematics textbook. I have followed the following work plan.

After conducting the course on research methodology, the title of the study was selected. Based on the concepts given in the course and referring to some literature, the title of the study was revised and it focused on teachers' perceptions of the algebra part of a grade ten mathematics textbook.

A research proposal was submitted to the faculty of education at the University of the Western Cape (UWC) after long discussion with my supervisor, Professor Cyril Julie.

The research techniques were proposed to be documentary analysis and interview. The interview questions have been tested with my colleagues at our residence, the Western Cape College of Education. The questions were revised three times, and examined by my supervisor.

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A cooperation letter was written by the faculty of education to the Ministry of Education (MOE) of the State of Eritrea.

After reporting of the topic of study and the procedure to be used for collecting data for the research to the Ministry of Education of the State of Eritrea, the Human Resource Development(HRD) office wrote a permission letter to the concerned Secondary Schools and offices.

Since there is no sufficient documents concerning textbooks, the only research technique that I have used for this mini-thesis is an interview. I intended to interview as many teachers as possible, within the proposed time available.

One interview was conducted as a pilot interview. Then, there was e-mail contact with my supervisor for a further feedback on this interview.

Based on the given feedback, the interviews were conducted.

3.4 Method of data collection

3.4.1 Sampling

Sampling is the process of selecting a number of individuals for a study in such a way that the individuals represent a larger group from which they were selected (Gay, 1981:85).

Among various types of sampling, I have used a purposive sampling method. In purposive sampling, the researcher

handpicks the cases to be included in his/her sample on the basis of his/her judgement of their typicality. In this way, he/she builds up a sample that is satisfactory to his/her specific needs (Cohen and Manion, 1989:103)

As indicated in chapter one, the study is located in Zoba Maekel (Central Zone) and Zoba Debub (Southern Zone) of the State of Eritrea. I have focused on the regions with a high density of schools. This is due the fact that I expect that there is communication of ideas and continuous discussion by mathematics teachers about their textbooks.

In Eritrea there are 38 public and private Secondary Schools. Seven of these are large and are in the capital city, Asmara (at Zoba Maekel). Furthermore, out of 11,097 grade ten students, 6075 are enrolled in Zoba Maekel (Central Zone) and 3059 in Zoba Debub (Southern Zone). Out of 186 grade ten sections, 109 are in Zoba Maekel (Central Zone) and 39 are in Zoba Debub (Southern Zone). And out of 168 mathematics teachers 93 are in Zoba Maekel (Central Zone) and 38 in Zoba Debub (Southern Zone), (Department of General Education, Ministry of Education of the State of Eritrea, 2000:1).

Having all these, I have selected five secondary schools as sites of research. Four secondary schools are from Zoba Maekel (Central Zone), and specifically from the seven large secondary schools of Asmara. These are: Barka Secondary School, Denden Secondary School, Izaak Tewoldemedhin Secondary School and Keih Bahri Secondary School.

The reason for selecting these four secondary schools at

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Asmara is that, I was working as a secondary school mathematics teacher in these schools. Here, I taught in Isaak Tewoldemedhin and Denden secondary schools in day classes as a full-time mathematics teacher, and in Keih Bahri and Barka secondary schools in evening classes as a part-time mathematics teacher. I am familiar with the staff members and I have close relationships with the department of mathematics of these schools. This helped me to communicate easily with the interviewees, and I could ably get available information for the research.

I intended to get a sample from rural or semi-urban secondary schools of Eritrea. This was due to the fact that I want to gain knowledge of perceptions of teachers' in such an area. Since there is no secondary school in the rural area of Eritrea, the fifth secondary school is from Zoba Debub (Southern Zone), and specifically Adi Keih secondary school at Adi keih, a place which is considered as a semi-urban area. It is located 110 Km's South of Asmara. The reason for selecting this school is that, before independence in 1990, the new secondary school curriculum was implemented in this secondary school. Since 1990, there was a discussion about the textbook in that school. I was expecting to reveal their insight and perceptions of the textbook from this school. In addition to this, I am familiar with mathematics teachers in the school, and I expected that they would be cooperative so that the interview could be conducted smoothly. Furthermore, I am familiar with the environment of the school, since I was a secondary school student in the school. This helped me to interact with the school environment easily.

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3.4.2   Contacting the interviewees

I planned to meet the teachers who are teaching grade ten mathematics in the selected schools.

As soon as I have arrived in Eritrea, I visited the selected schools. I interacted informally with the teachers. This helped me to create a strong rapport with the respondents in order for them to respond confidently during the interview.

After a time, I submitted the copy of the cooperative letter from the Human Resource Development(HRD) office of Ministry of Education(MOE) of the state of Eritrea to the director's office of the selected schools.

All the directors of the five secondary schools were cooperative. They decided on a comfortable place for the interviews. These were the director's office, laboratory room, computer room and head of department's office, at Adi-Kieh Secondary School and Isaac Tewoldemedhin Secondary school, Barka Secondary School, Denden Secondary School and Keih-Bahri Secondary School respectively.

I had a small meeting before the time of interview with the grade ten mathematics teachers of each selected schools. This helped me to introduce myself and

*   to explain the aim of the research,

*   to explain the aim of the interview, and to indicate that the opinion of each respondent would be of great help,

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- to arrange an interview time with each interviewee, and we also agreed that there will be flexibility on the scheduled time of interview.

Some of the interviewees asked me for the interview questions before hand. They wanted to discuss with one another the responses of the questions. However, I explained that the questions are almost open ended, and every respondent should be confident of his/her own opinion about the textbook. We have agreed to have a code for the name of each respondent. This helped the respondent to have confidence and to give his/her own information for the research.

3.4.3   Participants

In order to have sufficient information about the teachers' perceptions of the textbook, I was interested in interviewing all grade ten mathematics teachers in the selected secondary schools. All the selected teachers were volunteers except two, one in Denden secondary school and the other in Isaak Tewoldemedhin secondary school. They were not willing to be interviewed. They expressed their unwillingness by repeatedly not showing up on the agreed appointment times. Most of the respondents required that the schools remain anonymous. Their profiles are presented in accordance with their request for confidentiality.

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A profile summary of the interviewed teachers is described below.

Respondent	Zoba (Zone)	Qualifications	Teaching experience in years	Number of years taught grade ten
T_1	Maekel	B.Sc	15	6
T_2	Maekel	B.Sc	11	4
T_3	Maekel	12+2	27	20
T_4	Maekel	B.Sc	13	4
T_5	Maekel	B.Sc	23	7
T_6	Maekel	B.A	30	6
T_7	Maekel	12+2	15	2
T_8	Maekel	12+2	27	14
T_9	Maekel	B.Sc	12	3
T_{10}	Maekel	B.Sc	10	6
T_{11}	Maekel	B.A	17	6
T_{12}	Maekel	B.Sc	13	7
T_{13}	Maekel	B.Sc	25	8
T_{14}	Maekel	12+2	27	1
T_{15}	Debub	12+3	4	4
T_{16}	Debub	B.Sc	16	11

Table 3.1:Qualifications and experience of teachers

N.B.1. T_1 - respondent "1",

T_2 - respondent "2", and so on

2. In the qualification of teachers:

B.Sc - Bachelor of Science

B.A - Bachelor of Arts

12+3 - Advanced Diploma in Mathematics

12+2 - Diploma in Mathematics

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3.4.3 Conducting the interview

Once the interview sessions were finalized, the following procedures were implemented:

- Most of the interviews were conducted at the scheduled sessions.

- Both of us (the respondent and I), had a grade ten mathematics textbook. In addition to this I had a South African standard seven mathematics textbook. This textbook was used to indicate the difference between the sequencing in the Eritrean textbook and a textbook from another country. (see the Appendix p.106 how it was used during the interview)

- Any question of clarification on the part of the respondent was answered.

- I had indicated to the respondent that I intended capturing the respondents' answer through a mini-recorder and required the cooperation of the respondents in this regard.

- The interview was conducted in Tigrigna (one of the Eritrean official languages).

- I read the questions aloud.

- The respondent answered verbally.

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- The duration of each interview was approximately fifty-five minutes.

- At the end of the interview I thanked him/her for the willingness to participate in the research.

After the interview there was an informal discussion about the textbook and other texts used in the secondary schools with most of the respondents. Important points were taken as notes.

3.5 Method of data presentation and data analysis

3.5.1   Method of data presentation

After the interviews were conducted, the interviews were transcribed into a note book. The notes were edited. The transcribed interviews were translated into English. The notes were also then edited. There is a summary of the translated notes of each interview. This has been done in order to focus on the main questions which I have considered to be the main source of information for this study.

A sample of each of the above steps is found in the appendix.

After all these have been done, the data was summarized into eight points in relation to the basic points discussed in the literature. Similar responses from the respondents were clustered together, and were presented as the general opinion of the respondents.

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3.5.2   Method of analysis of the data

To analyze the collected data, I used my own means of analysis. Based on the reported data, certain themes were developed. The themes are key points to be discussed, which I considered as some key factors about teachers' perceptions of the algebra section of the textbook.

Hence, the following chapter focuses on the data presentation, and an analysis of the presented data in relation to the literature described in chapter two.

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CHAPTER FOUR

DATA PRESENTATION AND DATA ANALYSIS

4.1 Data presentation

As was explained in the research method, the findings of the interviews are presented according to the eight concepts that have been described in the literature review. The presentation of the data is as follows:

4.1.1 Teachers' perceptions of the textbook as resource material for teaching algebra in grade ten mathematics.

All the respondents have mentioned that the textbook is the main source of information in their teaching of algebra in grade ten mathematics.

However, all the respondents use other books for the following reasons:

- To have more clarification about some concepts in the textbook, such as the Cartesian Product of a set, rational inequalities, and so on.

- To have different exercises and examples to enable students to develop their mathematical skills.

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- To add other related exercises that can help the students understand the concepts easily.

- To have more relevant examples to enrich the concept of the textbook.

Some of the respondents also use other books in order to have broader knowledge of the subject matter. In addition, they wish to enhance the development of their students mathematical knowledge by familiarizing them with reference to other books.

Some of the respondents such as T_5, T_9, T_{12}, T_{15} and T_{16} said that the textbook is vast and they needed other references to summarize the concepts. They also suggested that the textbook should serve as reference material and they need other summarized materials.

Respondent T_5 suggested that the textbook looks like a combination of different mathematics books. He is therefore forced to refer to other books which he perceived to be a source of the textbook. He wants to confirm whether the textbook matches other books or not. He also suggested that the concepts of the textbook are more related to physics. He wants to relate the concepts of the textbook with other fields of study.

4.1.2 Teachers' perceptions of the relevance of the subject matter of the algebra section of the textbook

All the respondents stated that the algebra section of grade ten mathematics is about functions. Function is the core concept in algebra, and it is also applicable in different areas of study and daily activities of the students. These topics are also a base for higher studies. Hence, the theoretical concepts of the algebra section in grade ten mathematics are relevant.

Some of the respondents such as T_1, T_9, T_{12} and T_{15} have specifically explained the relevance of the topics in the following way:

- The first chapter – *Relation and Function*, is a base for all the concepts of the functions in grade ten mathematics and also for higher studies. It is applicable:

  - in physics to express motion as a function of time,

  - in chemistry to express the relationship of elements to chemical compounds,

  - in geography to identify the location of a map by the coordinate system,

  - in geometry to calculate the area and volume of an

object, that is, the magnitude of the measurements is in relation to the magnitude of their sides,

- in daily activities of the students to relate things as a function of money,

- in economics in higher studies, it is a base for the topic of linear programming.

- The second chapter - *Rational Function,* is applicable in our daily life through the word problems that are given in the textbook, and the concept of ratios. There is more application to physics. In higher studies in the application of optimization to evaluate the extreme points, the concept of rational function is necessary.

- The third chapter - *Sequence and Series* applies to the daily life of the students, for future prediction. The concepts are also good for the students to develop their mathematical skill.

- The fourth chapter - *exponential and logarithmic function* has application in different subjects, such as

- in demography for calculating population growth,

- in biology for predicting the growth of bacteria,

- in physics for predicting radio active substance,

- in banking for calculating the interest rate by

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using compound interest.

However, all the respondents argue that the textbook lacks practical application. The concepts of functions in the textbook are stated in a theoretical manner. In most of the topics the concepts are abstract, especially the first two chapters since they are stated in an abstract manner, teachers face problems with students following their explanations.

Respondents T_{15} and T_{16} suggested that in rural or semi-urban areas of the country it is difficult to make the theoretical concepts clear to the students. There is no practical application that goes parallel with the students' situation. For instance, the practical application of the concept of logarithms is related to banking. This is vague for the students, because students in rural and semi-urban are not business-oriented. It is better to relate these concepts to agricultural production and to have other appropriate examples related to the environment.

T_{16} explained that the concept of relation is nothing but ordered pairs with meaningful correspondence of objects or things. But, in a grade ten mathematics textbook it is introduced in a theoretical manner. There should be aspects related to the economic, culture, social, and politics of the students' environment. If it is related to the family situation and the daily activity of students, it will be meaningful. Especially the mature students would be able to grasp the concept easily.

All the respondents suggested that the concepts of the

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textbook depend only on numbers and ordered pairs of axes. To express it in a plane it is vague for students. There should be practical application. For example, the concept of sequence and series is easy for students, but it needs practical examples by way of introduction.

4.1.3 Teachers' perceptions of the sequence of the subject matter of the algebra topics of the textbook

All the respondents prefer to teach the topic of sequence and series after the topic of exponential and logarithmic function. Their reasons were the following:

- There is a flow of ideas from the concept of rational function to exponential and logarithmic function.

- The three chapters – *Relation and Function, Rational Function, and Exponential and Logarithmic Functions* have common characteristics, which includes:

  - a description of the domain and range of the graphs,

  - the application of the concept of the asymptotes and intercepts (especially for rational functions, and exponential and logarithmic function),

  - an analysis of the behaviour of the graphs, and

- a sketch of the graphs.

- There is a flow of ideas if the three chapters are taught consecutively.

- The concepts of sequence and series are new to the students. At grade ten level the topic has no relationship with graphing, the topic deals more with numerical calculations than with the concept of functions.

- The concepts of sequence and series are more advanced than the concepts of exponential and logarithmic functions. Hence, students first have to learn the simple concepts before the advanced concepts.

- The concepts of exponential and logarithmic function are applicable in the topic of sequence and series, such as in geometric progression.

Some respondents such as T_1, T_5, T_{12} and T_{15} said that there is a gap with regard to the ideas of the topics. This is due to the absence of the topic of polynomial function. They suggested that the topic of polynomial function should be taught after the topic of relation and function, because it can serve as a background for the rational function.
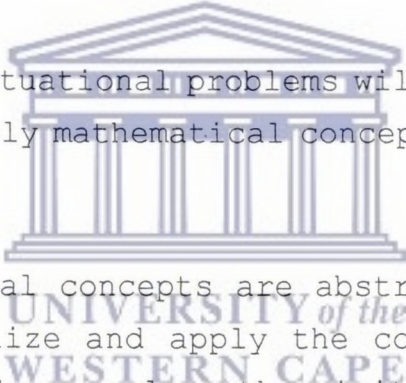
Some respondents such as T_5, T_{10}, T_{15} and T_{16} suggested that the word problems of the chapter on rational functions should be at the end of the chapter. It will be easier for students if

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they have learned it after they have developed their knowledge of rational function.

4.1.4 Teachers' perceptions of the sequence of the concepts of algebra topics in the textbook

This section deals with the sequence, whether teachers want to start teaching the topics of algebra in the textbook with theoretical concepts or with situational problems. The respondents have different ideas on this issue.

Some of the respondents suggested that to start with the situational problems is advantageous to the students due to the following reasons:

- To start with situational problems will motivate students to learn and apply mathematical concepts at the beginning of the chapter.

- Most mathematical concepts are abstract and there is a problem to realize and apply the concepts for solving real world problems, unless they initially relate to the environment.

- It is easy for students to understand theoretical concepts if they were started from a real situation. Then the mathematical concepts will be applied in different fields of study and students' daily activities.

Some respondents suggested that the sequential order of the

concepts of the topics should start from the theoretical concepts. Their reasons were the following:

- Mathematical equations are an aggregation of algebraic expression. Hence, students should have to know an algebraic expression before mathematical equations.

- The graphs and applications of algebraic concepts are dependent on the concepts of mathematical equations. That is, without having the concept of mathematical equations, one cannot draw the graphs of the functions, and even cannot apply the mathematical concept in solving situational problems.

Furthermore, they elaborated their ideas by knowing theoretical concepts and applying them in reality is easier for students at grade ten level. Students first have to master the mathematical formulae, otherwise teaching will not be productive. Hence students first have to know the theoretical concepts in order to apply the mathematical ideas to a real situation.

Some respondents such as T_5 and T_{12} said that the sequential order of the concept of the topics could differ from chapter to chapter. For instance with chapters that have a relationship with tangible objects, it is better to start with a real situation. While for other chapters, it is difficult to start from the real situation. For example in chapter one – *Relation and Function* it is difficult to start with a real situation, while in the other chapters, such as exponential and logarithmic function, and sequence and series they can be

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easily related to the environment. Therefore, it is not necessary to start with the same sequential orders in every chapter.

However, all the respondents argue that motivating student by having examples from a real situation is more beneficial. This is due to the fact that:

- Students could be able to relate mathematics to the environment.

- Students could relate mathematics to other subjects.

- Students could understand the theoretical concepts of mathematics easily. This also can help the students for the development of their mathematical skill.

4.1.5 Teachers' perceptions of the subject matter (content) of the algebra section of the textbook
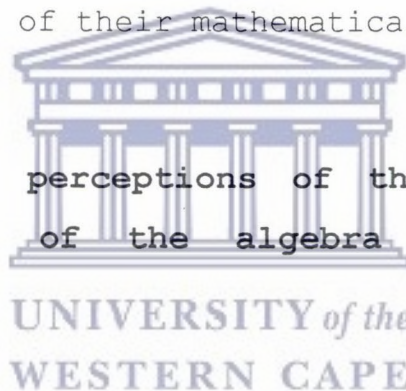
All the respondents suggest that most of the content of the topics in the algebra section of the textbook are appropriate to grade ten students, that is, students have to learn these concepts at this grade. However, most of the respondents pointed out that topics such as functions of several variables, sigma notation for a series, and harmonic progression are beyond the capacity of the students. Especially the topic of sigma notation for a series is

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embedded with proofs and difficult theoretical formulae with which students cannot cope at grade ten level.

Most of the respondents suggested that the objective of the above topics is not clear. Since they consider that the topics are irrelevant at grade ten level, they exclude them during their teaching.

Most of the respondents have demanded the inclusion of the concepts of set theory, set building method and intervals in the previous grade (in grade eight and grade nine). They can serve as a background of the concepts of Cartesian Product in the first chapter- *Relation and Function*, and the concepts of rational inequalities in the second chapter - *Rational function*.

Some of the respondents suggested that in order to have a flow of ideas the concept of linear inequalities and quadratic inequalities are needed as an introduction in the sub topic of rational inequalities.

Some of the respondents such as, T_9, T_{12}, and T_{15} suggested that the concepts of simple interest and compound interest are applicable. However, the textbook lacks detailed explanation and applicable exercises of the concepts of simple interest.

Most of the respondents suggested that the first two chapters -*Relation and Function, and Rational function* are prepared in an abstract manner. They are prepared in a solid theoretical way rather than prepared in easy and applied ways.

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4.1.6 Teachers' perceptions of the examples in the algebra section of the textbook
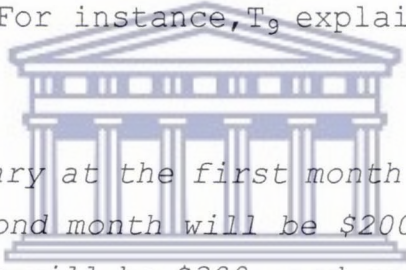
Most of the respondents said that the examples in the textbook are not sufficient. They pointed out that:

- The examples on page-2 and the graphical illustration of example number-3 on page-51, are not clear. That is,

  - it is difficult to relate to the theoretical parts, and

  - they do not encourage students to do the corresponding exercises.

- The topic of exponential and logarithmic function has no examples for the exercises. This has a drawback on the students and teachers since:

  - it creates difficulty for the students when they want to work independently of their teachers,

  - students will be totally dependent on their teacher's notes and examples, and can lack confidence in the subject, and

  - it creates incoherence among the teachers when they use their own examples.

- On page-24 the examples of inverse of a relation, the textbook only refers to the concept of order pairs. They

do not elaborate how to draw the graph of the relations.

Some of the respondents such as T_{15} and T_{16} suggested that there should be more examples in the topic of rational inequalities. To make the students understand the concept, more examples are needed. Those whose answers are two extremes (answers that have no limit points in both sides), whose answers are one extreme, and one at the middle (answers that have limit points on one of their sides), and whose answers are at the middle (answers that have a limit point on both sides) are important.

Some of the respondents such as T_5, T_9, T_{10} and T_{12} suggested that in the topic of sequence and series the examples are to be evaluated by inserting numbers. It is better to have practical examples. For instance, T_9 explains the examples to be as,

> *Mr X's salary at the first month is $100, in the second month will be $200, in the third month will be $300, and so on. What will be his salary at the end of the year? Hence students will have different ways to answer the question and it will be more relevant to them, and develop creativity.*

Some respondents such as T_2, T_5, T_9 and T_{12} argue that the examples in the textbook are satisfactory. They suggested that all examples should not be straightforward, and this will help students to develop their personal creativity. Otherwise,

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mathematics will be only content oriented. They have also suggested that the absence of examples in some topics of the textbook will help students to relate the concept to their prior knowledge. For instance, the absence of examples in the topic of exponential and logarithmic function will help students to recall their knowledge of grade eight and relate it to the concepts of function of that topic.

However, all the respondents agreed that the examples on page-2 and page-51 are vague, and they lead students to confusion.

4.1.7   Teachers' perceptions of the exercises in the algebra section of the textbook

All the respondents witnessed that there are satisfactory exercises in the textbook. They suggested that most of the exercises are helpful for the students.

T_5, T_9, and T_{12} said that there are exercises that relate to the concepts of previous grades. For instance on page-47, exercise number-1, items i and j, and on page 314 all the exercises, are related to grade eight topics. These help the students to recall their prior knowledge. On page-47 exercise number-1 introduces students to the higher mathematical course of calculus, and this helps the students to have a good background for their further studies.

However, all respondents suggested that there are exercises that do not correspond to the algebra section of grade ten mathematics. For instance, on page-5 exercises number-4 and

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number-5 are related to the concepts of equivalent relations(symmetry, reflexivity and transitivity). T_{15} suggested that these concepts belong to the course of abstract algebra at college level. These are beyond the capacity of students.

Most of the respondents suggested that there are exercises that need concepts that are not in the curriculum of elementary or secondary schools of Eritrea, but still they are appropriate to grade ten students. For example, on page-47, exercise number-10 and on page-329, exercise number-16, items C and D, needs the concept of absolute value.

Some of the respondents such as T_3, T_5 and T_9 said that the exercises of exponential function are limited on the graphs $Y=2^x$ and $Y=2^{-x}$. It should be extended to the graphs of $Y=3^x$ or $Y=5^x$. Students could have a general idea about the concept of exponent and can generalize for $Y=a^x$.

Some of the respondents suggested that in some part of the topics the exercises are not satisfactorily arranged. Some of the exercises are given ahead of the topics in which they are expected to be placed. For instance, on page-47 exercises number 4, 5 and 9 are belonging to the topic of exponential function, and exercise number-11 is an exercise of rational function, but, they are placed in the first chapter (the topic of relation and function). They comment that if they were placed in their proper place they would be more appropriate.

Some of the respondents such as T_5 and T_{15} suggested that the exercises on page-261 should be placed at the end of the

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chapter. They expressed the view that students could have understood the concept of the chapter and would have had enough examples to do the exercises. By starting with these theoretical exercises students could be frustrated, and develop negative attitude toward mathematics.

Some respondents such as T_9, T_{15}, and T_{16} suggested that the concept of infinite series on page-295 are clear and applicable. The topic is about divergent and convergent series. But, there is no example or exercise given about the concept.

4.1.8 Teachers' perceptions of the word problems in the algebra section of the textbook

All the respondents felt that the word problem exercises in the textbook are the most important ones. This is due to the fact that:

- They are applications of the theoretical concepts of algebra.

- They motivate students to relate mathematics to their environment.

- They help students to develop their mathematical ability.

- They encourage students to apply the concepts of algebra to different fields of study.

However, most of the respondents comment that:

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- the exercises on page 114 questions number 19 and 20 are beyond the capacity of students, and

- the word problems of rational function are mostly related to physics. There should also be exercises that relate to other fields of study.

Respondents T_3, T_5, T_{15} and T_{16} observed that the word problems on rational function are given all at once. That is, after discussing the whole concept of the topic the exercises are placed together. They suggest that these exercises will be more clear and students can have the required knowledge if they were present after each corresponding concept of the topic. T_9 also said,

> *the concept of word problems should be elaborated by graphical or pictorial illustrations. Students would able to relate the graphical illustration and the theoretical concepts. Hence, they can understand the concept easily.*

Based on these findings, the data will be analyzed by developing key themes that are related to the review of literature.

4.2 Putting things together: An analysis of the data

In the previous section of this chapter the results of the research were presented. This section of the chapter will develop certain key themes and the analysis of the data of the research.

4.2.1 Analysis of the data and development of the themes.

The following are the themes that have been identified by analyzing data collected in respect to the teachers' perceptions of the algebra section in the prescribed Eritrean grade ten mathematics textbook. This was used to interrogate the collected data. The themes thus develop a link between the literature and the empirical data.

Two themes were identified from the data. The themes thus identified is closely linked to key themes in the literature. These are:

A. The relevance of the algebra section of the textbook

B. The appropriateness of the algebra section of the textbook

N.B. The numerals which are written in the analysis refer to the concept of the data which are presented in the data presentation of the research.

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4.2.1.1 The relevance of the algebra section of the textbook

The algebra section of the grade ten mathematics textbook is about functions. Function is a core concept in algebra. The concepts of algebra that are embedded in the textbook have an application in different fields of study such as physics, chemistry, biology, geometry, demography, economics, and so on. These topics are also the base for higher studies, and help students to develop their mathematical knowledge and skills. Hence, the theoretical concept of the topics is relevant. However, the textbook lacks practical applications. The algebra concepts in the textbook remain abstract ideas and theories. (4.1.2, 4.1.5, 4.1.6, 4.1.7 and 4.1.8).

The given concepts should be related to the actual situation of the students. As some respondents indicate the examples and the exercises given in the textbook are not parallel with the background and needs of the students. Especially for those students in the rural and semi-urban areas of the country, the mathematical concept of the topics is vague. The examples and exercises in the textbook do not relate to their environment(4.1.1, 4.1.2, 4.1.6, 4.1.7 and 4.1.8).

The sequence of the concepts embedded in each topic of the textbook is seen in relation to the interest of the students. That is, which sequence is meaningful to the students and which sequence can give clear understanding about the concepts and their applications? Are the major questions in every teachers' mind. There are different opinions on this idea. Some of the respondents argue that to start with situational

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problems is advantageous to the students, because students can be motivated to relate mathematics to their environment and other fields of study. This will enable them to realize the abstract concepts of algebra and to apply them to a real situation (4.1.1, 4.1.4 and 4.1.8).

Others suggested that students should first know the theoretical concepts of mathematics in order to apply them in solving real situation problems. They argue that mathematical equations are an aggregation of algebraic expressions, and to draw the graph of functions and to apply the concept in a real situation there is a need for the knowledge of mathematical equations. Hence, students have to know algebraic expression and then mathematical equations, in order to have effective application of the concepts and solving situational problems (4.1.4).

There is also an opinion which seems to combine the above two opinions. Some of the respondents suggested that the sequence of the concepts in each chapter differs from chapter to chapter. There are topics that can easily relate to the students' environment, such as sequence and series, and exponential and logarithmic functions. Otherwise, one cannot be forced to start with situational problems in every topic of algebra. After grasping the theoretical concept of the topics, students can apply to their daily activity (4.1.4).

However, all the respondents agreed that motivating students by using examples from their environment would be more advantageous. That is, students could able to relate mathematics to their environment and understand the

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theoretical concepts easily. Then they can apply the concepts of the chapters in their daily activities and can have good foundation for their further studies. (4.1.1, 4.1.4 and 4.1.8).

There are some irrelevant topics included in the algebra part of the grade ten mathematics textbook. For example, the respondents want the exclusion of some topics such as, Functions of several variable, Sigma notation for a Series and Harmonic progression during their teaching mathematics. Otherwise, classroom interaction will not be effective (4.1.5).

4.2.1.2 The appropriateness of the algebra section of the textbook

The textbook is the main resource material for teaching and learning algebra in grade ten mathematics in Eritrean Secondary schools. However, it is not accessible to the teachers and students. The textbook does not serve all students equally. That is, the textbook is more related to the topics of a science stream. In addition, students in rural and semi-urban areas have no equal access from the contents of the textbook like those students in urban areas, because the examples and exercises are not related to the environment of rural and semi-urban areas(4.1.1, 4.1.2 and 4.1.5).

In order for the teaching and learning process to be effective, students should actively participate in classroom

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interaction. However, the concepts of algebra in the textbook are abstract, and have depth in relation to their previous grades (grade eight and grade nine). As a result, teachers face problems with students following their explanations. Since then, in order for students to ¯have a clear understanding about the concepts teachers demand an inclusion of additional topics in grade ten mathematics textbook. For example, the concept of polynomial function is a base for the concept of rational function (4.1.2, 4.1.3 and 4.1.5).

There are unclear concepts in the algebra part of the textbook. Students need to be familiar with the concepts such as set theory, intervals and absolute value in their previous grades. These can help them as a background for some concepts in the textbook such as, relation and functions, and rational inequalities (4.1.1, 4.1.2, 4.1.5 and 4.1.7).

The textbook is insufficient for teaching algebra in grade ten mathematics (for Eritrean students). It does not give clear and broader knowledge to the students. It ignores detailed explanations, and applicable exercises of some topics such as simple interest, relation and function (Cartesian Product), and the graph of exponential function (to have a general concept from the form of the expression $Y = a^x$). There is a need for supplementary reference materials. This help teachers to clarify the theoretical concepts and relate the concepts of the topics to practical applications of some fields of study and students' daily activity so that students can learn effectively (4.1.1, 4.1.3, 4.1.5, 4.1.6, 4.1.7 and 4.1.8).

The sequential order of the topics of the algebra section in

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a grade ten mathematics textbook is not satisfactory. The topics should be arranged in such a way that the concept of one chapter should serve as a background to the next chapter. According to the respondents teaching experience, there is an illogical flow of ideas among the topics of the algebra section of the textbook. There are some common characteristics among the three chapters that deal more with the functions, namely: relation and function, rational function and exponential and logarithmic functions. As the finding reveals, there will be a logical flow of ideas if the teachers have taught relation and function, polynomial function, rational function, exponential and logarithmic function, and sequence and series consecutively. In addition, the teaching and learning process would be from simple to advanced concepts (4.1.3, 4.1.5, 4.1.6 and 4.1.7).

Textbooks should present basic contents which students can understand at their grade level. However, in the algebra section of the textbook, there are topics which students cannot yet handle. For instance, functions of several variable, Sigma notation for a series, and Harmonic progression are beyond the capacity of the students (4.1.5 and 4.1.7).

As indicated in the literature, examples in a textbook help to clarify the mathematical concepts and to guide students to work on the listed exercises. Moreover, textbooks are expected to have sufficient and satisfactorily arranged examples. There are two different opinions in relation to the examples that are embedded in the algebra section of grade ten mathematics textbook.

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One of the opinions is that the examples in the textbook are insufficient. Some respondents suggested that some of the examples such as on page-2, page-24 and page 51 are not clear. There is also a need of more examples on the topics of rational inequalities, practical examples of sequence and series, and graphical illustration of the word problems. And they point out that topics such as exponential and logarithmic function, and infinite series (in the topic of sequence and series) have no examples. These create difficulty for students when they work independent of their teachers and to relate the concept to reality. Students develop dependency on their teacher's work. The absence of examples also create incoherence among teachers, on having to create their own examples (4.1.1, 4.1.3 and 4.1.6).

The second opinion is that the examples in the textbook are satisfactory. Some of the respondents suggested that it is not necessary to have direct and numerous examples in each chapter of the textbook. There should be creativity on the students' side, otherwise mathematics will be content oriented. The limited number of examples in some topics will help the students to develop their creativity. For instance, the topics of exponential and logarithmic function have no given examples, but students have a background knowledge about the topic in their previous grades. The absence of examples will help the students to recall their previous knowledge (4.1.6).

However, all the respondents agreed that the examples on page-2 and page-51 the graphical illustration of example number-3, are not clear. These examples can lead the students to confusion (4.1.6).

As revealed in the literature of this mini-thesis, textbooks are expected to provide list of questions that help students to practice on the exercises of the concepts, to solve problems and to know the details of the contents. The nature and arrangement of the exercises in the textbook also influences students' participation in discovery strategy and to upgrade individuals experience. There are satisfactory exercises on the algebra part in the textbook. Some of the exercises have forward and backward linkage of mathematical concepts. For instance, on page-47 exercises number-1 items i and j, and exercises on page 314 are related to grade-8 topics, and on page-47 number-8 introduce the students to the concept of calculus (4.1.7).

However, there are some inappropriate exercises. For instance on page-5 exercises number 4 and number 5 are related to the concept of equivalent relations (symmetry, transitivity and reflexivity). These are beyond the capacity of the students (4.1.1, 4.1.2 and 4.1.7).

There is unsatisfactory arrangement of exercises in some parts of the algebra part of the textbook. For instance, on page-47 (on the topics of relation and function), exercises number 4, 5 and 9 are belonging to the topics of exponential and logarithmic function, and exercises number-11 belong to the topics of rational function (4.1.3 and 4.1.7).

There is also the issue of placement of exercises. For instance, the exercises on page 261 some respondents suggested that if they were placed at the end of the chapter, students could have enough examples and knowledge to do the exercises.

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Otherwise, they can create a negative attitude toward the chapter (4.1.3 and 4.1.7).

There is an inappropriate number of exercises in some parts of the textbook. For instance, in the topics of infinite series there is no exercise given that explain the concept of divergent and convergent series (4.1.1, 4.1.5 and 4.1.7).

Among various type of exercises word problems seemed to be used to train students to apply their mathematical knowledge and skills in a real world. In addition, they make mathematical concepts pleasant and motivating. There are sufficient word problem exercises in the algebra part of the textbook. These can help the students to relate mathematical concepts to different fields of study and their environment. However, some of the problem exercises are not appropriate. For example, on page 114 exercises number 19 and number 20, are beyond the capacity of the students (4.1.8).

There is an inappropriate arrangement and presentation of word problem exercises. The word problem exercises are not related to all fields of study, they mostly relate to physics. In addition, the word problem exercises of rational function will be productive if they were placed after each concept of the sub-topic (4.1.3, 4.1.5 and 4.1.8).

4.3 Conclusion

This chapter dealt with the presentation and analysis of data by the development of themes. Themes were developed from the literature study and used to interrogate the collected data

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through the empirical study. The themes identified handled the relevance and appropriateness of the algebra section of the prescribed Eritrean grade-10 mathematics textbook, based on the teachers' perceptions of the section. The next chapter will focus on the discussion of the analyzed data, conclusion of the study and some recommendations based on the study for the development of the textbook.

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CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This final chapter presents a discussion on the study based on the findings and the related literature reviewed. Conclusions are drawn from both the literature study and the empirical research. Recommendations, emanating from the study is then proposed for the development of the textbook.

An attempt has been made to synthesise the knowledge gained from the empirical evidence in the study, evidence from the studies reviewed, and theoretical conceptualisation presented in previous chapters.

5.1 Discussion and conclusion

Upon reflection of the analysis of the results, it is gratifying to see that it is possible to identify some specific factors that can promote the teaching and learning processes through teachers' perceptions of the algebra section of the prescribed Eritrean grade ten mathematics textbook. By improving the identified factors, it is expected that the textbook will move along to meet its purpose for school learning.

The main factors which the respondents emphasised for the accessibility and productivity of a mathematics textbook are: the case of the relevance and appropriateness of the contents and their presentations within the textbook. Education for

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relevance has different meanings for different people (Knumiller, 1984:61). However, even though it has different meanings, the education given is relevant if it reflects the needs of the students and the society as a whole. According to the findings of this study, teachers argue that the relevance and appropriateness of mathematical content and their presentations depend on the application of the concepts to the daily lives of the students and other disciplines, and the matching of the concepts of the contents and their presentation to the students.

Curriculum developers experience difficulty when deciding which item of content should be included in the syllabus to provide knowledge and skill. Most modern syllabus have a balance between knowledge and skill. It is perhaps, the emphasis given by the syllabus writers to skills and processes that gives each syllabus its distinct flavour (Parkinson, 1994:8). However, Tranver, et al (1997:51) indicate that teachers make a decision on selecting what mathematical content is to be learned at a certain level, and they also make important decisions on selecting mathematical facts and procedures. They also explain that teachers differ in their approach to the teaching of content of mathematics for the item of knowledge and skills. This varies according to their beliefs. From the results of the analysis of the data in this study, the Eritrean grade ten mathematics teachers have different views on mathematics. Some of them want every topic to start with the theoretical concept of mathematics, and then to proceed to the application of these concepts to daily activities of the students. While others, want to relate the mathematical concept at the beginning of the chapter. That

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is, they want to start with situational problems, and then to proceed to the theoretical formulas.

The difference in their instructional approach is due to the fact that they have different views and attitudes to mathematics. Askew and Millet(1994:5) point out that teachers view the mathematics curriculum in terms of content and process skills. Their view can be reflected through their perceptions of the textbook. For instance, from the analysis of the data of this study, some respondents want to have numerous and related applicational examples on each topic of the algebra section of the textbook. This is due to the fact that they need their students to follow the procedures of the examples for doing the corresponding exercises. They also expect that students can learn mathematical concepts without any challenges. On the other side, some respondents believe that it is not necessary for every topic to have numerous and straight forward examples of the concepts and the corresponding exercises. They argue that students should develop creative abilities through their mathematical lessons, otherwise mathematics will remain content-oriented. The mathematical concepts and exercises should not be limited to the specified topics. There should be backward and forward linkage of the study, in order for students to have a good foundation for their higher studies. It is assumed that they need their students to develop problem solving processes.

However, even though teachers have different views on mathematics, their opinion is vital in the development of resource materials. Harrison (1980:11) points out that a number of studies have indicated that even though teachers

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differ in their assessment of the suitability of a particular textbook, their judgements are reliable and consistent if pooled. Secondary school mathematics teachers have aims for their mathematics teaching: To provide tools and skills necessary for use in the real world, everyday life and other subjects, and to develop creative ability of the students. From the analysis of the study, all the respondents suggested that the concepts of the content in the mathematics textbook must have a relationship with the students' environment and with different fields of study, so that students can use mathematical concepts in their daily lives and help them in their further studies. All the respondents agreed on motivating students by giving examples from their environment, the result being a more suitable and productive learning environment. They also have a common opinion regarding those topics that are not fit for the students of grade ten in the Eritrean secondary curriculum. In addition, all the respondents prefer to have a more practical application of mathematical contents of the textbook which relate to the theoretical concepts.
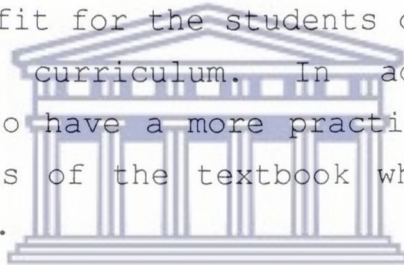
This study has found that the respondents have common opinions and problems on the contents and their presentations in the textbook. Therefore, points of conclusion can be drawn from this study.

The finding reveals that teachers need other resource materials for more clarification of the concepts in the algebra part of the textbook, because the textbook is not sufficient for the teaching and learning process of algebra in grade ten mathematics. This is due to the fact that

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students have difficulties in following the explanation of the concepts of some topics of algebra. The examples and exercises in the topics of algebra are not related to the environment of all students who use the textbook. In addition, it is pointed out that not all the contents and their presentations of the algebra topics in the textbook match the students. Furthermore, the analysis reveals that the mathematical concepts embedded in the algebra part of the textbook are abstract and lack practical application, and that the textbook ignores detailed explanation and applicable exercises of some topics. In addition it reveals that students lack prerequisite knowledge of the concepts that are embedded in the topics that create difficulties, and that there is unsatisfactory arrangement of the algebra topics in the textbook.

From the above, one can conclude that:

- There are irrelevant and inappropriate topics in the algebra section of the prescribed Eritrean grade ten mathematics textbook.

- The sequential order of the topics is not satisfactory.

- The examples, exercises and word problems (practical exercises) are not sufficient and not satisfactorily arranged.

Hence, the textbook is not accessible to the teachers and students.

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To sum up, the analysis reveals that teachers do not believe that the textbook serves its purpose. In order to develop the textbook so that it serves its purpose based on this study, some recommendations are forwarded.

5.2 Recommendations

Several recommendations can be made with regard to the algebra section of the textbook for the future. As explained in the previous section of this chapter some recommendations will be pointed out based on this study. The recommendations are clustered in two themes in which I believe that they are helpful for the development of the textbook. The recommendations concerning the themes are:

- the algebra section of the textbook

- the authors of a textbook in Eritrean education

5.2.1 Recommendations for the algebra section of the textbook

The textbook should provide content which is suitable for use by all populations in the country. This is both a cultural and educational necessity in providing equal opportunity for all students. The textbook can be more effective if:

- the mathematical concept goes parallel with the students'

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situation. There should be appropriate and relevant examples and exercises related to the environment of all students. Exercises which are beyond the cognitive level of the students should be avoided and vague examples as revealed in chapter four should be clarified.

- there are motivating examples from real world situation at the beginning of every topic in the textbook.

- there is a detailed explanation and more exercises on the concepts of the topics such as infinite series and simple and compound interest.

- there are practical exercises on every topic of the textbook, such as word problems that are related to daily activities of the students, and to different fields of study.

- the topics of functions of several variables, harmonic progression and sigma notation for a series are excluded from the curriculum.

- the topic of polynomial functions is included in the curriculum of the grade ten mathematics textbook, and the topics: Relation and function, polynomial function, rational function, exponential and logarithmic function, and sequences and series are arranged consecutively.

In addition, the secondary school curriculum should include the topics of set theory, intervals and absolute value in grade eight and nine mathematics programmes, which can be

background knowledge for some concepts of grade ten algebra.

5.2.2 Recommendations for the authors of a textbook in Eritrean Education

To improve the quality of a textbook, the writers need:

- to research their mathematical topics and related ideas from mathematics education research more thoroughly. This will enable the inclusion of recent theories and findings to the algebra section of the textbook.

- to consult experts in the field so as to help them improve the quality of the content material (Kahn, 1978:246).

- to work collaboratively with Eritrean secondary school mathematics teachers. For instance, Gray worked with a group of teachers, in a project which its main principle was to develop curriculum materials to support teaching of science to grade eight students (Gray, 1997:402). Therefore, I suggest to consult annually or semiannually with the teachers who use the textbook, for their comments and suggestions about the textbook. The development process of the textbook would therefore be up-to-date.

- to investigate the curriculum once again in collaboration with the Curriculum Department of the Ministry of Education of the State of Eritrea. Fraser (1990) cited

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by Doidge (1990:15) proposes that clear didactical guidelines be found for the writing of textbooks, so that the textbook makes genuine contributions to effective teaching and learning. These guidelines with regard to the content and their presentation in the textbook help the textbook authors and the curriculum developers to be aware of the intended content of algebra section of the grade ten mathematics textbook.

Generally, the production of "excellent" textbooks require time, research and expertise. It also requires the piloting of textbooks in schools, evaluation and revision before they are published.

5.3 Concluding remarks

This mini-thesis focussed on the investigation of teachers' perceptions of the algebra section of the prescribed Eritrean grade ten mathematics textbook, particularly the relevance and appropriateness of the topics to the students.

Even though there are a range of views of mathematics amongst the respondents, a number of areas regarding the algebra section of the textbook and how effective it is, were identified in this study. The problems have been identified and certain recommendations have been made to alleviate them.

As Young and Nuttall (1989:224) argue, the close correspondence between the official syllabus and the content of the textbook causes a strong dependence of teachers on a

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textbook in their teaching processes. It is hoped that the issues discussed here will be brought to the attention of those involved in textbook production; that is, authors, publishers, curriculum developers and the Ministry of Education of the State of Eritrea as a whole, in order for the problem to be addressed. Perhaps a textbook for the newly revised syllabus, due to be implemented in the near future, will be of a higher relevance and be well-matched to the needs and abilities of students.

This research illuminates some of the problems associated with the algebra section of the textbook, and it is hoped that it will serve as a base on which appropriate action can be taken.

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TRANSCRIBED INTERVIEW

ቃለ መጠይቕ ምስ መምህር -1

ድሕረ ባይታ መምህር-1

መምህር -1 ብቘጽሪ ብቐዕ መምህር ኢዮም። ብ1984 ዓ. ም ኣብ ኣስመራ ዩኒቨርስቲ ብቘጽሪ ናይ ሳይንስ ባቸለር ድግሪ ተመሪቖም።

መምህር-፣ ኣብ ቤት ትምህርቶም ናይ ቐጽሪ ቀጸላ ትምህርቲ ወይ፣ ዲፓርትመንት ተጸዋዒ መምህር ኢዮም።

ቃለ መጠይቕ

ሕ- መምህር ክንደይ ዓመት ናይ ምምህርና ተመኩሮ ኣለኩም?

መ- ዓሰርተ ሓሙሽተ ዓመት ምሂረ።

ሕ- ክንደይ ዓመት ቐጽሪ ምሂርኩም ?

መ- ኩሉ ናይ መምህርና ተመኩሮይ ኣብ ምምሃር ቐጽሪ ኢዩ። ስለዝኾነ ክኣ ዓሰርተ ሓሙሽተ ዓመት ቐጽሪ ምሂረ።

ሕ- ክንደይ ዓመት ዓስራይ ክፍሊ ምሂርኩም ?

መ- ሸዱሽተ ዓመት ዓስራይ ክፍሊ ቐጽሪ ምሂረ።

ሕ- ዓስራይ ክፍሊ ክትምህሩ ከለኹም እንታይ ጸገማት ኣጋጢሙኩም ይፈልጥ ?

መ- ተማሃሮ ቐሩብ መሰረት ኣብ ሻሙናይን ታሽዓይን ሒዘም ስለ ዝመጹ ዓስራይ ክፍሊ ምምሃር ቐሩብ ጽሓሽ ኢዩ። እንተኾነ ግን ዓስራይ ክፍሊ ቐጽሪ ትሕዝቶ ሕይል ዝበለ ኢዩ፣ ጸገማት ክኣ ኣሎ። ማለት ዓስራይ ክፍሊ ቐጽሪ ሕመረት ናይ ካልኣይ ደረጃ ቐጽሪ እዩ። ስለዚ እቲ ትሕዝቶ ናይ እቲ ኣምር ምዕባል ዝበለ ዕምቆት ዘለዎን እዩ። ብፍላይ ኣብ ናይ መጀመርታ ክፍቲ ስለስተ ሰሙን ዝኾውን ተማሃሮ እንሆም መገለጺ ኣይከታተሉናን እዮም። ድሓር ግን እንዳ ልመድም ስለ ዝኾዱ ቐሩብ ምክትታል ይጅምሩ። እቲ ሽግር ግን ዝተጋነነ ኣይኮነን።

ሕ- ዓስራይ ክፍሊ ቐጽሪ ክትምህሩ ከለኹም እንታይ ዓይነት ናውቲ ትጥቀሙ ?

መ- ቀንዲ ዝጥቀመሉ እቲ ናይ ዓስራይ ክፍሊ ናይ ቐጽሪ መጽሓፍ ኢዩ።

ሕ- ስጋብ ክንደይ ትጥቀሙሉ ?

መ- እዚ መጽሓፍ ቀንዲ መሳርሒና ክኾውን ተመጢኑን ተወጢኑን ደረጀኡ ሓሊዩ ዝተዳለወ መጽሓፍ ኢዩ። ስለዚ ኩሉ ግዜ ንጥቀመሉ። ከምኡ'ውን ሓደ ሓደ መጽሓፍቲ ይጥቀም።

ሕ- ንኣብነት ዓስራይ ክፍሊ ኣልጀብራ ክትምህሩ ኩለኹም እንታይ ናውቲ ትጥቀሙ ?

መ- መብዛሕትኡ ጊዜ ንዓስራይ ዝተዳለወ መጽሓፍ ይጥቀም፣ ሳሕቲ ግን ካብ ቤት ንባብ ከምኒ ኮሌጅ ኣልጀብራ ከም መወከሲ ይጥቀም።

ሕ- ስለምንታይ ካልእ ተወሳኺ መጽሓፍ ኣልጀብራ ክትምህሩ ትጥቀሙ ?

መ– እዚ ተወሳኺ መጽሓፍቲ ኣስፈሖ ነቲ ኣብ መጽሓፍ ዘሎ ትሕዝቶ ወይ ኣምር ንምግላጽን
ሓደ ሓደ ተዛማዲ ዝኾነ ኣምር ናይ እቲ ትሕዝቶ ናይቲ መጽሓፍ ኣድላይ እንተዘይኮይኑ
ንምውሳኽ ይሕግዝ። ብተወሳኺ ተግባራውን ተዛማድነትን ዝኾኑ መላመዲታት ብቐሊሉ
ንትመሃሮ ዝኽግቡ ንምርኣይን፣ ዝተፈላለዩ ኣብነታትን መላመዲታት ንተመሃሮ ናይ ቁጽሪ
ክእለትም ንምምዕባል ዝሕግዝ ንምንዳይ።
ካብቲ ዝተዳለወ መጽሓፍ እቲ መሰረታዊ ትሕዝቶ፣ ኣምር ከም ቲዮረም ደፈኒሽን
ከምኡውን መሰረታዊ ኣብነታት ይጥቀም። መብዛሕትኡ እቲ መላመዲታት ተመሃሮ ባዕሎም
ክሰርሕዎ ይገድፈሎም።

ሕ– ንኣብነት ኣብ ቀዳማይ ምዕራፍ ኣየኖት እዮም እቶም መሰረታዊ ዝኾኑ ወይ ዘይኮኑ ?

መ– ኣብቲ መጽሓፍ ኣብ ምምሃርን ምስትምሃርን ዝግደፍ ኣለም ግለተይ ኣይኮነን። ንተወሳኺ
መብርሆ ሓበሬታን እያ ካልእ መጽሓፍ ዝጥቀም።

ሕ– ኣብ ኣልጀብራ ክፋል ናይቲ መጽሓፍ እንተድኣ ሪኢና፣ እቶም ምዕራፋት፣-
ሪሌሸንን ፋንክሸን፣ ራሽናል ፋንክሸን፣ ስኩንስን ስርየስን፣ ከምኡውን ኤክስፖነንሻልን
ሎጋሪዝምን ፋንክሸን እዮም።
ኢዚኣቶም ስጋብ ክንደይ ምስ ናህና ኩነታት ብቚዓት ኣለዎም ?

መ– ወልኾ እቲ ቀንዲ ትሕዝቶ ናይ ዓስራይ ክፍሊ ኣልጀብራ ፋንክሸን እዩ። ኣቐዲም ከም
ዝነገርኩኻ ዋላ እኳ ኣብ ዝቐደማ ክፍልታት ይማሃሮ እምበር ኣብ ዓስራይ ክፍሊ እቲ
ኣምር ዉምቀት ኣለዎ። ብብቕዓት እንተድኣ ሪኢና ካእ ብመሰረቱ ቁጽሪ ቲዮረ እዩ።
መብዛሕትኡ ቀጥታዊ ርክብ ምስ ከባቢ የብሉን። እንተኾነ ግን ንላዕለዋይ ትምህርቲ
መሰረት እዩ። ስለዚ ብቕዓት ኣለዎ ንብል።

ሕ– ንኣብነት ቀዳማይ ምዕራፍ እንታይ እዩ እቲ ብቕዓቱ ?

መ– ቀዳማይ ምዕራፍ ብዛዕባ ሪሌሸን ፋንክሸንን እዩ። ፋንክሸን ካእ ኣብ ኣልጀብራ ዓስራይ
ክፍሊ ቀንዲ ሓመረት ኮይኑ ናይ ቁጽሪ ተግባራዊ ስርሓት ኣብ ካልእ ዓይነት ትምህርቲ
ዝካየድ እዩ። ንኣብነት ኣብ ፊዚክስ ብዛዕባ ምንቅስቓሳት ብመንጽር ጊዜ ክንምህር ወይ
ከንተገብር ናይ ፋንክሸን ፍልጠት የድሊ፣ ኣብ ከሚስትሪ ርክባት ናይ ምውህያድ ከሚካላት
ናይ ፋንክሸን ፍልጠት የድሊ፣ ከምኡውን ኣብ መዓልታዊ መነባብሮና ንጥፈታትና
ብመንጽር ገንዘብ ንምርኣይ ናይ እዚ ኣርእስቲ እዚ ፍልጠት የድሊ። ስለዚ እዚ ምዕራፍ
እዝ ኣዝዩ ብዙሕ እዩ ምባል ይከኣል።

ሕ– እሞ እዚ ምዕራፍ ኩሉ እዚ ዝበልካዮ ተግባራዊ ስርሓት ይገልጽን የቅርብን ዶ?

መ– ናይ ብሓቲ እቲ ኣርእስቲ ብቲዮረ እዩ ቀጹ ዘሎ። ኣዝዩ ተግባራዊ ንጥፈታት ይሓጽር
እዩ። ከምዚ ኣቐዲም ዝገለጽኩዎ ምንቅስቓሳዊ ንትፈታት ብመንጽር ጊዜ ከምኡውን መዓ
ልታዊ ንጥፈታት ብመንጽር ገንዘብ ጌሩ ናብ ተግባራዊ ንጥፈት እንት ዘተኩር ኣዚዩ
ውጽኢታዊ ምኾነ ኔሩ። ስለዚ ኣብ መግለጺታቱ፣ ኣብ ኣብነታቱ፣ ከምኡውን ኣብ
ኣብነታቱ ተግባራዊ ኣብ ከንዲ ቴዮሪ ዝኾውን፣ ንጥፈታታ ዝዐድም ክህሉ ኣለዎ።

ሕ– ኣብዚ መጽሓፍ ኣስራርዓ ናይ እቲ ምዕራፋት ናይ ኣልጀብራ ክፍሊ፣-

- ሪሌሸንን ፋንክሸን
- ራሽናል ፋንክሸን
- ስኩንስን ስርየስን ከምኡውን
- ኤክስፖነንሻልን ሎጋሪዝም ፋንክሸን

ኮይኑ ተሰሪዑ ኣሎ። እዚ ከመይ ትሪኦ ?

መ– ኣብዚ እቲ መጽሓፍ ሪሌሸን ፋንክሸንን ኣቐዲም ራሽናል ፋንክሸን ምስዓቡ ጽቡቕ እዩ።
ምኽንያቱ ብዛዕባ ፋንክሸን ኣምርን ናቱ ስእልን (ግራፍ) ብቐሊሉ እቲ ኣብ ራሽናል
ፋንክሸን ዝተደለየ ኣምር ክረድኣካ ይኽእል። ዝተተሓሓዙ እዮም፣ እንተኾነ ግን ቅድሚ

ስኩንስን ስርየሰን ኤክስፓንንሻልን ሎጋሪዝምን ፈንክሽን እንተዝምህሩ ምሓሽ። እዚ ከኣ ብስለሰተ ምኽንያት ኢዩ።

ቀዳማይ፡- እዚ ኣምር ናይ ስኩንስን ሰርየሰን ቁሩብ ዉምቀት ኣሊዮም ምዕብል ዝበለ ኢዩ። ስለዚ ኣብ ምምሃር ምስትምሃር ሒደት ካብ ቀሊል ናብ ከቢድ ይኸውን።

ካልኣይ፡- ኣምር ናይ ራሽናል ፈንክሽን ኤክስፓንንሻልን ፈንክሽን ዝተተሓሓዝ እዩ። ኣብ ደሞይንን ረንጅንን ኣብ ምስኣል ግራፍቱ፣ ኣብ ምትንታን እቲ ግራፍ ኣዝዮም ዝተቀራረቡ ኢዮም። እዚዮም ካብ ምስ ስኩንስን ስርየሰ ይቀራረቡ።

ሳልሳይ፡- ሓደ ሓደ ናይ ስኩንስን ሰርየሰን ኣምር ፍልጠት ናይ ኤክስፓንንሻልን ሎጋሪዝምን ዝደልዩ ኣለዉ።

ስለዚ ስኩንስን ሰርየሰን ብድሕሪ ኤክስፓንንሻልን ሎጋሪዝምን እንተ ተማሃርናዮ ይሓይሽ።

ሕ- ከምዚ ኣብዚ መጽሓፍ ዘሎ ኣሰራርዓ ገርካ ዶ ትምህር ?

መ- እወ

ሕ- ስለምንታይ ?

መ- ርኢ፣ እዚ መጽሓፍና ኣብ ክልተ ዝተከፍለ እዩ። ማለተይ ምዕራፍት ሓደ፣ ክልተ፣ ስለስተን ሹዱሽተን ኣልጀብራ ዝሓዘለ ክኸውን እንከሉ ምዕራፍት ኣርባዕተን ሓሙሽተን ሸውዓተን ከኣ ጂዮመትሪ ዝሓዘለ እዩ። ኩሉ ምዕራፍት ኣብ ሓደ ዓመት ክንውድኣ ስለዘይንኽእል ንሕና ምዕራፍ ሹዱሽተ (ማለተይ ኤክስፓንንሻልን ሎጋሪዝምን ፈንክሽን) ናብ ዓሰርተ ሓደ ክፍሊ ኣሰጋግርናዮ።

ሕ- እሞ ስኩንስን ስርየሰን ቅድሚ ኤክስፓንንሻልን ሎጋሪዝምን ምምህር ጸገማት ዶ ኣይፈጥርን?

መ- ይፈጥር እዩ። ሱቅ ኢልና እቲ ናይ መጽሓፍ ኣሰራርዓ ክንክተል ስለ ዝደለና ኢና።ብዛዕባ እዚ ከኣ ብዙሕ ጊዜ ተዛሪብና ናብ ክፍሊ ካሪኩሉም እውን ኣመልኪትና ስጋብ ሕጂ ግን መልሲ ኣይረኸብናን። ሎሚ ዓመት ከኣ ክንዘራረበሉ ኢና።

ሕ- ኣብ ውሽጢ ሓደ ኣርእስቲ ዘለዉ ኣምር ኣሰራርዓ ኽ ከመይ ትርእዮ?

መ- ብኣይ ወገን ጽቡቅ እዩ።

ሕ- መምህር ኣብዚ ናሀና መጽሓፍ እንተድኣ ሪኢና ኣሰራርዓ
  - ኤክስፓንንሻል (ምግላጽ)
  - ኢኩሽን
  - ፈንክሽን ግራፍን ድሓር
  - ተግባራዊ ንጥፈታት ኣለዉ።

  ኣብዚ ናይ ደቡብ ኣፍሪቃ ደረጃ - ሸውዓተ ናይ ቁጽሪ መጽሓፍ ኣሰራርዓ ግን
  - ተግባራዊ ንጥፈታት
  - ፈንክሽን ግራፍን
  - ኢኩሽን ድሓር ኤክስፕሬሽን ኣለዉ።
ብዛዕባዚ እንታይ ሓሳባት ኣሎካ ?

መ- እዚ ናይ ደቡብ ኣፍሪቃ ኣዕሙቖ ኣይራኣኹምን። እንተሾነ ግን ብናተይ ወገን ካብ ኩውንት ተላዒልካ ምምሃር ዝበለጸ ኮይኑ ይስምዓኒ። ንኣብነት ንተማሃሪ ብጨቡጥ ነገራት ብእትጥቀመሉ ሓሳባት ወይኻ ኣምር ብምብጋስ ብቐሊሉ ይርድኦም። ድሓር ኣብ ተግባራዊ ንጥፈታት የውዕሎም። መብዛሕትኡ ጊዜ መብዝሕትኦም ናይ ቁጽሪ መግለጺ

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(ኤክስፕረሽን) አብስትራክት ስለ ዝኾኑ ብትዮሪ ምድማር እቲ ኣምር ብሩህ ኣይኮነን፣ ኣብ ተግባር ምውዓሉ'ውን የጸግም።

ሕ- ከምዚ እንተድኣ ኮይኑ ከመይ ጌርኩም ትምህሩ ?

መ- መብዛሕትኡ ግዜ መተባብዒ ኣብነታት ኣብ ክውንነት ካብ ከቢቢኣም ኢና ንህቦም ድሓር ነቲ መጽሓፍ ንኸተሉ። እዚ ተመሃሮ ቁሩብ ንክመሃሩን ኣብ ተግባር ንኸውዕልዎን የተባብዖም።

ሕ- ንኣብነት ኣብ ምዕራፍ ሓደን ክልተን እንታይ መተባብዒ ትጥቀሙ ?

መ- ኣብ ቀዳማይ ምዕራፍ ብዛዕባ ንጥፈታት ብመንጽር ጊዜ ከምኡውን ካልእ ተመሃሮ ዘተባብዕ ይጥቀም። ኣብ ምዕራፍ ክልተ ካ ግድል ካብቲ መጽሓፍ ካብ ካልእ ምስተማሃሮ ዓቕሚ ዝኸይድ ርእና ብሉ ይጅምር፣ ድሕርዚ ግራፍ ንክስእሉን ግራፍ ንክገልጹን ንተማሃሮ ቀሊል ይኸውን። ከምኡውን ንመጻኢ ፍልጠቶም ይሕግዞም።

ሕ- ምዕራፍ ሓደ፣ ክልተ እንተድኣ ሪኢና ከምኡውን ምዕራፍ ሹድሽተ ዝተፈላለየ ኣቀራርባ ኣለዎ። እዚ ኣብ ምምሃርን ምስትምሃርን ሓደት ጸገም ዶ ኣየምጽእን?

መ- ወልጀ ብዙሕ ኣየምጽእን ኢዩ። ኣቀድም ከም ዝገለጽኩም ካብ ክውንነት እንተድኣ ጀሚርና እቲ ኣምር ብቀሊሉ እዩ ዝርስኣካ። ግን ኣብ ምዕራፍ ሹድሽተ ማለት ኤክስፓንሽያለን ሎጋሪዝሚክ ፈንክሽን እቲ ኣምር ናይ ግራፍ ምስ ራሽናል ፈንክሽን ዝተተሓሓዘ እዩ። ንሱ ንቀጻሊ ዝውስካን ንቀጻሊ ዝጉድልን ፈንክሽን ኢዩ ዝበርሁ ከምኡውን ተግባራት ናይ ፈንክሽን ብቀሊሉ የረድኣካ።

ሕ- እቲ ናይ ቁጽሪ ትሕዝቶ ናይቲ መጽሓፍ ከመይ ትርእዮም? ንቶም ተማሃሮ ማዕቀኖም ድዩ?

መ- እቲ ናይ ቁጽሪ ትሕዝቶ ኣዝዩ ከቢድ ኢዩ። ብኣይ ወገን እዚ መጽሓፍ ክዕሎ ከሎ ስሚዒት ዝተሓወሰ ትንቢት ነሩ ከበዛል ይኸኣል። ምኽንያቱ ተመሃሮ ብዙሕ ብዛዕባ ቁጽሪ ኣብ ካልኣይ ደረጃ ክፈልጡ ተዳልዩ ነሩ ማለተይ እዩ። ሓደ ሓደ ኣርኢስትታት ካብ ዓቕሞም ንላዕሊ ኣለው። ንኣብነት ቀዳማይ ምዕራፍ ብቀሊሉ ተመሃሮ ከም ዝርድኦም ገርካ ምቅራብ ምትካእስ ነሩ።

ሕ- ከመይ ጌርኩም ብቀሊሉ ተመሃሮ ከም ዝርድኦም ጌርኩም ማቅረብኩም?

መ- ሓራም ሕጂ ከምዚ ወይ ክምቲ የጻግመኒ ኢዩ። እንተኾነ ግን ጊዜ ወሲድካ ካልእ መጽሓፍ ብምውካስ ድሕሪ ነዊሕ መጽናዕቲ ብቀሊሉ ተመሃሮ ከምዝርድኦም ገርካ ምቅራብ ከም ዝኽኣል ይኣምን። ንኣብነት ብወገነይ ንክቀልል ድሕሪ ቴዮረምን ደፈንሽንን ብቁን ማዕቀኖምን ብዝኾኑ ኣብነታት ነቲ ኣምር ናይቲ ቴዮረም ደፈንሽንን ምግላጽ የድሊ። እንተኾነ ግን እዚ መጽሓፍና ብፍላይ ኣብ ቀዳማይ ምዕራፍ ብድሕሪ እቲ ቴዮረምን ደፈንሽንን ብዘይ ብቁዕ ኣብነታት ቀጥታ ብዙሕ መላመዲታት የቅርብ። ከም ንኢለጠ ተመሃሮ ብዘይ ሓደ መረዳእታ ናብቲ መላመዲታት ይጉዮ፣ መረዳእታ ናይቲ ኣምር ስለ ዝጎደሎም ከኣ ብዙሕ ይሸግሩ። ስለዚ ብቁዕን ማዕቀኖምን ዝኾነ ኣብነታት ሂብካ ውሱን መላመዲታት ናቶም ናይ ቁጽሪ ፍልጠት ከማዕብሉ ምኽኣል ነሩ ይበል።

ሕ- ንኣብነት እቲ መላመዲታት ኣብ ቀዳማይ ምዕራፍ እንታይ ሕጋቅ ጽልዋ ኣለዎ?

መ- ኩሉኹም መላመዲታት ዝተመሳሰሉ እዮም፣ ስለዚ ብዝሒ እንተዛይደኩኑ ጸገም የብሉን።

ሕ- እስከ ገጽ 298 ንርኤ። ሲግማ ኖተሽን፣ ፎር ኢስርየስ። ከመይ ትርኢዮ ?-ንክትምህሮ የጸግም ዶ?

መ- ኣቀድም ከም ዝገለጽኩልካ ኣብ ምድላው ናይዚ መጽሓፍ እዚ ኣገዩ ስሚዒት ነሩ ይበል። ንጽር እዩ፣ ኣምር ናይ ሲግማ ኖተሽን ኣብ ቁጽሪ ዓለም ዓቢ ጊደ ኣለዎ። እንተኾነ ግን

ካብ ተመሃሮና ዓቕሚ ንላዕሊ ኢዩ። ብዙሓት ኣረጋገጽ ዝብሉን ብርቱዓት ኣመርን አለዉም። ንእብነት ኣብ ገጽ 302,303 ከምኡውን 305,306 ዘለዉ መላመዲታት ብፍላይ ካሊ ካብ ቁጽሪ 11-20 ኣረጋገጽ ዝብሉን ርክባት ኣመሰካር ዝብሉን እዮም። እዚ ከአ ካብ ናይ ተማሃሮና ዓቕሚ ንላዕሊ እዩ።

ሕ– እሞ እቲ መፍትሕ ዳስ እንታይ ኢዩ ?

መ– ብኣይ ወገን እቲ ኣርእስቲ ብምሉኡ ካብቲ መጽሓፍ ምግሳል ይሓይሽ።

ሕ– ኣብዚ ኣልጀብራ ክፍሊ ካልእት ንምምሃርም ዘጸግሙ አለዉደ?

መ– እቲ ቀንዲ እኪ ናይቲ መጽሓፍ ስፍሓት እዩ። ብሓደ ዓመት ምውድኡ ኣዝዩ ኣጸጋሚ እዩ።

ሕ– ብዛዕባ ስፍሓት ድሓን። ንሕና ኣብቲ ትሕዝቶ ጥራይ ነቱኩር። ገጽ 92 ንኡስ ኣርእስቲ ራሽናል ኢን ኢኪሊትስ ከመይ ትሪኡም?

––– ....
ማለት ምኽንያታዊ ብምክንያት ምፍታሕ ድሕሪ ባይታ ይሓትት።

ሕ– ናይ ምንታይ ድሕሪ ባይታ ?

መ– ብሩህ ናይ ራሽናል ኢን ኢኪሊቲስ መረዳታ ንክህልወካ ናይ ኪድራቲክ ኢን ኢኪሊቲስ መረዳታ ክህልወካ ኣለዎ። ንኣብነት ተመሃሮ (ህ+2) (ህ−2)>0 ክፈልጡ ይግባእ። ቅድሚ $\left(\frac{\mho+2}{\mho-2}\right)>0$ ምምሃርም። መብዛሕቲኦም ተማሃሮ ራሽናል ኢን ኢኪሊትስ ብሳይንቻርት ገዶርም ምስራሕ ይመርጹ። ካብ ብምኽንያታዊ ምፍትሑ። ምኽኒያቱ ብቐሊሉ እቲ መረዳታ ወይከኣ እቲ ወሳናዊ ቁጽሪ ማለት ዜሮ ዘጽዕጽ ክረኸብ ስለ ዝኽእሉ። እንተኾነ ከኣ እቲ ሓቐኛ እኩብ ክረኸቡ ናይ መልሲ ጸገማት የጋጥሞም። እዚ ከኣ ብኣይ ወገን ሕጽረት ናይ ፍልጠት እኩል ወይ ድሕሪ ባይታ ኖቶም እዩ ይብል። ምኽኒያቱ ኣብ ናይ ካልኣይ ደረጃ ካሪኩሉም ብዛዕባ ኣምር ናይ እኩብ ዝገልጽ ኣርእስቲ የሉን። እኩብ ኣርእስቲ ዘይምህላው ከኣ ንኩሉ ነቲ ናይ ኣልጀብራ ትምህርቲ ኣብ ዓስራይ ክፍሊ ይጸልዎ እዩ።

ሕ– ኣብ ገጽ 295 ዘሎ ንኡስ ኣርእስቲ ሃርሞኒክ ፐሮግረሽን ከመይ ትሪኡም?

መ– እዚ ዝተፈላለየ ፐሮግረሽን ንምርኣይ ሱቅ ኢሉ ዝእተወ እዩ። ጠቕምታቱ ምስካልኣ ኣርእስቲ ምትሕሓዙን ከምኡውን ብቐዓቱ ኣይርድኣንን እዩ። ኣነ ኣብ መጽሓፍ ስለዘሎ እየ ዝምህሮ። ንምምሃሩውን ጸገም እዩ።

ሕ– እዞም ኣብነታት ኣብ መጽሓፍ ዘለዉ ከመይ ትሪኦም? ኣዐግብቲ ዲዮም?

መ– እወ ጽቡቓትን ኣዐግብትን ኢዮም።

ሕ– እስኪ ገጽ 2 ንርኤ፡ ከመይ ትርእዮ?

መ– ከምቲ ኣቐዲም ዝጠቐስኩዋ ሓደ ሓደ ኣርእስታታት ኣለዉ 6ቴዮርም ደፈንሽን ሂያም ኣብነታት ዘይብሎውም፡ ሱቅ ኢልና ካብቲ መላመዲታት ብፍላጥና ንቐርቦ።

ሕ– ብዛዕባ ገጽ 49 ዘለዉኽ እንታይ ትብልዎም?

መ– ኣብዚ ኣብርእሲ እቲ ኣምር ናይ ፋንክሽን ምብርታው እቲ ውሁድ ፋንክሽን እንብሎ ከኣ እንሃ ብርቱዕ እዩ። ኣብ ኣብነት ሰለስተ እንተድኣ ርኢና እቲ ስእላዊ ወይ ግራፋዊ መግለጺ

ንጹር አይኮነን። እቲ ናይ ቴዎሪ አመር ይበልጽ። ስለዚ መታን ተማሃርቲ ከይደናገሩ እቲ ግራፋዊ መግለጺ እንተ ዝተርፍ ይመርጽ።

ሕ- ካልእ መገዲ አሎ ዲዩ ነቲ አምር አቐልል አቢሉ ዝገልጽ?

መ- አነ ሕጂ ብዙሕ አይነቓሕኩሉን አለኹ እንተኾነ ግን ካልእ መንገዲ ይህሉ ኢዩ።

ሕ- እስኪ ጉዳ 313 ንርኤ ከምይ ገርኩም አብዚ ትምህሩ?

መ- አብዚ ኩልና ተመሃርና አብ ዝሓለፈ ክፍልታት ተማሂሮም ኤልና ኢና ንሕስብ አምበር ዋላ ሓደ መላመዲታት የለን። እዚኢትም ብዛዕባ ሕግታት ናይ ኤክስፓኖንሻልን መምርሒ ናይ ኤክስፖነንትን ስለ ዝኾኑ ነፍሲ ወከፍም አብነት የድልዮም ነሩ። አነ ንባዕለይ ቅድሚ ናብ መላመዲ ምእታወይ ብአብነታት ተበጊሰ እየ እቲ ሕጊ ዝገልጽ። ስለዚ አብነት አዝዩ እየ ዝጉድሎ። ዝተፈላለና መማህራን ዝተፈላለየ አብነታት ስለ ነቅርብ ከአ አብ ምውህድ አመሃራና ጸገም አለም።

ሕ- እዞም መላመዲታት አብዚ መጽሐፍ ዘለዉ ከምይ ትሪአዎም?

መ- አዝዮም ብሉጻትን ካብ ዝተፈላለየ መጻሕፍቲ ዝመጹን ብዙሓትን ኢዮም።

ሕ- ናብ ጉ 4 ንኪድ፣ እዚ ከመይ ትርአዮ?

መ- አብዚ ብፍላይ መላመዲ ቁ 4 ቁ 5 ቡርቱዓት ኢዮም። ንጹራትውን አይኮኑን። ብዛዕባአም ዝገልጽ ናይ ቁጽሪ አመር ወይ አብነት የለን።

ሕ- እሞ ተማሃር ጽቡቅ ገሮም ክርድኦ እንታይ መፍትሒ አሎ ትብሉ?

መ- አመር ናይ ረፍሊክስ፣ ስይመትሪ ትራንዚቲቪት ዝገልጽ ሓደ ንኡስ አርእስቲ ክህሉ አለም። አብዚ ምዕራፍ እዚ ጎዲሉ አሎ።

ሕ- አብ ጉ 47 ዘለዉ መላመዲታት ከመይ ትሪኡዎም? ብፍላይ መላመዲታት 8-11 ዘለዉ?

መ- ቁ 8 ብዛዕባ ዝተፈላለዩ ረጅሒታት እያ እትገልጽ። ተማሃር ከአ አብ ምርዳእ ጸገም አለዎም። ብሓደ ረቂሓ እንተዝኸመር ቀሊል ነሩ። ንአብነት $υ(λ) = 3λ+2$ እንተኾነ $υ(መ)$ እንታይ ይኸውን ድሕር ናብ $υ(መ+ለ)$ ርኸብ ዝብል ይምዕብል። ካልእ ግን ድሓን ኢዩም።
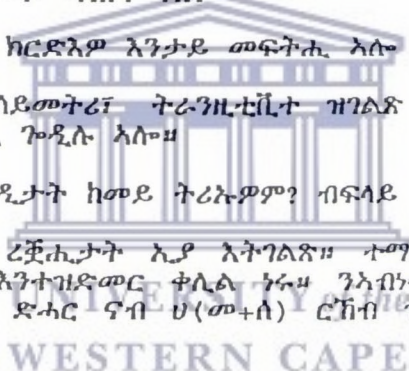
ሕ- ቁ. 10 $λ>0$ እንተኾይኑ እሞ $υ(λ)=2λ+1$ ከምኡውን $ሐ(λ)=λ^2$ እንተኾነ
$$\sqrt{(υ+ሐ)(λ)} - \sqrt{ሐ(λ)}$$ ይብል።
እቲ ዶመይን እንተዘይውሃብ እንታይ ሳዕቤን ነይሩዎ?

መ- እዚ ናብ አብሶሊት ሻልዩ አምር ይመርሐና። ብዛዕባ አብሶሊት ሻልዩ ዝገልጽ አርእስቲ አብ ናይ ካላእይ ደረጃ ካሪክሎም የለን። አነ ብወገነይ እቲ አርእስቲ አብ ካሪክሎምና ይእቶ ይብል።

ሕ- አብ ጉ 293 ዘለው መላመዲታት ከመይ ትሪኡዎም?

መ- እዚኦም አብነታት ልዕሊ ዓቐሚ ተማሃር ኢዮም። ብፍላይ ቁጽሪ አርባዕተን ሹዱሽተን አገዮም ቡርቱዓት ኢዮም። እቲ አመር አብዚ ደረጃ ንጹር አይኮነን። ብተወሳኺ እውን አብ ጉ 305-306 ዘለው መላመዲታት ካብ ቁጽሪ 11-20 ከምቲ አቐዲም ዝገለጽኩዎ አገዮም ካብ ዓቐሚ ተማሃር ንላዕሊ ኢዮም። አመሰኽኸርን አረጋግጽ ዝብል ኢዩ ዘሉ ስለዚ ናብ ላዕለዋይ ክፍሊ እንተዝሰጋገር መሓሸ።

ሕ- አብ ገጽ 314 ዘለዉ መሳመዲታት ክ ከመይ ትሪኡዎም?

መ- ኩሎም እቶም ሕቶታት ምምሃርም አየጸግምን ብቕዓት ክሳ አለዎም። እንተኾነ ግን ሓደ ሓደ ጌጋታት አለዉ። ሕጇ ድኣ ብዙሕ ርግጸኛ አይኮንኩን አምበር ብፍላይ ቁጽሪ ሸውዓት ጌጋታት አለዎ። ድሓር ሓሲበ ክነግረካ እየ።

ሕ- ንቁ. ሰለስተን ቁጽሪ አርባዕተን አብ ገጽ 314 ዘለዉ ከመይ ትሪኡዎም?

መ- እቶም ሕቶታት አምር ናይ ምጉዳልን ምውሳኸን ፋንክሽን ኢዮም ዝገልጹ። ብኣይ ወገን አቀዲምና እቲ ኢኮሸን ብኢንተጀር አብክንዲ ደሲማል እንተነቅርቦ ይቀልል። ብዝተረፈ ብጣዕሚ ጽቡቃት ሕቶታት ኢዮም። አብ ገጽ 97 ግን ናይ ቦታ ምዝንባል ናይቲ ሕቶታት አሎ። ንኣብነት ቁጽሪ አርባዕተ፣ ሓሙ-ሸተ፣ ትሽዓት ምስ ኤክስፓነንሻል ፋንክሽን እንተነዘቀርቡ። ከምኡውን ቁጽሪ ዓስርተ ሓደ ናይ ራሸናል ፋንክሽን ኢዮ። ስለዚ አብ ግቡእ ቦትኡ እንተንዝኾኑ አዝዮም ውጽኢታውያን ምኾኑ።

ሕ- እዞም ግድላት አብዚ አልጀብራ ክፍሊ ናይዚ መጽሓፍ ዘለዉ ከመይ ትሪኡዎም?

መ- ግድላት አገዙም ተግባራዊ ቁጽሪ ኢዮም፣ ንተማሃሪ ቁጽሪ ምስ ከውንነት ንክገናዝብዎ የተባብዑ፣ ከምኡውን አምር ናይ አልጀብራ አብዝተፈላለየ ዓይነት ትምህርቲ ንክውዕል ይመርሑ። እንተኾነ ግን አብ ካልኣይ ምዕራፍ ዘለዉ ሕቶታት ብርቱዓት ኢዮም። ብፍላይ አብ ገጽ 114 ቁጽሪ 20 ዋላ ሓንቲ ምስቲ ተዋሂቡ ዘሎ አብኖታት ርክብ የብሉን።

ሕ- እንታይ መገዲ አሎ ብቀሊሉ ክንህበሉ እንኽእለሉ?

መ- እሞ ሕጇ ከምዚ ክብል አይክእልን እየ። ሓሲበ ክነግረካ።

ሕ- ብዛዕባ አልጀብራ ናይ ዓስራይ ክፍሊ፣ ብዙሕ ተመያይጥና፣ ካብ ተመኩሮኩም እዛ መጽሓፍ እዚኣ ከመይ እንተኾነት እያ አብ ጥቅሚ ተማሃሮ ትውዕል?

መ- ከም ዝነገርኩኻ መጀመርታ እቲ 6 ቲዮሪም ደፍንሽን ምስ ሰፈረ፣ ድሓር ብቁዓት ዝኾኑ አብኖታት ተቐርብ፣ መብርሂ ከኣ ምኾነ፣ ቀጺሉ ዝተመርጹ መላመዲታት ይወሃብ። እቲ መጽሓፍ ንተማሃሪ ካብ ከውንነት ብምብጋስ ክተባብዖም አለዎ። ብዝተኻእለ መጠን እቶም አብኖታት መላመዲታት ተግባራዊ ናይ እቲ ቲዮሮም አምር ክኾኑ ይምረጹ።

ሕ- ካልእ እንታይ ርኢቶ አለኩም?

መ- ዋላሓንተ የብለይን። አይትሓዙለይ ክፍሊ አሎኒ። ካልእ ተወሳኺ ሓበሬታ እንተድኣ ረኺበ ክነግረካ እየ።

ሕ- የቐንየለይ፣ ለንበት ሰዓት 10:00 ናይ ንግሆ ንራኸብ።

መ- ሕራይ።

A TRANSLATED TRANSCRIPTION

Interview with T₁

T₁   is a qualified mathematics teacher. He is a graduate of B.Sc degree in mathematics from Asmara University in 1984.

Title:- He is a senior mathematics teacher (head department of mathematics)

Interview

I: How many years of teaching experience do you have?

R: I have taught for fifteen years.

I: For how many years have you taught mathematics?

R: All my experience are on teaching mathematics. I have taught for fifteen years.

I: How many years have you taught grade ten?

R: I have taught grade ten for six years.

I: What problems do you face when you teach grade ten mathematics?

R: Since the students have base in previous grades, to teach grade ten mathematics is better than grade eight and grade nine. However, there is a problem with students following my explanation. This is due to the concepts embedded in grade ten mathematics. The contents of grade ten mathematics are core of high school mathematics and the concepts are also advanced and have depth than previous grades. Our problem is for two or three weeks, after that students will adapt the

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condition and they try to follow the explanation. I mean that the problem is not serious.

I: What resources do you use in teaching grade ten mathematics?

R: I use the textbook as well as reference books as resources.

I: How often do you use the textbook?

R: The textbook is our standard resource and I always use the textbook.

I: For example, when you teach algebra of grade ten mathematics what other resource do you use?

R: Mostly I use the textbook and some times I use other books from the library, such as college algebra and others as a reference material.

I: Why do you use other additional materials for teaching algebra?

R: I use additional books for further clarification of the concepts and if necessary to add other related concepts to the content of the textbook. Mostly from the textbook, I teach the basic concepts such as theorems and definitions, and some basic examples. In order to reduce students' dependency on their teachers, I let the students to do most of the exercises by themselves.

I: For example in chapter one which are the basic ones and which are not?

R: I don't mean that there are contents in the textbook that are ignored during teaching learning process. I use other reference materials for more clarification of the concept and to see more applied and related exercises, so that students can cope with the concepts easily.

I: Let as see the algebra part of the textbook, the topics are:

> relation and function,
>
> rational function,
>
> sequence and series, and
>
> Exponential and logarithmic function
>
> How far are these relevant?

R: Well, the main concept of grade ten algebra is about function. As I have told you before, even though they have learned it in previous grades, in grade ten the concept has depth. As to the relevance, mathematics by it self is theoretical and mostly there is no direct relationship between mathematics and the environment. The concepts of grade ten mathematics are base for further academic development of the students. Based on this, I can say that the topics are relevant.

I: For example, chapter one what is its relevance?

R: Chapter one is about relation and function. Function is a core of algebra in grade ten and for mathematical application in other subjects. For example, in physics the motion concept as a function of time it needs the theoretical concept of relation and function, in chemistry to express the relationship of compounds it needs a knowledge of relation and function. It is also true that in our daily activity to analyze things as a function of money, there is a need knowledge of relation and function. Hence, the topic is relevant.

I: Does the topic treat all these you have explained in a practical manner?

R: Really the topic is more theoretical. It lacks practical application of the concepts. As I have

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mentioned before if it expresses the concepts in relation to situations such as: motion as a function of time and daily activity as a function of money (in which one is dependent on the other) it would have been more productive. Hence, in its expressions, in its examples and in its exercises there should be a practical application of the contents rather than embedded with theoretical concepts.

I: In this textbook, the sequence of the chapters of algebra section are:

- relation and function,
- rational function,
- sequence and series, and
- exponential and logarithmic function.

How do you see it?

R: The concept of relation and function to be first and followed by rational function is good. In other words, after discussing the concept of function and their graphs it will be easy to understand the concept of rational function and their graphs. They have coherent concepts. However, it would be better if we teach the chapter of exponential and logarithmic function before the chapter of sequence and series. This is due to three reasons. Firstly, the concept of sequence and series is more advanced than of the concept exponential and logarithmic function. Therefore, teaching precedes from simple to complex, and it would be easy to understand and to apply it. Secondly, there is a coherence between the concept of rational function, and exponential and logarithmic functions in various ways. For instance, in describing the domain and range of the

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functions, in the construction of the graphs, and in analyzing their graphs. The concepts of these functions are more related to each other than with sequence and series. Thirdly, there are contents in sequence and series that needs the concept of exponent as their prerequisite, such as in geometric progression and infinite series. Hence, the topic of exponential and logarithmic function should be taught before sequence and series.

I: Do you teach according to the sequence in the textbook?

R: Yes

I: Why?

R: You see, our textbook has two parts. That is, chapter one, two, three, and six are algebra parts, while chapter four, five, and seven are geometry parts. Since all the topics cannot be covered in one scholastic year, in this school we agreed to postponed the chapter of exponential and logarithmic function to grade eleven.

I: Doesn't it create a problem when you teach sequence and series before exponential and logarithmic function?

R: It creates, but simply we agreed to follow the sequence of the textbook. We had a lot of discussion about the sequential order of the topics and we also reported to the curriculum department, but until now we haven't got any response. This year we will also consider the issue, and we will report to the curriculum department.

I: How is the sequential order of the sub-topics within the topics?

R: In my opinion it is good.

I: If we see the textbook the sequence within a topic is:

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> Mathematical expression,
>
> Mathematical equation,
>
> Function and graphs, and
>
> Mathematical application (situational problems)

While in South Africa Standard Seven Mathematics Textbook the sequence within a topic is:

> Situational problems (application),
>
> Functions and graphs,
>
> Mathematical Equations, and then
>
> Mathematical expressions

What do you think about this?

R: I haven't seen in detail the South Africa textbook. In my opinion, to start with a real situation is better than to start with theoretical mathematical expressions. That is, to start with tangible or useable ideas would be easy for students to understand the mathematical concept. It is better to start from a real problem to develop mathematical expression and then to apply in a more practical ways. Since most mathematical expressions are abstract to start with theoretical concept and to develop mathematical application is difficult. It becomes difficult in applying and solving real world problems.

I: If this is the case, then, how do you teach?

R: Mostly we motivate our students by giving some examples from real situation, and then we follow the instruction of the textbook. This motivates students to learn and apply mathematics, and mathematical concepts becomes relevant at the beginning of the topic.

I: For instance, in chapter one and chapter two what motivating problems do you use?

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R: In chapter one, I use examples such as motion as a function of time, and others that motivate students. In chapter two, mostly I start with word problems from the textbook and from other reference materials that are appropriate to the students. After expressing word problems in a mathematical expressions it becomes easy to use graphical illustration for further knowledge.

I: If we see chapter one, chapter two, and chapter six, they have different way of presentation. Is there a problem during your teaching process?

R: Well, it doesn't create much problem. As I have told you before if we start with situational problems the concepts would be understood easily. While in case of chapter six-*Exponential and Logarithmic Function* the concept of the graphs are a continuation of the graphs of rational function, and the topic clarifies the increasing and decreasing characteristics of the functions. It is also easy to understand the application of the functions through the graphs.

I: How do you see the mathematical content of the topics? Is it appropriate to the students?

R: Some of the mathematical contents is difficult. In my opinion I think there was an ambition when the textbook is prepared. I meant that they wanted the students to know more mathematical concepts at secondary level. There are concepts and presentations beyond the level of the students. For instance, the topic of function can be prepared in away students can understand easily.

I: How can you prepare in an easy way, so that students can understand?

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R: Well, now I can't say this and that, but if we take time, having reference material and long study I believe that it can be prepared in a way that students can understand the concept easily. For instance, in my opinion to make it easy, after expressing theorems and definitions there should be appropriate examples that can clarify the concept of the theorems and definitions. While in the textbook especially in chapter one, after defining some terms and stating the theorems, without having appropriate examples there is a plenty of exercises. As we know students want to do the exercises immediately after introducing them the topic. Without having clear concept about the content it enables them to do the exercises. Hence, if there are appropriate examples before the exercises, limited number of exercises can develop their mathematical knowledge.

I: For example, in chapter one what is the draw back if there is more exercises?

R: Almost all the exercises are similar. If there are more exercises the volume of the book is enlarged. To do all the exercises there will be shortage of time. Otherwise there is no problem with the exercises.

I: Let us see on page 298(sigma notation for a series), what do you say about this topic? Is it compatible?

R: As I have told you before, there was an ambition on preparing the textbook. It is obvious that the concept of sigma notation has a great role in mathematics, but it is beyond the capacity of the students. There are many proofs and difficult concepts described in the textbook. For example, on page 302 and 303, on page

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305-306 all the exercises from number 11 to number 20 are proofs and show the relationship of the expressions. These are beyond the capacity of students.

I: Then what do you think is the solution?

R: In my opinion I would like the sub topic to be excluded, and I always exclude during my teaching.

I: Is there other concept that is incompatible in the algebra section of the textbook?

R: The main problem is the volume of the book. It is difficult to cover in one scholastic year.

I: Never mind about the volume of the book. Let us focus on the contents of the topics. Let us look on page 92. How do you see the sub-topic of rational inequality?

R: The concept of rational inequality is difficult. Especially, in the first part, the case by case method of solution requires students' background.

I: Background of what?

R: To get clear understanding of rational inequalities they should have an understanding of quadratic inequalities. For example, students must know $(x+2)(x-2)>0$, before learning $(x+2)/(x-2)>0$. Most students wants to solve the question of rational inequalities by sign chart method than case by case method. This is because they can easily identify the boundaries or the zero value of the equations. Even in this method they face a problem when they state the true set of their answers. This is due to lack of the concepts of set. In our secondary school curriculum there is no topic of set theory, and the absence of the concept of set affects the students in the whole courses of algebra section in grade ten mathematics.

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I: What about the topic of harmonic progression, on page
     295?

R: The topic is simply introduced for the sake of
     knowledge that there are different type of
     progressions. For me its relevance and its relation
     with other topics is not clear. Simply I teach my
     students since it is in the textbook. There is also a
     difficulty on teaching the topic, because it is not
     easy to relate the concept to other topics or to the
     environment. Most of the time I exclude during my
     teaching.

I: How do you see the examples in the textbook? Are they
     satisfactory?

R: They are good and satisfactory.

I: Let us see page 2, how do you see this?

R: As we have discussed before there are topics that have
     no examples after defining the basic concepts and
     stating the theorems. When, there is no example, we
     select examples from the exercises, and this creates
     incoherent among ourselves.

I: What about the examples on page 49?

R: Here, besides the difficulty of the concept of
     function, the concept of composition of function is
     more difficult. If we see example three, the graphical
     illustration of the example is not clear. The
     theoretical concept is better than the graphical
     illustration. I would like to ignore the pictorial
     presentation of the examples.

I: Is there any other alternative way to make the concept
     clear and easily understood?

R: Now I can't suggest the alterative way, but there might

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be another way.

I: Let us see page 313, how do you see it?

R: There is no example. Every one of us considers that the students have learnt it in previous grades. But, since these are exponential laws or rules of exponents, there is a need of example for each law. I begin my teaching with my own examples in order to explain the rules before introducing to the exercises. Different teachers can also have different examples. This lack of examples in the textbook and using different examples can lead the students to confusion.

I: How do you see the exercises that are in the algebra section of the textbook?

R: There are many good exercises that are selected from different books.

I: Let us see the exercises on page 4? How do you see them?

R: Here, especially exercise number 4 and number 5 are difficult. They are vague. There is no given mathematical concept or examples which are related to these exercises.

I: What do you think the solution in order for students to have clear understanding about these exercises?

R: There should be an inclusion of the concepts of: transitivity, symmetry and reflex. These concepts are missed from the chapter.

I: How do you see the exercises on page 47?

R: I want to focus on the exercises from number 8 to 11. Number 8 explains the expression of different variables. Students have a problem in understanding this concept. It would be easy if we start with single

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variables. What I mean is, if

f(x) = 3x+2, we have to start with evaluating f(h),
then we proceed to find f(x+h), rather than jumping to
evaluate function of several variables. While others
are compatible.

I: In question number 10:

       if x>0; f(x) = 2x+1 and g(x) = x²;

       find $\sqrt{(f+g)(x)} - \sqrt{g(x)}$.

       if the domain is not given what will be the result?

R: This will lead us to the concept of absolute value,
       hence there should be a topic that explains the concept
       of absolute value.

I: How do you see the exercises on page 308?

R: These exercises are beyond the capacity of students.
       Especially questions number 4 and number 6 are advanced
       course questions. The concept is complex at this level.
       In my opinion it is better to exclude from the
       curriculum.

I: How do you see the exercises on page 314?

R: All the questions are good and they are compatible.
       But, there is a mathematical incorrectness. Especially
       in exercises number 7, there are incorrect questions.
       Now I am not in a position to identify them, I will
       tell you latter after I check them.

I: How do you evaluate the exercises of question number 3
       and 4?

R: These questions explain the concept of increasing and
       decreasing functions. In my opinion it would be better
       if we first express the equations by integers instead
       of decimals and variables. Otherwise they are good

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exercises.

On page 47 (on the first chapter) some exercises are placed out of their topics. For instance, questions number 4, number 5 and number 9 belong to exponential functions, and question number 11 belongs to rational function. If they were in their proper places it would have been easy for students to cope the concepts and the exercises would be productive.

I: How do you evaluate the word problems on the algebra section of the textbook?

R: The word problems are the applied ones. They motivate students to relate mathematics to real situation and the concept of algebra to different field of study. However, the problems in chapter 2 are difficult. Especially, on page 114 question number 20 have no relation with the examples that are stated to introduce to the problems.

I: What do you think the way that problems can be made compatible?

R: Well, now I can't say something about it, but I will think and I will tell you latter.

I: We have discussed a lot about the algebra section of grade ten mathematics textbook, from your experience how can the textbook be accessible to the students?

R: As I have told you, the textbook should motivate the students by starting the topics from the real situation. After stating theorems and definitions there should be an appropriate examples that clarify the concepts, and have to be followed by selected exercises that develop the students' mathematical ability. As far as possible, the examples and exercises should be

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practical application of the theoretical concepts of the topics.

I: What other comments do you have?

R: I don't have other comments, excuse me I do have a class. If I get any additional comment I will inform you.

I: Thank you, see you on Sunday at 10:00 a.m.

R: Ok.

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SUMMARY OF THE TRANSCRIPTION

Background of T_1

Teacher-1 is a qualified mathematics teacher. He is graduate of B.Sc. Degree in mathematics from Asmara University in 1984.

Responses to the questions

1. Response for question number-1

What problems do you face when you teach mathematics in grade-10?

The respondent said that even though the students in grade ten have base in their previous grades since the mathematical concepts of the contents are advanced and have depth than before, for the first three weeks there are some problems with the students following my explanation.

2. Response for question number-2.

What are the resources that you are using in teaching the algebra part of the textbook?

The respondent mentioned that the textbook is the main source of information in teaching and learning process. However, he also uses other books for the following reasons:

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- to have more clarification about the concepts in the topics.

- to add other related concepts to the content of the textbook if necessary.

- to see for more applied and related, examples and exercises that can help students to cope the concept easily.

- to get different exercises and examples that enable the students to develop their mathematical skill.

3. Response for question number-3.

In the algebra section of the textbook the topics are:
- **Relation and function,**
- **Rational function,**
- **Sequence and Series, and**
- **Exponential and Logarithm function.**
  How far are they relevant?

The respondent said that the theoretical concept of algebra in grade ten mathematics is relevant. The focus of the chapters is on the concept of functions. Function is a core in algebra and in other subjects that have mathematical applications (algebraic application) such as: in physics to express motion as a function of time, in chemistry to express the relationship of elements in a compound, in our daily life to analyze things as a function of money, and so

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on. The topics are also base for further studies.

However, the content of the topics lacks practical application. They are stated in a theoretical manner. The theoretical concepts of relation and function are not related with our actual activities, such as: the relation of families, the relation of commodities and products, as well as other application in other field of study.

4. Response for question number-4.

In the textbook the sequence of the algebra section is:
- **Relation and function,**
- **Rational function,**
- **Sequence and Series, and**
- **Exponential and Logarithm function.**
  How do you see it?

The respondent is not happy with the sequence of the topics. He suggested that the topic of Sequence and Series to be taught after the topic of Exponential and Logarithmic function. This is due to:

- the concepts of Sequence and Series are more advanced than the concepts of Exponential and Logarithmic function. Hence, students first have to learn the simple concepts then the advanced ones.

- the concepts of Exponential and logarithmic function are more applied in the topic of Sequence

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and Series, such as in geometric progression.

- there is coherence (flow of ideas) between the concepts of Rational function, and Exponential and Logarithmic function. These are:

  - in describing the domain and range of the functions,
  - in analyzing the graphs. That is, applying the concept of intercepts, asymptotes and behavior of the graphs, and
  - in construction the graphs.

5. Response for question number-5.

The sequence of the sub-topics within the topics in the textbook is:
   -algebraic expression,
   - mathematical equations,
   - functions and graphs, and
   -mathematical application.
While in this (other book) South African standard - 7
   mathematics textbook the sequence is:
                 - situational problems,
                 - functions and graphs,
                 - mathematical equations, and
                 - algebraic expression
       How do you see this?

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The respondent liked the sequence in South African standard -7 mathematics textbooks. He argue that:

- to start with situational problems motivate students to learn and apply mathematical concepts.

- most mathematical expressions are abstract. There is a problem to realize and to apply in solving real world problems.

- it is easy for students to understand theoretical concepts if it was started from real situations (tangible things and useable concepts). Then the mathematical expression will be applied in more practical ways.

- to start from the real situation make mathematical concepts more relevant right at the beginning, and also becomes the base for further applications.

6. Response for question number - 6.

How do you see the mathematical content of the topics? Are they appropriate?

The response was as follows. The mathematical contents in the topics are difficult and some are presented in difficult ways. Moreover, the following comments are pointed out:

- there are sub-topics whose concepts are beyond the capacity of the students, such as *sigma notation*

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for a series and harmonic progression. The content
of sigma notation for a series is embedded with
proofs and difficult theoretical formulas in which
students cannot cope at this level.

- the topic of *Relation and function* is prepared in
  a solid theoretical way rather than preparing in
  easy and applied form.

- the sub -topic of *Harmonic progression* has no
  relevance with the grade level. Its objective is
  not clear. It is also incompatible (there is a
  difficulty on understanding the concepts).

- the sub - topics of *Rational inequalities* need the
  concept of set theory as a back ground, but there
  is no topic that discussed the concepts of a set
  in a secondary curriculum. In addition, in order
  to have a flow of ideas, the concepts of quadratic
  inequalities are needed as an introduction in the
  topic.

7. Response for question number - 7.

**How do you see the examples in the topics? Are they
sufficient?**

The respondent informed that there are no sufficient
examples. He points out that:

- there are unclear examples which do not motivate the students to work the followed exercises. For example: on page - 2, the examples of Cartesian product are vague, and on page - 49 the graphical illustration of example number-3 is not clear. It is difficult to relate with the theoretical parts.

- the topic of exponential and logarithmic function has no example for the exercises. This creates difficulty to the students when they want to work independent of their teacher. It also creates incoherence among teachers when they use their own examples, and can lead students to confusion.

8. Response for question number - 8.

How do you see the exercises on the topics? Are they sufficient and satisfactorily arranged?

The respondent witnessed that there are sufficient exercises in each topic of the textbook. However, in some part of the topics they are not satisfactorily arranged.

- some exercises are out of the topics and they have no backward linkage with the secondary or elementary curriculum. For example, on page 5 exercises number - 4 and 5 refers to the concepts of equivalent relations (transitivity, reflexive and symmetry). In addition, on page 47 exercise number-10 needs the concept of absolute value, and the topic is not in the secondary curriculum.

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exercise number-8 are not arranged as from simple to advanced concept. They have to start by single variable then have to proceed to several variables.

- some of the exercises are given ahead of the topics in which they are expected to be placed. For example, on page 47 exercises number 4, 5 and 9 are belong to exponential function. In addition, exercises number-11 is an exercise of rational function, but these are placed in the first chapter-*Relation and Function*. If they are in their proper places they would be more appropriate and become productive.

- there are also exercises beyond the capacity of the students, such as the exercises of sigma notation for a series. On page 308 exercises number 11-20, all are proofs and demand to show the relationship between the properties. On page 293, exercises number 4 and 6 are also beyond the capacity of students.

9. Response for question number - 9.

I: How do you evaluate the word problems of the topics?

The respondent stressed that the word problems of the topics are more important ones.

- they are an introduction to the practical

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application of algebra.

- they motivate students to relate mathematics with a real situation.

- they help to apply the concepts of algebra in different fields of study.

However, exercise number-20 on page 114 is not clear and have no relation with the concept of the topic.

10. Response for question number - 10.

We have discased a lot on the algebra part of the grade ten mathematics textbook. From your experience how can the textbook be accessible to the student?.

The respondent suggests that:

- textbooks should motivate students by starting the topics from the real situational concepts.

- after stating theorems and definitions there should be appropriate examples that clarify the concepts. This has to be followed by selected exercises which can help to develop students' mathematical ability.

- as far as possible, the examples and exercises should be practical application of the theoretical concepts of the topics.

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