TOPIC: TOWARDS AN EXPLANATION FOR LOW MATHEMATICS UPTAKE AT ADVANCED LEVEL.

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APPROVAL FORM

TOWARDS AN EXPLANATION FOR LOW MATHEMATICS UPTAKE AT ADVANCED LEVEL

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DEDICATION

This project is dedicated to my loving husband Robert, my sons Sudden and Tawananyasha and my daughters Lucy, Chido and Rufaro. This is for you all. You taught me to persevere and to be patient
ABSTRACT

The study was conducted in order to find an explanation for low mathematics uptake at Advanced Level. The study specifically sought to establish the challenges to low uptake of mathematics by students at Advanced level and to find possible intervention strategies to improve the uptake of mathematics at that level. In this research, schools which offer mathematics at Advanced level in Bikita district were selected at random. Selection was done using stratified random sampling in which schools were put in strata, selecting and non-selecting schools were put in different strata. From the selecting schools, two schools were selected and from the non-selecting, four schools were selected using simple random sampling thus obtaining six schools for the research. From the six schools, 274 Advanced level students and 6 Heads of mathematics department were chosen using simple random sampling. The main sources of data were a questionnaire which was administered to the 274 students and the interview schedule to the 6 Heads of the mathematics department. The researcher sought permission from the district Head of Education and from Heads of the schools before carrying out the research. The study found that among the challenges to low uptake of mathematics at Advanced level, was lack of teaching and learning and resources, influence from peers and parents, poor teaching methods and lack of subject combinations with mathematics at some schools. To these challenges, Heads of department added that students lack guidance on importance of including mathematics in their combinations. Students and Heads of mathematics department suggested, as one of the intervention strategies, that schools are to source essential resources for uptake of mathematics to improve. The study recommended that the Ministry of Primary and Secondary Education should focus on career guidance to enlighten students about the career opportunities which Mathematics opens up for them, as a way of encouraging more students to take up the subject. Furthermore, the study recommended teachers to vary teaching methods and make the learning of mathematics exciting in order to lure more students to study mathematics.
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CHAPTER ONE
INTRODUCTION

This study focuses towards an explanation for low mathematics uptake at advanced level. This chapter will present the background to the study, give the statement of the problem, purpose of the study, define research objectives and questions and explain the significance of the study. Assumptions, delimitations and limitations of the study would also be considered. Key terms to be used in the study will be defined in this chapter.

1.2 Background

Mathematics is seen by society as the foundation of scientific and technological knowledge that is vital in social-economic development of the nation. Because of this, Mathematics is a compulsory subject at both primary and secondary levels in Zimbabwe. Mathematics is also a basic entry requirement into any prestigious courses such as medicine, architecture and engineering among other degree programmes. Despite the important role that mathematics plays in the society, there has been a low uptake of mathematics at Advanced Level.

Out of 32764 school candidates countrywide who attempted the Zimsec November 2015 examinations, 8202 or 25.03% wrote mathematics while 197 or 0.6 % wrote further Mathematics (Zimsec, 2016). Zimsec (2016) also reported that 72.18% of the candidates scored grade E or better meaning that 21.33% of the candidates graduated with pass in Advanced Level Mathematics. The Uptake of Mathematics pales in comparison with the most popular subject, English and Communication which was attempted by 50.86 % of the school candidates and passed by 99.99 % of the candidates (Zimsec 2016).

The number of school candidates who graduated with Mathematics was therefore less than 50% of the passes for the most common subject. The uptake of mathematics among Zimbabwean students is much lower than in Singapore which is one the world’s emerging economies and had 53.21% of the Advanced Level candidates attempting Mathematics in 2015 and 97.3% of them passing the subject (OECD, 2016). In the UK 34.42% of the candidates attempted Advanced Level Mathematics in 2015 with a pass rate of 97.2% (UK Education Dept, 2016)

After observing that the percentage of population which graduated with Science, Technology, Engineering and Mathematics qualifications in Zimbabwe’s tertiary system is low, the
government has since launched a programme which promotes Advanced level students to study Science, Technology, Engineering and Mathematics (STEM) subjects by paying their tuition fees (Nnadozie, 2016). This move to improve the uptake of Mathematics and Science subjects is a complementary move to efforts which were already being made at class room and school level to encourage students to further their Mathematics studies. The policy of Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) attaches importance to the promotion of Science and Mathematics education on the bases that as it is considered a pillar to beneficiation and value addition to natural resources (ZIMASSET, 2013). An increased uptake of Advanced Level Mathematics would therefore be a significant contribution to the national development agenda. This study sought to give an explanation for low Mathematics uptake at Advanced Level.

1.3 Statement of the problem

An effort to increase the uptake of Mathematics by Advanced Level students have been on the agenda for years and has been boosted by the STEM scheme under which students are sponsored. Despite such efforts the uptake of mathematics at Advanced Level remains pathetically and disturbingly low. This study, therefore, attempts to give an explanation of low mathematics uptake at Advanced Level, challenges associated with the low uptake of mathematics at Advanced level and interventions to overcome the challenges.

1.4 Purpose of the study

This study was meant to give an explanation for low Mathematics uptake by students as they progress from Ordinary to Advanced Level. The study also investigated Mathematics teachers and Heads of Mathematics Department (HODs) citing challenges and school interventions to reduce or overcome the challenges encountered.

1.5 Research questions

This study problem was addressed through the following research questions:

1. What are the challenges contributing to students’low mathematics uptake at Advanced level?
2. What are the possible interventions strategies to overcome the challenges so as to improve the uptake of Advanced level mathematics?
1.6 Research objectives

The research sought

- To establish challenges that lead to low mathematics uptake at Advanced level.
- To determine possible interventions measures that can be taken towards improving the uptake of mathematics at Advanced level thereby giving an explanation for low mathematics at Advanced level.

1.7 Assumptions of the study

The research was based on the assumption that:

- Mathematics students and Heads of department (HODs) of schools who were interviewed, gave their true views.
- The Headmasters of sampled schools would permit the researcher to carry out the study.
- All information collected during the study was not biased.
- Mathematics students in Zimbabwe are learning in a homogeneous environment where they are subject to same external factors and also can benefit from the same opportunities

1.8 Significance of the study

The findings of this study,

(i) Would identify challenges or barriers to uptake of mathematics at Advanced level.
(ii) Would provide insights on how to improve the uptake of mathematics at Advanced level.
(iii) Would help identify interventions to overcome the challenges and improve uptake of mathematics at Advanced level.
(iv) Would help departments of education and school management teams of high schools to come up with strategies which may be taken to improve the uptake of mathematics at Advanced level.
(v) Would help the Ministry of Primary and Secondary to find ways of incentivising students who opt to study mathematics at Advanced level.
(vi) Would assist school administrators on selection of students who qualify to take up the subject at Advanced level.

(vii) Would help parents to understand the importance of mathematics for their children thereby encouraging those who would have passed mathematics at Ordinary level to continue or take the subject at Advanced level.

1.9 Limitations

The following aspects may limit the researcher to execute the research effectively:

- Heads of mathematics department may be suspicious of the researcher and fail to give detailed information of their schools for fear of victimisation or may exaggerate some information for prestige which may compromise the researcher’s results.
- Heads of department may fail to cooperate for reasons, such as jealousy, too much work at work places or ignorance on importance of researches and give inadequate information.
- Students may rush through questions and give wrong answers or leaving questions unanswered or write meaningless answers since most do not know the importance of research to the researcher and for them.
- On the questionnaire, if questions are ambiguous to them, students usually do not time to think seriously about solutions, they simply write what immediately come in their mind and write it, thus, again compromising results of the research.
- The researcher suggested that both qualitative and quantitative representation would be used but some results obtained may be difficult or impossible to represent using quantitative methods thus the researcher will resort to use more of qualitative than quantitative.
- The researcher is a full time teacher at Chirumba High and part-time student at Bindura University of Science Education, meaning to say the researcher may be affected by work and fail to get time to carry out the research more effectively.
1.10 Delimitations of the study

The study was focused on Advanced level students from six high schools of Bikita district, Masvingo province in Zimbabwe. Of interest also, were Heads of Mathematics Department from the same six schools of Bikita district. The study was conducted from the 1st of January 2017 to 30th of June 2017.

1.11 Definition of terms

Explanation-according to Cambridge dictionary, explanation is the details or reasons that someone gives to make something clear or easy to understand. In this research, the word explanation shall mean to make clear by explain what may lead to low uptake of mathematics at Advanced level and also to try and give solutions to those challenges.

Uptake-according to Cambridge dictionary, uptake is the rate or act of accepting something. In this study, uptake will be used as selecting a subject from a list of subjects on offer.

Mathematics-According to Jeffrey et al, (2013) Mathematics is a systematic treatment of magnitude relationships between figures and forms and relationship between quantities expressed symbolically. Cambridge dictionary defined it as the study of numbers, shapes and space using reason and usually system of symbols and rules for organizing them. In this study, mathematics is one of the subjects on offer at Advanced level.

Advanced level-is a subject based qualification conferred as part of the general certificate of education. Is a school leaving qualification offered by the Education bodies in Zimbabwe. It is a two year course after Ordinary level and is a requirement for university entrance. (Cambridge dictionary) In this study, Advanced level is a two year course after Ordinary level in which 3 or more subjects are studied. These subjects may include mathematics or not.

Challenge- according to Cambridge English Dictionary means a situation of being faced with something that needs great mental or physical effort in order to be done successful and therefore it tests a person’s ability. In this study challenges will mean difficulties in the teaching and learning of mathematics.

Intervention- according to Webster, (1938), intervention is the act of inserting one thing between others, like a person try to help. In this study intervention will mean possible strategies or solutions put in place in trying to improve the uptake of mathematics.
Low—according to Harkin, (1986) low means below average in amount, extent or intensity. It is ranked near the beginning or bottom on some scale of measurement. In this study, low means having few number of students as compared to other subjects.

1.12 Summary

In conclusion, the background of the study focused on the importance of mathematics as it is a basic requirement into prestigious courses such as medicine, engineering and other degree programmes. The statement of the problem hammered on efforts to increase the uptake of mathematics at Advanced level and noted that despite these efforts the uptake of mathematics at Advanced level is still disturbingly low. The purpose of the study was put down as to find an explanation for low mathematics uptake at Advanced level by looking at challenges which lead to this low uptake of mathematics at Advanced level and then identifying interventions to overcome the challenges. The study problem was addressed through two questions: What are challenges with regards to students’ uptake of Advanced level mathematics? And what are the interventions to improve the uptake of mathematics at Advanced level? The significance of the study is mainly to help mathematics teachers, Heads of Department of mathematics, stake holders and even Ministry of Primary and Secondary Education to come up with what could be done to improve the uptake of mathematics at Advanced level. Also to help parents to understand the importance of mathematics to their children and encourage them to take mathematics at Advanced level if they pass the subject at Ordinary level. Assumptions, limitations and delimitations of the study have been stated and lastly definitions of terms have been given in the study for readers from any background to understand the study and its purpose to be clear to everyone.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews research literature related towards an explanation for low mathematics uptake at Advanced Level. The chapter focuses on literature associated with challenges to low uptake of mathematics at Advanced level and also on interventions to improve uptake of mathematics at this level. The literature review was based on a theoretical framework which was adopted for the study.

2.2 Theoretical Framework

According to Web (2012), a theoretical framework is a collection of interrelated concepts which is a guide to ones research. In this research the researcher would be guided by the motivational theory of education. The research on explanation for low mathematics uptake at Advanced level is based on Keller’s ARCS model of motivational design theories. According to John Keller’s ARSC model of motivational design theories, there are four steps for promoting and sustaining motivation in the learning process: Attention, Relevance, Confidence and Satisfaction. According to Keller, attention can be grabbed by active participation, variability, humour enquiry in congruity and conflict. This he said, students learn by hands on methods, varying learning styles, maintaining interest, use of visual stimuli and brainstorming activities. On relevance Keller suggested that relevance should be established to increase the learners’ motivation.

Keller established six strategies: Experience, Present worth future usefulness, needs matching, modelling and choice. The teacher has to explain to learners the present and future use of mathematics and as a teacher, ”be what you want them to be!” The teacher has to allow learners to use different methods to pursue their work. Keller suggested that the teacher should help students to understand their likelihood of success, help students to estimate their probability of success and allowing learners to fill some degree of control over their learning and assessment. Lastly on satisfaction Keller suggested that learning must be rewarding or satisfying. Teachers according to Keller have to make the learner feel as though the skill is
useful or beneficial to them. Also, the teacher has to provide feedback and reinforcement. He added that when learners appreciate the results they will be motivated to learn because satisfaction is based upon motivation which can be intrinsic or extrinsic. However, Keller discouraged teachers not to patronize the learner by over–rewarding easy tasks.

2.3 Challenges leading to low mathematics uptake

Over the years theories have been adopted that are related to specific issues, these theories encompass various psychological motivational theories such as cognitive theories of motivation, mathematics anxiety, theories of self-determination, goal theories of self personal construct and others. In trying to shed light on this study topic under discussion, numerous of these theories were used by the writer so that the subject under study can be easily understood. It is the writer’s submission that these theories were of great significance as they aid to explain challenges leading to low uptake of mathematics and interventions to improve the uptake at Advanced level. The current research suggests the low uptake is due to various factors that have some theoretical basis. The writer’s personal feelings are also cited in view of discussions by different authorities.

2.3.1 Social background

Ezewu (1989) argues that a child’s mental capabilities and emotional behaviours, as necessary ingredients for school education, are greatly influenced by the type of family an individual comes from. Many pupils tend to have a distaste of mathematics as it requires a lot of practice which they lack at home. Evans (2002) argues that emotional response of the students towards mathematics appears to be learnt through social interaction with family and community through use of negative adjectives about the subject. Civil (2003), postulates that some students come from families where both parents did not pass mathematics at any level. In such situations, pupils develop hatred of mathematics through lack of support and encouragement from parents. The reverse is true with families where parents and other siblings passed mathematics; the pupils will excel and take up mathematics due to family back up.

Cotgrove (1977), postulates that the socialising role of education can be negative as it functions to mould individuals to perform roles required by the dominant class and is
repressive. In other words, the dominant class sets the tone of the curriculum. Thus, dominant class children may perform better in mathematics due to exposure and they also know very well the uses of the subject in the life. Hence, they take mathematics at Advanced level whilst children from poor background or families may fail and hence dread the subject.

2.3.2.2 Attitudes of parents and society

Attitudes of parents and society towards mathematics could be a challenge to the uptake of mathematics by students at Advanced level. The community plays an important role in determining whether its children will be good to the subject or not. This, according to the interaction theories, human beings learn through interaction and emulation. It is the success of the members of the community that enhances the achievements of its pupils (Child D, 1989). Through motivation and support, like provision of school fees, guidance on employment opportunities and social praising; children will take up even a subject they consider to be challenging like mathematics. Pupils will work an extra mile because mathematics has proved to have a societal value and recognition, hence social mobility. This means the society plays an important role in encouraging their children to take up mathematics at Advanced Level.

Without encouragement from parents, children tend to shun the subject whilst some fear to fail mathematics, hence they do not take it at Advanced Level. It is the parents or society’s duty to give light to its children by explaining job opportunities associated with mathematics, these jobs include engineering, medicine, architecture and some high paying and prestigious jobs.

2.3.3 Parental involvement

Mathematics is a practical subject and require parents to purchase all material that the student wants to use like graph books, mathematical sets and calculators among others. This means that parents need to take part in creating a conducive environment for learning mathematics by buying personal textbooks for pupils, buying exercise books and encouraging educational tours (Arbanas, 1989). For Arbanas parents are involved in three ways which are: activities at home, working with their children’s class teacher and projects parental involvement aimed at cognitive development of the child.

Parents who fail to provide mathematical resources put children at a great disadvantage; hence their children will not perform well in mathematics thus failing to take mathematics at
Advanced Level. Parents need to supervise their children’s homework and studies if they mean serious business. Students need monitoring when they are at home, particularly after school and during weekends when doing homework and private studies. Parental involvement has long been identified as a contributory factor in enhancing student success at school in many ways. Parent involvement can be by way of monitoring reading activities at home, assisting child with homework or communicating with a child about learning experiences at school.

2.3.4 Lack of resources

Lack of resources can be a barrier or challenge to the uptake of mathematics at Advanced level. (Doves, 1986 quoted by Chivore, 1994) states that common sense suggests that teachers, however well educated and trained, are rendered less effective if schools lack basic resources for learning to take place. Chivore further observes that in Africa only 4% of the national revenue is spent on material while 96% is spent on salaries. This clearly shows that resources are never adequate for learning to effectively take place. The situation is even worse in rural areas where there is a shortage of classrooms, textbooks and even exercise books. Thus, from the writer’s point of view, the above theories simply imply that lack of essential resources can be a barrier or a challenge to the uptake of mathematics at Advanced level. It is very difficult for students to pass without adequate textbooks.

Some teachers lack teaching and learning resources and this affects the quality of teaching mathematics. Teachers who lack textbooks fail to plan effectively. Schools that lack library facilities and Wi-Fi fail because teachers and students cannot access information necessary for planning and for their homework respectively. Textbooks availed today have illustrations, exercises and examples which assist students’ understanding so their unavailability pose problems to students’ concept formation and development. It should be noted that the critical issue is not the mere presence of resources but how those resources are actually used in the classroom. It is argued that textbooks act as a source of content for both the teacher and the learner during the teaching process (Brunner, 1966). This implies that resources are very necessary for students to perform well in mathematics so that they take it at Advanced Level.

2.3.5 Teaching Methods

There is an argument that on issues of mathematics low uptake at Advanced Level, some researchers discovered that teachers are the source of problems due to the methods and
activities they use when teaching mathematics. Akinpelu (1981) argues that it is the method of teaching and the role of the teacher in the teaching process that enables pupils to uptake the subject. Thus, the uptake of mathematics has greatly exacerbated by the way in which it has been taught since long back. Teaching methods have relied on a behaviourist model of leaning, a paradigm which emphasises leaning by rote.

Sidhu (1995), argues that a part of the student’s apathy is a result of a teacher’s method of teaching which may result in their backwardness. The above authority suggests that students like newness and novelty. Besbridge and Jerman (1981), postulate that pupils tend to like the subject when they use short, easier and manageable methods, compared to long and tiresome methods which make them hate the subject. From the above statement, the study of mathematics carries a stigma which can only be eradicated by employing good teaching methods. Hence, teachers should always be prepaid to adjust their methods of teaching.

The free encyclopaedia May (2011), postulates that a good teacher does not hold rigidly to a single paradigm or set of assumptions but draws up multiple theories, styles or ideas to let pupils gain complementary insight into the student. Hence, it is how the teacher disseminates information that yields positive or negative results. Collaborated efforts amongst students result in a higher degree of accomplishment by all participants. Students help each other and in doing so, build a supportive community. This raises their performance level as well as their belief in their ability to do well in mathematics. (Barkley et al, 2005), discuss the use of team learning, in which students act as teaching assistance. The use of learning groups also contributes to the development of trust and cooperation amongst students as well as their instructors. Depree (1998), has found out that small group’s instructions significantly increase mathematics confidence for historically underrepresented groups such as female students. In the writers’ view, team work improves attainment in mathematics. Students need different voices to grasp concepts. Concepts become clear when explained by their counterparts. Students will enjoy the subject and this will result in an improvement in the uptake of mathematics at Advanced Level.

Writings such as journals, error analysis and students’ developed word problems can also enhance learning in mathematics; it can improve students understanding of mathematics as well as their attitude and beliefs about mathematics. Research reviews that it is an effective strategy for minority students, for example, students learning with disabilities (Loud, 1999, Pugalee, 1997). However as (Meiser and Rachel, 1998), pointed out that, students writing
assignments must be carefully designed in order to successfully foster students’ learning and engagement. Without a connection to the class material, a writing assignment will be less engaging to students and unlikely to increase students’ understanding or attitudes towards mathematics.

Teachers often prefer using authoritarian methodology or the didactic pedagogy procedures in which the learners are viewed as receptive repositories eagerly waiting the deposits of experts. Such methodologies reduce the learner’s status to a mere guest in the learning process. This type of learning is devoid of critical thinking, alienates the learner and subjects him/her to untold boredom and anxiety. The fact that mathematics is a practical subject is often disregarded in preference for the less effective traditional pedagogical methods such as lecturing. Students are made to gallop from one concept to another without being actively engaged in the construction of mathematical ideas. When students fail to grasp the basic ideas, they naturally become frustrated.

As mathematics teaching changes across the world, faculties teaching mathematics courses must rethink both what should be taught and how it should be taught (Mathematical association of America, 2010). The implication of this statement affects recruitment and hiring, professional development and curriculum review and revision in the area of mathematics. Many educators are highly qualified in the discipline of mathematics; however, they have limited course work or formal training in the discipline of mathematics, college teaching, student learning or application of varied teaching strategies. These may teach outdated information and thus resulting in low passes at Ordinary Level and low uptake of mathematics at Advanced Level. These strategies and varied teaching methods are meant to make mathematics exciting, thus luring students to take mathematics at Advanced Level.

### 2.2.6 Curriculum issues in mathematics

Sidhu (1995) says the philosophy of life has changed and consequently the philosophy of education has also undergone a revolution. Thus, the curriculum issues in mathematics should be organised in light of these changes. The curriculum that suited a few years ago is not necessarily capable of satisfying our present needs. Curriculum issues in mathematics may cause maths phobia because of the unrevised matter in line with present changes, for example, e-leaning which will enable pupils in solving mathematical problems globally.
Zimbabwe mathematics is regarded as one of the core subjects. It is also a prerequisite subject for entry into professions such as teaching, engineering, medicine and other professions. Teachers have zealously responded to this requirement by over teaching the subject on the expense of other subjects on the Zimbabwean curriculum. Over learning the subject has in some instances created anti- mathematics feelings or anxiety experiences amongst the learners thereby leading to low mathematics uptake at Advanced level.

2.3.7 Self-efficacy, anxiety and lack of confidence

Research supports the relationship between attitudes towards mathematics and achievements in mathematics. Ma and Xu (2004), found a reciprocal relationship between every attitudinal measure used in this study and mathematics achievement. This is a significant study contributing valuable information regarding the relationship between student’s attitude and achievement. In addition to the relationship between attitude towards mathematics and students’ success, research findings also reveal the impact of other effective factors including low self efficacy and confidence in ability to do mathematics, tests anxiety and mathematics anxiety (Bates 2007, Bonham 2008, Hall and Panton 2005, Higbee and Thomas 1999, Rodriguez 2002, Tobias 1993). These effective variables can be challenges to students’ success and have a negative and inhibitory impact on learning and performance in Mathematics (Decorte et al 2008).

Self –efficacy, which is one’s ability to succeed in specific situations, if it is low in a student, can be a big challenge for someone to take mathematics at Advanced Level. Mathematics anxiety, one’s fear for mathematics is another challenge which leads to most students failing to take up mathematics at Advanced level. (Perry, 2004), suggested that anxiety subsists even in some grown up persons, for example, teachers are controlled by people’s thinking or beliefs. This anxiety maybe caused by fear emanating from the real incidents of failure and inadequacy (Perry, 2004). It is also connected to emotional factors which include anger, tension, guilty and dislike as suggested by (Cockroft, 1982 cited by Ernest, 2002). Mathematics anxiety can affect student’s mathematical performance by upsetting the memory of a student as well as causing the student to be nervous and failing to concentrate.

The above authorities are relevant to the current study as these factors maybe affecting students to take up mathematics at Advanced Level and help teachers to come up with copying strategies and to take measures to encourage students not to avoid mathematics where possible. An effective way to reduce mathematics anxiety is to create a safe learning
environment in which students feel comfortable expressing themselves without fear or ridicule. Use of the following strategies can foster a safe environment and create a sense of belongingness, discuss classroom etiquette, use ice breaks or group warm-up activities, teach relaxation techniques and use effective assessment instruments to help students understand their attitude towards learning (Boylan, 2008). From the writer’s point of view, this is a rich area of information for educators designing mathematics courses and should be definitely not ignored by anyone attempting to improve student’s uptake of mathematics at Advanced level.

Lack of confidence can also emanate from the belief that mathematics is difficult and cannot be taken further than Ordinary Level. The growth of this myth results in pupils not putting maximum efforts in their work, failing to master concepts and getting low symbols in mathematics.

Student’s faculty and support staff need to understand the influence of these effective factors on students’ success and retention in mathematics. These should be familiar with and employ strategies to help and alleviate mathematics anxiety, raise self-efficacy in students and build self-confidence and maximise students’ uptake of mathematics at Advanced Level.

2.3.8 Professional Development

Educators are encouraged to attend mathematics workshops and conferences like those held at Bindura University of Science Education (BUSE). Those who participate in such activities are encouraged to share what they would have learned with their colleagues in formal and informal settings. It is important to realise that sustained and intensive series of professional development activities are much more effective than “one-shot” professional development workshops (Boylan, 2002). From the writer’s point of view, that is why government in collaboration with UNICEF have engaged on a programme to help educators to develop professionally by paying their tuition fees. Those with first degrees, like the writer, were to take on masters’ degrees, those with diplomas and certificates were to take up first degrees and those without professional qualifications were to take them up at different universities around the countries. By so doing, the problem of shortage of science and mathematics advanced teachers was reduced. Some teachers have long been from college and never attended some kind of in-service training.

Over and above pre-service training, there must be provision for in-service training, for the constant up-dating of professional knowledge (Gagne, 1974). Brain is like a slate and if not
sharpened, it rotes and decays totally, therefore, teachers need in-service and staff development to keep updated with current information and be able to disseminate it to students. Moreover, teachers should be involved in the marking of public examination. This provides the teacher with a skill on how to set tests and marking skill. Students given proper practice of likely examination questions are likely to perform well in those examinations. Also, teachers can identify topics that are continuously and frequently set and teach them effectively such that students will do very well in those topics of mathematics, thus improving students’ performance at Ordinary Level and increasing the uptake of mathematics at Advanced Level.

2.3.9 Lack of Motivation

Lack of motivation, either from within the students (intrinsic) or from the teacher (extrinsic) can be a challenge for uptake of mathematics at Advanced Level. The cognitive theory of motivation is premised upon three aspects; self determination, competence and need to seek and conquer favourable challenges accordingly, facilitate logic of self determination and alleged competency. It is important to note that the extent to which a person is intrinsically motivated in a certain situation is influenced by the mentioned aspects. Self determination denotes sense of acts that are based on choice as opposed to choices that are driven by the coercion or obligations. According to Gagne and Deci (2005), inert motivation can be described as the propensity to examine a person’s external world. It is the interest and curiosity that encourages persons to engage in a certain activity even without external influence.

The importance of intrinsic motivation is that it drives or influences students to engage in the learning process on their own evolution free from external influence. This means that students engage in mathematics because they find joy in the subject and those students seek to learn from the complete joy of learning as supported by Bok, (2009). The students’ learning is usually influenced by the desire to achieve certain goals for example, mastering some mathematical concepts and formulas.

Furthermore intrinsic motivation is associated with students understanding of their proficient in mathematics as they are inspired by inquisitiveness or by grades and to whether their orientation towards educational accomplishment can be characterised as a mastering orientation. Intrinsic motivation from the other angle seems to be only more or less related with these variables as said by Gottfried Fleming, (2001).
There is also extrinsic motivation which refers to people’s adoption and responses to socially given demands, patterns of behaviour and limits. These encompass the behaviour to gain something, shun threat and get some acknowledgement by other people or match to certain values. Walker, Greene and Mansel (2006) have the assumption that supports the view that those students who are influenced by extrinsic motivation slot in academic activities to attain rewards, for example better grades, endorsements or to invadepunishment for poor grades. Such students’ motivations have a propensity to be focused on such performance achievements as attaining positive judgements of their proficiency from parents, teachers, peers or evading depressing judgement of their performances.

It is generally acceptable that when individuals slot in activities which they are motivated intrinsically, they have the propensity to display a number of pedagogically attractive behaviours which includes, amplified time on a task, perseverance or determination in the time of failure, more planned processing and monitoring of understanding, assortment of more complicated task, greater inventiveness and risk taking, selection of deeper and of more efficiency performance and learning strategies and choice of activity in the absence of extrinsic rewards, Lapper (1998) as cited by Alderman, (2013). This theory is applicable to this study because it helps teachers to identify ways of motivating and enhance student performance in mathematics.

Furthermore, on motivation, behavioural theories of motivation postulate that motivation is regarded as encouragement for performing certain behaviour. These theories focus on the prospective variation between an individual’s perceived necessity for success and perceived necessity for avoiding failure. The theories show that success in mathematics is a dominant influence on the inspiration to achieve. Students recognise success as important, they will take on mathematics if they anticipate being successful. More so, students will not take mathematics for the sake of doing it but they will be inclined to take pleasure in doing mathematics, which they have a reasonably high prospect of accomplishing as opposed to activities for which the possibility of success is very low, (Dickinson and Butty, 1989 cited by McCarty et al, 2001). Even though success may not be the only important factor to task behaviour, it is clearly connected to the attainment of enthusiasm of students in mathematics. More crucial way of achieving success in classroom is through incentives to boost motivation amongst students. It is important to note that when students are provided with incentives to achieve, the motivation and achievement of the entire class can be changed.
2.3.9 Personal Construct Theory

Snow, Corno and Jackson (1996), cited by Fulmer and Frijters (2009), suggested that personal construct theories are ideographic approaches that seek to determine individual differences in terms of their thinking. These theories are based on the fact that individuals build knowledge to foretell outcomes of certain activities. The reason for adopting the personal –construct model in study of motivation is to draw construct schemes of individual in order to expose the way they assess certain activities. The descriptive in this case serves to map the connection between constructs in order to determine the cognitive composition behind motivation. Personal-construct is concerned with the processes as opposed to the study of motivation that is typically premised upon the end results of motivational processes, for example the ability attribution achievement.

The theorists believe that motivation emanates from rational cognitive processes and they provided mode of appreciation of these processes, for example personal construct was used by Owens (1987) to illustrate two teachers’ approaches towards mathematics and mathematics teachings. The approach, although the teachers’ conceptions of their mathematics background were remarkably similar and although they tended to rate themselves as most similar to the person they considered their “best” mathematics teacher, their concepts of what makes a good teacher differ markedly. The teacher who felt that more difficult mathematics was enjoyable also felt that inquisitiveness was a desirable trait for a mathematics teacher. Owen concluded that their constructs about mathematics and mathematics education play a powerful role in determining how teachers anticipate their students’ interest. From the writer’s point of view, the teacher’s conception towards mathematics and the teaching of mathematics may be a challenge to the students’ uptake of mathematics at Advanced Level.

2.3.10 Rewarding performance

Generally, when students are rewarded for performing better in mathematics, they have a tendency to enjoy mathematics further and achieve it better unlike when they are not provided with rewards. These incentives can be provided in groups or individually to motivate them to accomplish their tasks due to the fact that group or individual’s scores are rewarded. Students who are stimulated to assist others are pressured to learn well themselves. Whereas the idea of rewarding success can improve the uptake of mathematics at Advanced Level, the
concept of reward to increase motivation to students has been criticised concerning its hidden cost of reward (Lepper and Greene, 2015).

It has been argued that rewards weaken or prejudice the intrinsically motivating activity because rewards will influence or drive the behaviour of students and it would be the reason why students disengage mathematics activity. Therefore, rewards have particular side effects of diminishing subsequent intrinsic motivation. Students will not perform very well in the absence of rewards and there is likelihood that students will not engage in mathematical activities in future. Some scholars like Lepper (2015), suggest that when rewards are employed to get hold of someone to slot in some activity, the prospects of subsequent disillusionment with the activity increases considerably.

2.3.11 Lack of Encouragement from Teachers

Goldhaber and Brewer (2000), alludes that teachers were at the forefront of advising on careers and subject selection. This means that teachers in their lessons should keep on saying “mathematics would open up your opportunities, it is an all year round subject and it goes with everything”, thus, teachers have influential sixth form pastoral roles which they use to promote mathematics as a companion subject. Teachers should emphasise the value of statistics for its connection to social and life sciences. Students visiting college and considering science and technology should be guided in preliminary interviews to take mathematics within these pathways. Such guidance was seen as making mathematics more attractive to widen range of students.

Teachers in their lessons should aim to inspire interest and show that “like anyone can do”. Furthermore, teachers should eradicate the myth that maths is a very difficult subject and is only for few students who are good enough to mathematically adept. It is believed that mathematics is for intelligent students only. Teachers, parents and the media as well indoctrinated children into believing that mathematics is in born and therefore a preserve of the few. On the contrary mathematics is a human trait possessed by the entire race. Hence everyone has the capacity to understand mathematical concepts provided he or she is given ample time to reach the expected criterion.

2.3.12 Gender Differences

Mathematics is linked to hard sciences like physics and chemistry which are perceived as boys’ subjects while food and nutrition, fashion and fabrics are considered female subjects.
The most common pairings of Advanced Level with mathematics are chemistry, physics and biology (Hillman, 2014) and girls are much less likely than boys to take physics almost as likely to take chemistry and more likely to biology. Girls are more likely to take non-science subjects with mathematics following their balanced GCSE (Bell, Malacova and Shannon 2003). Families with low science capital do not have the network of support that is needed to sustain girls’ engagement in mathematics and science careers.

Teachers should provide examples in mathematics that relate to range of STEM careers including architecture, veterinary sciences, health caring and business and teachers should explain their relevance. Schools have an important role to play in building networks of information for families about the diverse ways in which girls are using the mathematics they learnt in school. Haralambos and Holborn (1990) say that the child’s self concept is affected by manipulation, that is male and females are exposed to different activities. Thus girls are given dolls, soft toys and miniature domestic objects and appliances to play with while boys are given toys like cars, aeroplanes and others which encourage more practical and logical reasoning. So when it comes to classroom situation, males will perform better in mathematics, while girls will shun the subject.

Research has also shown that less girls than boys take up mathematics at Advanced Level. Parents and teachers also share the belief that girls are too weak to do mathematics. A study by Gordon (1995) in core education high schools yielded the results that teachers regarded the girls as having lower mental capabilities than boys. A related study by Nanty and Poloke (2001), carried at the National University of Lesotho with a sample of 563 students reviewed amongst other things that mathematics achievement was significantly gender related. Although there is no conclusive evidence to suggest that mathematics is indeed male dominated, these stereotypic attitudes discourage girls from taking mathematics at Advanced Level. On the other hand such stereotypes empower boys to become more autonomous learners than females (Femmema and Peterson, 1985). The negative perception about girls’ inability to do mathematics destroy the girl-child self confidence.

Self confidence is absolutely important as it lease a positive significant correlation with mathematics achievement (Reyes, 1980). Most girls developed feelings of inadequacy that result in generalised feelings of incompetency that paralysed initiative and expectation of failure regarded as incompetent by teachers and boys. Poor achievement in mathematics by girls does not necessarily imply lack of potential on the part of the learner. Botson,
sprinthall et al (1998) also argue that boys score higher than girls in sciences like mathematics while girls generally retain a linguistic superiority throughout life. The authors claim that many females tend to fear mathematics as they go up the ladder. This is a true reflection even at tertiary institutions, where quite a number, before mathematics was compulsory, were enrolled without mathematics. Females are also disadvantaged by household chores hence they have little time for practice in homework and they cannot compete with their male counterparts.

Interventions to interest girls in mathematics should start in the early years of secondary school. Furthermore, interventions should address families as well as students and provide information and local contacts that help them feel knowledgeable and comfortable with steps to stem career. Also, students to be provided with clear messages and girls in particular, about the wide range of careers and degree courses for which Advanced level study of mathematics would be beneficial. Schools are to invite current or previous female advanced level students to speak to younger students about the importance of mathematics in their degree course or future employment both in stem and non stem fields. Moreover, there is need for the school to develop a school culture in which girls aspire to study mathematics at Advanced level.

2.3.13 Mathematics Abuse and Mathematics Language

Another challenge which may lead to low mathematics uptake at Advanced Level is the abuse from teachers, parents and peers faced by students during the learning of mathematics. Mathematics abuse may be defined as any negative experience uncounted with mathematics teachers, peers or parents while doing mathematics(Fror,2003). Statements such as, you are dull or you will never pass mathematics are common. Experiencesuch as this may arouse feelings of shame, frustrations, helplessness, failure and uncertainty.

Students who present problems are vied as ‘outsiders’ who at most have no right to be in the mathematics group. There is no consideration for remediation or adopting teaching methods that befit the learner. It is hardly surprising therefore those mathematicians are accused of stiff-nakedness due to their inability to dilute the content in order to achieve greater comprehensibility.

There is no doubt mathematics is taught by man of knowledge who possess authority in their field. There is a presumption by some such authorities that since the subject is simple for
them it is also simple for everyone. Many students end up contenting that they are not good enough for mathematics when in fact they are fading on wrong mathematical milieu. More to this the language is a language of mythology. Mathematical language has hidden and mystified meaning. Different mathematics jargon used makes the subject incomprehensible and incommunicable. To access these ideas one needs to understand the language.

Mathematics teachers had been accused of raw eclecticism (Elismbrgea 1998). They prefer to be abstract, thus mythologizing the subject hence the common belief that mathematics is shrouded in mystery. Some mathematics teachers content the weak students doing mathematics are in the wrong area and should therefore leave. Teachers who abuse learners by undressing them down for giving wrong answers create antagonistic environment that has a pernicious effect on the learning of mathematics. The effect that humiliations have is that those rebuked either reflect resentment or express fear.

Parents and teachers should stop pedalling philosophies that createmathematics phobias in students. Mathematics should be stripped off its mythical character. Teachers, parents and peers should not abuse standards during the learning of mathematics. Students should find joy in the learning of mathematics so that the uptake of maths at all levels is improved. According to Costello (1991) language plays a fundamental role in learning mathematics and success in the subject depends much on it. If communication breaks down, then no positive response is expected from work assigned.

Mathematics vocabulary confuses many pupils for example words like quotient, dividend and divisor make life uneasy to most pupils especially in lower classes. On logarithms of numbers, words like the characteristics for integral part and the mantissa for the decimal part of logarithms tend to confuse students. Orton (1987) supports the above points and says that there are additional problems when they particular words carry a mathematical meaning which is different from the usual everyday meaning. The author gave the word ‘relation’ which means a set of ordered pairs in mathematics, while in everyday life it refers to a member of the extended family: This puts students on horns of dilemma when they come across such terms in mathematics. Orton (1987) also talks about axes on the Cartesian plane as the horizontal and vertical. These, axis will later are ‘X and Y’ axis adding more confusion to those who dread mathematics. Axis in geography refers to the movement of the earth causing days and nights, which will cause confusion to a pupil doing mathematics. Generally, it is the teacher’s role to clarify issues so that pupils understand. Students tend to avoid certain
subjects such as mathematics because the image this subject has in contrast with other subjects. This is also influenced by the image that a relevant age group have of themselves. It is assumed that the general image of science subjects and students’ image are highly incompatible. Hannover, Kessels (2004), suggest that the acquisition of a self image, that is about oneself mould the personality and behaviour of an individual throughout one’s life span.

2.3.14 Prior Attainment in Mathematics

Noyes (2009), used database for a cohort of 41000 Advanced Level students and found out that prior attainment at Ordinary Level mathematics was the single and most significant predictor of continuing to Advanced Level. Eighty-two percent of students with an A in mathematics continued to Advanced level and beyond. This clearly indicates that when somebody passes mathematics at one level that one is compelled to take the subject to a higher level that is passing Ordinary Level would push somebody to take the subject at Advanced Level. Boys and girls achieve very similarly at Ordinary Level. Therefore, having a good examination results and enjoying mathematics make a difference to students choosing mathematics.

2.3.15 Self-Determination Theory

(Brohpsy, 2013), suggests that the self-determination theory points out that students become interested in school related activities usually when the activities are interesting and relevant to their lives and verify their competences. The perception mentioned above supports students’ perseverance in their studies. This means students may not know the relevance of mathematics in their lives and hence fail to take mathematics at Advanced Level. Some researchers suggest that another cause of low uptake in mathematics is that teachers do not make known to pupils the aims and purpose of learning mathematics which will help them to know where they will be going and where they will be coming from in as far as mathematics is concerned. Purposeless learning is not learning at all.

Teachers may help students to develop their motivation through provision of self sufficiency supportive classrooms which shape the children’s need for competence and self-determination. Also, there is need for career guidance to students so that they know subjects relevant for their careers.
It is argued that learners develop a positive attitude towards a subject when they see the need in doing it (Zimbri, 1999). In line with that thinking, Rogers (1969) abstracted a number of principles about learning. Of relevance to this study is the one which states that significant learning takes place when the subject matter is perceived by the student as having relevance for his/her own purpose when the individual has a goal he/she wishes to achieve and sees material presented to his/her relevant to the goal, learning takes place with rapidity.

Some students feel that mathematics is of no relevance to them because they are specialists in arts. This means that when students complete Ordinary Level, they already have career in mind and their choice of subjects at Advanced level will be directed towards the intended career. If their career has nothing to do with mathematics, they do not take it at Advanced Level. This is one of the challenges leading to low mathematics uptake at Advanced Level.

2.3.16 Self-to-prototype matching

(Hannover, Kessels, 2004), suggest that, the acquisition of a self-image that is the familiarity about one’s self, mould the personality and behaviour of an individual throughout the life span. It has a particular strong impact during the first two decades of life. As individuals move through childhood and adolescence, different self-related goals become salient in response to changing conditions, such as biological changes like puberty, achievement of different stages of cognitive development and social changes like entering high-school. As a result, the child or adolescent constantly acquires new self-knowledge as he or she incessantly engages in self-definition, with the process of self-definition being active and self-initiated (Ruble, 1994).

In the school context, in order to obtain new self-knowledge, students may choose to enter social situations in which they can express behaviours that they believe to be relevant to their actual or desired self-definition. In order to constantly adapt their self-image to a changing environment, they may also search for situations in which they can elicit self-verifying feedback with respect to the characteristics they ascribe or want to ascribe to themselves (Hannover, 1998 cited by Hannover, Kessels, 2004).

Consider the introduction of the new subject, physics, at high school as an example. As has been described in more detail in the work by (Ruble 1994 cited by Hannover, Kessels, 2004), in such a new psychological situation, the student concentrates on the defining features and
procedures of the new topic, thus actively gathering information in order to draw inferences about the topic’s applicability and relevance to the self. In other words, the student may focus on the relevance of the new subject, physics, to his or her self-definition and his or her liking for physics may vary according to the self-relevance attached to the new subject.

The self-to-prototype matching concept supports that object perception is structured around a typical, average or modal “best example”. Hannover, Kessels (2004), suggest that persons have prototype in their mind concerning them that is called self-prototype. Individuals also have prototype about others and as well as situations, the former one is called person prototype. (Hannover, Kessels, 2004) suggest that, prototype describes only an individual who is generally regarded as a representative of a group for example a students. (Setterlund et al (1993) as cited by Hannover, Kessels, 2004) suggests that students to make choices, options, and persons imagine the prototype individual would be available in each every option. The approach suggests that, people choose things which provide the best match between the prototype persons and self-prototype.

The approach is applicable to a school situation where students choose certain subjects, as they pursue a certain course or subject to enrol, students are anticipated to employ self-to-prototype matching. The approach can be used to predict certain behaviour of children, as they make choices in a free environment. Student’s choice on type of subjects is likely to be shared by the overlap between self-image and prototypical image. The strength of the overlap influences the individual’s approval of a course or a subject.

It has been noted that individuals in the extend they employ prototype matching. This is influenced by the fact that, sometimes people have their distinct image about themselves, for example, high clarity. (Campell, 1990 cited by Hannover, Kessels, 2004), suggest that individual differ in the degree to which the contents about them are defined in an unambiguous and convinced, temporary stable and internally consistent manner. This is useful to our context, only individual students who adequately have clear image of who they are, are expected to use self-to-prototype matching as a basis for their academic choices in school.

The other relevance to the study is that the assumption only refers to the situation where individuals have free and positive choices that are situations in which the persons can actively choose amid several options, however, persons can also desist from entering any of the available circumstances. Usually persons choose among a set of positive options, preferring
arts subjects over science subjects. It is common that in other schools the choice of students can be limited by the fact that there are limited options and students do not have choices. It is also common to find schools where students do not have options. In most situations students do not have choices. In those circumstances, students have to do arts or they have to do commercial subjects with or without mathematics because there are no other choices available.

Figure 2.1: Combination of theories on challenges and intervention theories

Figure 2.1 shows that a combination of theories on challenges to low uptake of mathematics at Advanced level and theories on interventions to improve the uptake at Advanced level will lead towards an explanation of low mathematics at Advanced level.
2.21 Conclusion

In conclusion, a theoretical framework for the research study was identified and the theories mentioned above reviewed the position of the institution of knowledge pertaining to challenges to the uptake of mathematics at Advanced level. The theorists have hammered on the following challenges: perception of teachers, parents and students on mathematics, mathematics anxiety and value of mathematics, self-esteem, attitudes towards mathematics, mathematics abuse, mathematics jargon and other challenges. The theories indicate that parents and teachers’ attitudes and beliefs towards mathematics can affect the uptake of mathematics either positively or negatively. If the teachers, parents and the community support their children by giving their children required resources and education, more students will take up mathematics at Advanced level. Furthermore, the theories indicate that mathematics anxiety and abuse should be eradicated, self confidence should be cultivated in students and also motivation should be maximised so that students take up mathematics. The chapter also indicated some interventions such as allowing students to learn mathematics actively, autonomously and practically so that students get involved in the construction of mathematical ideas.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The proceeding chapter reviewed some of the pertinent findings towards an explanation for low mathematics uptake at advanced level. This chapter focuses on describing and justifying the methods used for selecting the most appropriate research design for the problem and emphasis will be on the most suitable data collection techniques and data analysis plan to employ.

3.2 Research Design

According to Wampold et al (1992), Research design is a basic tool the researcher uses in order to conduct the research. Creswell (2009), indicates that research design are plans and procedures for research that span the decision from broad assumptions to detailed methods of data collection and analysis. He further highlighted that is the plan or proposal to contact research and it involves the intersection of philosophy, strategies of inquiry and specific methods. He indicates that decisions about choice of a design is further influenced by the research problem or issue being studied, the personal experiences of the researcher and audience for whom the researcher writes.

Devos (2001), quotes research design as ‘blueprint’ or detailed plan for how research study is to be conducted. Bory and Gall (1989), noted that some research designs are stranger than others and Robert (2003), highlighted that the main purpose of a research design is to help to avoid a situation in which the evidence does not address the initial research questions. He further adds on that the research design is more than a work plan. Kerlinger (1986), acknowledges that a research design is a plan, structure of investigation conceived so as to obtain answers to research questions or problem. He goes on to emphasize that the plan is to complete scheme or program of the research. It includes the outline of what the investigator will do from writing the hypothesis and their operational implications to the final analysis of data. In other words, a research design is a tool that comprises a plan for investigation and a way of conducting the study.

Against the background provided by the literature to the proceeding chapter an empirical investigation encompassing both the qualitative and the quantitative approaches was adopted.
This was considered suitable because the research study aimed at gaining insight and knowledge from the experiences and opinions of mathematics Heads of Department (HODs) and from Advanced level students. Both designs were selected to maximize on the benefits accruing from each and reducing the limitations of both. In other words, each approach has its strengths and weaknesses and the best research study often combines the features of each design in a complementary manner.

Mwiria and Wamahiu, (1995) postulate that qualitative helps the researcher to obtain in depth data both within and outside the school. Hence, data from within the school can help the researcher to discover the internal dynamics of the teaching learning process and the hidden curriculum that remains invisible. Best and Khan (1993), asserts that qualitative research design describes events, persons and many others scientifically without the use of numerical data. It comprises in-depth open ended interviews, direct observation and writing documents. In this study, the qualitative research design was used on interviews with Heads of mathematics Department in order to get information on challenges on uptake and intervention strategies to improve that uptake. Baker et al (1995), suggest that use of qualitative methods enables the individual to do studies in depth.

Creswell (2009), adds on to say qualitative approach is a means of exploring and understanding the meaning individuals or groups ascribe to a social or human problem. He further indicates that the process of the research involves emerging in the participant setting, data analysis inductively building from particulars to general themes and the researcher making interpretations of the meaning of the data. This means that the researcher can ask questions and get answers and continue to probe for more from the given answers. One is not confined to observable phenomena or only what is quantifiable. The researcher can probe, prod and cajole to enter the inner recesses of subjects.

The qualitative research is usually carried out on the context of explaining the status of some given educational phenomena. In this case, the method is highly valuable for expert and public opinions on explaining challenges for low mathematics uptake at Advanced Level. The method gathers data, which describes the nature of existing conditions which in turn forms the basis for a review so that future decisions can be made (Cohen and Manion, 1989). This study sought to make a descriptive study of challenges to uptake of mathematics at Advanced Level by students and initiatives to increase the uptake of the subject at that level. Qualitative research Design was suitable because the research was carried out on a specific
sector of education, secondary education sector (Muganda, 2010). A Descriptive Survey also allows the researcher to describe a unit in details in context and holistically (Orodho, 2003). A unit is a single selection selected to research and gather statistics of the whole for example when studying a group of school students, a single student could be a sampling unit. In this study the researcher gets information from the students and from Heads of mathematics department and quote and analyse some of the findings using comments on those quotes.

Quantitative research indicates numerical representation, with aim of highlighting and explaining the research finding. Quantitative approach provides numeric description of trends, attitudes and opinions describing phenomenon in words in the analysis and collection of data. Creswell (2009), indicates that quantitative is a means for testing objectives theories by examining the relationships among variables. These variables in turn can be measured, typically on instruments so that numbered data can be analyzed using statistical procedures. Kumar (2011), highlighted that quantitative approaches have more clarity and distinction between approaches and methods of presentation. He elaborates that findings through quantitative approach can be replicated and tested whereas this cannot be easily done using quantitative design. In this research line graphs, pie charts, bar graphs and chi-square tests were used and analysed. Owusu (2003 on line), contends that it is advantageous to use the combined methodological approaches of qualitative and quantitative research especially in Sub-Saharan Africa where complex rural-urban scenarios exist. Hence, the researcher adopted a mixed approach involving qualitative and quantitative.

Qualitative strategy of document analysis is going to be used as well to bridge the gap between findings from the survey results and reality. Documents are also a crucial source of information in many areas of inquiry. Best and Kan (1993), argued that when document analysis is used as a descriptive research, current documents and issues are the foci. The analysis is concerned with the explanation of the status of some phenomenon at a particular time of its development over a period of time. It serves as a useful purpose in adding knowledge to fields of enquiry and explains certain social events. However, quantitative strategy was also used to analyse data from documents. Data was represented on line graph so that the reader could clearly see the trend of subject enrolment in schools for the past 5 years. The researcher then analysed data using the graphs drawn. These methods are particularly useful in this instance because the research study is investigating uptake of mathematics by Advanced Level students. The researcher looked at official records which show the number of students at those schools that enrolled mathematics and other subjects at Advanced Level.
for the past five years 2013 to date. Consequently, any records written and maintained by
teachers, Heads of Department or Heads during the time 2013 to date were useful sources of
evidence to compliment that obtained through questionnaires or interviews. Although the
process of examining documents and abstracting relevant data can be time consuming, it is
sometimes a rich source of information (Breakwell and Milward, 1995).

3.3 Study Population.

Cohen and Manion (1994) defines population as an entire group of people on objects which
all have at least one characteristic in common and must be defined specifically and
unambiguously. Deacon et al (1990) supports this by putting a population as a group of any
individual that have one or more characteristic in common that is any interest to the research.
These individuals become potential units of observations for the study by the researcher.
Furthermore, Laboritz et al (1976) states that, the population is the total at which the
investigation is directed, the composition of the target population depend on the problem to
be investigated. The population for the students’ questionnaire included all Advanced Level
students in Bikita District, Heads of Mathematics Department of all schools offering
mathematics at Advanced Level, 11 schools. The population of students was 943 students,
and 11 Heads of Mathematics Department.

3.4 Sampling Techniques

Stratified and simple random sampling techniques were employed to get a representative
sample of the individual which were used to get comprehensive data required. According to
Wegner (1999), sampling is the process of selecting a representative subject from the
population to determine the population parameters of the random variables under study.
Charles (1974), states that a sample is a smaller group of individuals selected from the
population and intended to reflect accurately the characteristics of the sample. He further
accords that the sample is part of the larger population and is mostly selected to be
representative of the population. Therefore sampling is generally selecting a portion of the
overall population that is to be investigated by the researcher.

A sample according to Scott and Usher (1996) is any part of a population used to generalize
findings to the larger population. A school list of all 11 High Schools, in Bikita, offering
Mathematics at Advanced Level was obtained from the Education Officer (EO) secondary
schools and this constituted a clear sampling frame. In this research, stratified random
sampling was used to select a sample on which the questionnaires were applied. Stratified sampling technique was used first to choose schools from both selecting and non-selecting schools. Stratified random sampling technique was described by Damney (1979), as the most effective sampling method. Jack, Frankel and Norman (1996), support Damney by defining stratified sampling as the most effective as it gives all members of the population an opportunity to be selected for the sample. Stratified random sampling increase sample representativeness of the population thus the reason why the researcher used it to get the sample.

According to Cohen and Marion (1989), stratified sampling involves dividing the population into homogeneous groups, each group containing subjects with similar characteristics. Like in this study, boarding schools (selecting) and day high schools (non-selecting). From the Boarding schools, 2 schools were chosen and from the Day High Schools, 4 schools were chosen using simple random sampling which Cohen and Marion (1989) defined as sampling technique where each member under study has an equal chance of being selected. In simple random sampling the names of all the boarding and day Schools were arranged in alphabetical order and numbered 101 to 103 and the 104 to 111 respectively. After this, a set of random numbers was used to draw the two schools from Boarding schools and 4 schools from Day High schools. The six schools consisted the 50% of the schools offering Mathematics in Bikita district and this gives a good representative subject of the population. A sample of 274 students and six Advanced Level Heads of Mathematics Department was used for the study. To get a sample of the Heads of department, the researcher simply considers those of the selected schools. For the students, the researcher took lists of names all Advanced level students from their schools before the day of visit. These names were coded with random numbers and researcher select depending on the number of students at school who will in forms 5 and 6. Since there were 943 students and the sample was to have 274 students, the researcher would every 4th student, thus getting 236 students. The process was repeated to the remaining 707 to get 38 students. The researcher picked every 18th student and the sample had 274 students.
3.5 Instrumentation

Farvilouma (2003), define instruments as tools used for collecting information and data needed to find solution to problems under investigation. Pierce (2009), indicates that careful planning for data collection can help with setting realistic goals. He further eludes that data collection instruments can save time and can increase the study’s credibility and once the data procedure has been determined, a time for completion should be established. The instruments used in this study included questionnaires for students, interviews with Heads of Department (HODs) and checklists for the analysis of documents or records in the school for students taking mathematics and other Advanced Level subjects for comparison.

3.5.1 Questionnaire

Scates (1994) defines a questionnaire as a set of questions presented in written form to the respondents in order to obtain view. Quick (1987), defines a questionnaire as a written set of questions, with a large number of people asked in order to provide information. Mwiria and Wamahiu (1995), postulate that a questionnaire is a data gathering instrument through which respondents answer questions or respond to statements in writing. Questionnaires can be in closed form, where respondents call for short check mark responses while the open form calls for a free response in the respondents own words. Questionnaires are easy and quick to administer and data analysis especially from closed ended questions is fairly easy (Mhlanga and Ncube, 2003). The questionnaire was intended to examine the challenges leading to the low uptake of mathematics at Advanced Level. However these instruments sometimes restrict subjects in responding to questions and may also have a problem of low rate of return. To avoid some of the pitfalls in research, the researcher physically distributed the instruments and collected them the same day. The questionnaire consisted of both open ended and close ended questions. Both types of questions were incorporated to maximize the strength of each thus reducing the weaknesses of both.

The researcher tried to avoid misunderstandings by designing simple and straight forward questions mostly guided questions in which one respondent chooses an appropriate response by use of a tick. For example a question: How do you describe your subject combination?. Answer was selected from arts, sciences, commercial with maths and commercials without maths. By using such guided questions, silly or funny responses were avoided. Another question was: In your opinion, what do think are intervention strategies to increase maths uptake at Advanced level? However, few structured questions were included to get
respondents’ views on challenges for low mathematics and interventions that might be put in place to increase the uptake of the subject at Advanced Level. Also, to find out why they chose to do Advanced Level at the schools where they are.

3.5.2 Interview

Interviews are systematic way of talking and listening to people (http://www.who.int) and are another way to collect data from individuals through conversations. Interviews are a way of collecting data as well as gain knowledge from individuals. Frey and Oishi (1995), define an interview as a purposive conversation in which one person asks prepared questions (interviewer) and the other one answers (the respondent). They also emphasize that this is done to gain information on a particular topic or a particular area to be researched. Oppenhim (1992), postulates that an interview is a conversation between the interviewer and the interviewee with the purpose of eliciting certain information from the interview. Best and Khan (1993), asset that an interview is when one is finding out what is in or on someone else’s mind through asking questions. In other words, it is a data gathering device through direct verbal interaction between the researcher and respondent. An interview, according to Quick (1987), allows the researcher to study the more complex aspects of the experience. It allows the interviewer to ask for elaboration or redefinition of the response if it appears in complete or ambiguous.

Unlike the questionnaire, the respondents, in an interview, will be given verbal report; answering questions asked by the interviewer, hence, will also allow the researcher to extract more specific information. The interview schedule for the school mathematics Heads of Departments was designed to augment data collected through questionnaire. In fact the instrument was a follow up on students ideas and would investigate motives and feelings which the questionnaire can never do (Kidder, 1981). Data was collected regarding the challenges to low uptake of mathematics at Advanced Level and also on school interventions to increase the uptake of Mathematics at same level. Some Heads of department were very supportive and explained solutions clearly whilst others took it as waste of time. However, the researcher was able to get solutions to all questions, except for one Head of Department who totally refused to be interviewed.
3.6 Reliability and Validity.

In order for research data to be of value and of use they must be both reliable and valid. Reliability refers to the consistency or repeatability of results when an experiment is replicated under the same conditions. Validity is described as the degree to which a research study measures what it intends to measure. To ensure that the methods employed were valid and reliable some measures were taken. Question wording and ordering was subjected to a thorough scrutiny by consulting some research experts, colleges and the research supervisor before final copies were drawn. In addition to that, the researcher considered investigating the problem from different angles than looking at it in only one way, (Neuman) in this instance, different types of research and data collection instruments were used. Also validity and reliability were ensured by carrying out a pilot study to find out challenges leading to low uptake of mathematics at Advanced level and to find out schools interventions in order to raise the uptake of mathematics at Advanced level.

The pilot study was carried out at one school in Bikita District offering mathematics at Advanced Level. The school was selected purposively. The small trial run was done in order to identify errors, ambiguity in questions and misconceptions in instruments. Response options which were either incomplete or misleading were also identified and corrected. Students had no misconceptions and no question seem to be ambiguous such that the questions went to students in the study as they were. For the interview questions would be explained further to the respondent and there was no need of reconstructing questions. Validity was assured by checking and rechecking the research instruments to ensure that they covered the research questions for the study. Data collection was kept anonymous and data was collected from the respondents individually in the absence of any peers or superiors in order to encourage their honest contribution.

3.7 Data Collection Procedures.

Through Bindura University of Science Education (BUSE), the researcher sought permission from the Ministry of Primary and Secondary Education to carry out the research in Bikita District. The researcher communicated with the sample schools a week before the visit in order to set the stage and be able to gain entry into these schools. The researcher compiled an itinerary of visits and visited all the six schools as per schedule. Questionnaires were submitted and collected on the same day of the visit and interviews were conducted.
concurrently. The researcher then made a document of analysis of school records such as subject enrolment lists of Advanced Level students for the period under study.

3.8 Data Analysis Plan
The process entails unlocking meaning hidden in raw data generated from the research (questionnaires and interviews). Both qualitative and quantitative data will be analyzed. Kish (1965), indicated that the main format for the presentation of qualitative data is narrative. He further stated that this narrative needs to be supported using evidence from raw data which can be presented as direct quotes paraphrased illustrated themes. Presentation of findings was done through graphs such as pie charts, bar charts, on tables and line graphs. A Chi-square test was also carried out on whether different challenges had different effects or same effects on student’s uptake of mathematics at Advanced level. Quantitative data was submitted and converted into frequency distribution tables and figures. The purpose of the analysis was to move towards an explanation for low mathematical uptake at Advanced level. This was done through finding challenges leading to low uptake and also finding interventions to increase the uptake of mathematics at Advanced level. When presented in those ways data will be easier to understand, interpret and analyze. A quantitative textual representation was employed on responses from some parts of the interview and document analysis. Some software in the computer was used to draw graphs to represent found information as on figure 4.6.

3.9 Summary This chapter outlined the methodology that was used in the research study. Strengths and weaknesses of each strategy were highlighted to justify their inclusion, for example both qualitative and quantitative approaches were explained. Research instruments which were used for data collection and eventually a data analysis plan was presented. The next section is going to analyze and interpret the research findings.
CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction
This chapter presents analysis and discusses the data collected in the research study. The prime purpose of data collection was to move towards an explanation for low mathematics uptake at Advanced level by discussing challenges which lead to the low uptake and interventions which may be put in place to increase the uptake of mathematics at advanced level. Two hundred and seventy-four questionnaires were administered to Advanced level students and semi-structured interviews were carried out with six mathematics Heads of Department. A document analysis of the documents and official records in the schools’ Heads of mathematics Department were undertaken as well: enrolment by subject, of advanced level students which were either kept by heads or Heads of Department. Data analysis was broken down into groups namely responses on challenges leading to low mathematics uptake at Advanced Level from students and Heads of Department, initiatives to increase the uptake of mathematics at Advanced level from students and responses from documents. these were analyzed separately to clearly show trends of subjects uptake at Advanced level responses from students and from heads of departments were also analyzed separately data that was presented first was from students on challenges, followed by data from Heads of Department on challenges and initiatives than lastly data from documents which was used for comparison with findings from the questionnaire. Information from documents showing enrolment by subject for the past five years was also presented and analyzed.

4.2 Response rate
The study was intended to administer 274 questionnaires among Advanced Level students at 6 schools in Bikita district and conduct 6 interviews with Heads of Mathematics Department in the schools.
Table 4.1 summarizes the response rate which was obtained for the study.:

<table>
<thead>
<tr>
<th>Instruments used</th>
<th>Sample size</th>
<th>Number of valid responses</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires</td>
<td>274</td>
<td>257</td>
<td>93.79%</td>
</tr>
<tr>
<td>Interviews</td>
<td>6</td>
<td>5</td>
<td>83.33%</td>
</tr>
</tbody>
</table>

Table 4.1 shows the response rates of Advanced Level students and Heads of Department of mathematics six sampled schools. The researcher distributed 274 questionnaires to Advanced Level students at sampled schools. Out of the 274 questionnaires, 257 of them were returned whilst 17 were not returned, thus a 97.79% response rate was achieved as shown on table 4.1 above. The response rate was such high because the researcher distributed and collected the questionnaires personally. The interview managed to get a response rate of 83.33% which was also very high. Only one Head of Department was not prepared to have an interview for reasons not disclosed to the researcher. Both response rates were in excess of the 60% which was recommended by Baruch and Holton (2008) as the minimum condition for getting credible findings in a research study.

4.3 Demographic characteristics of respondents

4.3.1 Gender

Figure 4.1 Distribution of the respondents by gender.
Figure 4.1 represents gender of respondents who participated in the questionnaire. Fifty-two percent of the respondents were male whilst 48.31% of them were females. The findings show that the respondents were almost equally distributed among males and females. The findings appear to reflect the true situation since schools have a policy of balancing recruitment of both genders. It clearly shows that the results were not gender biased. These results were extracted from the questionnaire, on gender of respondent. The findings in the research were feelings from both girl and boy students studying Advanced Level from the sampled schools.

4.3.2 Students who are studying Mathematics

Figure 4.2: Distribution of the students according to whether they were studying Mathematics.
Figure 4.2 represents the distribution of students according to whether they were studying Mathematics at Advanced Level or not. Seventy-seven percent of the respondents were not taking Mathematics whilst 23.22% had Mathematics as one of their subjects. At Day High Schools most students do not take mathematics as one of their subjects compared to students at Boarding Schools where most students prefer to take mathematics. This was shown on the questionnaire where most students who showed that they were on boarding schools also showed that they had mathematics as one of their subject of specialization.

4.3.3 Gender of students who take Advanced Level Mathematics

Figure 4.3 Distribution of respondents who study Mathematics at advanced level by gender.
Figure 0.1 shows the distribution of students who study Advanced Level Mathematics by gender. Sixty-nine percent of the students who had taken up mathematics were males while 30.65% were female. There was a gender disparity as more male students took up Mathematics than females.
4.3.4 Subject combination

Figure 4.4 subject combinations of the students who participated in the study

Figure 4.4 shows that sixty five percent of the respondents were studying arts subjects, whilst 4.87% studied science subjects, 13.86% commercials including Mathematics and 16.10% had commercials excluding Mathematics. The questionnaire required students to show their subject combination and results came out as shown on figure 4.4 above which shows that the majority of students chose combinations with no mathematics. Quite a small number of students were taking sciences and commercials with mathematics whilst arts department was overloaded with students.

4.4 Regarding Research Question 1 on Challenges to low uptake of Mathematics at Advanced Level.B2: What are the challenges to the uptake of mathematics at Advanced level?

The questionnaire asked students to identify challenges to low uptake of mathematics at Advanced level and the respondents came out with the following challenges which are represented on the table below. The results were extracted from B2 of the questionnaire.
From table 4.2 above, the researcher managed to present and analyze the challenges, which led to the low uptake of Mathematics to Advanced Level, mentioned by the students.

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>%age of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor results at Ordinary Level.</td>
<td>46.7%</td>
</tr>
<tr>
<td>2. Perception that Advanced Level Mathematics is difficult.</td>
<td>70.0%</td>
</tr>
<tr>
<td>3. Perception that Advanced Level Mathematics is irrelevant for chosen carrier (not carrier related).</td>
<td>27.2%</td>
</tr>
<tr>
<td>4. Low pass rate in Mathematics at the school.</td>
<td>38.9%</td>
</tr>
<tr>
<td>5. Lack of confidence in the teacher.</td>
<td>23.3%</td>
</tr>
<tr>
<td>6. Inadequate learning resources.</td>
<td>40.9%</td>
</tr>
<tr>
<td>7. Influence from peers.</td>
<td>29.6%</td>
</tr>
<tr>
<td>8. Influence from family.</td>
<td>19.5%</td>
</tr>
<tr>
<td>9. Influence from teachers.</td>
<td>19.5%</td>
</tr>
<tr>
<td>10. Poor teaching methods.</td>
<td>77.8%</td>
</tr>
<tr>
<td>11. Long complex syllabus.</td>
<td>9.7%</td>
</tr>
<tr>
<td>12. Gender differences</td>
<td>10.2%</td>
</tr>
<tr>
<td>13. Mathematics abuse</td>
<td>25.6%</td>
</tr>
</tbody>
</table>
4.4.1 Poor results at Ordinary Level

Figure 4.5 Distribution of results obtained by students in mathematics at Ordinary Level.

Figure 4.5 show the Ordinary level results attained in mathematics by the students who are doing Advanced level at six sampled schools. Only 5.99 percent of the respondents had A grade while 8.51% had B, 16.85% had C, 30.71% had D and 37.83% had either an E or a U in mathematics at Ordinary level. Most of the respondents had symbols which did not allow them to qualify for Advanced level mathematics. Only 14.7 were in a better position to take mathematics at Advanced level for they got As or Bs at Ordinary Level. 16.85 got Cs and these passed mathematics at Ordinary level, however, with this weak pass, they could not take the mathematics at Advanced level as one of their subject. The information shows that the majority of the students failed mathematics at Ordinary level (67.71%). These could not take mathematics at Advanced level. The findings are consistent with Perry (2004) and the mathematical anxiety theory which suggests that past failure will induce fear of failure in future. Since the majority of students got a C and below, they found it impossible to take mathematics at Advanced level.

*Chido:* I do not even know how got an A at Ordinary Level. It was a mystery and I even do not want to try them at Advanced Level.
This was a quotation from Chido, one the respondents of the questionnaire who tried to express that taking mathematics at Advanced level was too risky. The finding suggests that poor results at Ordinary level have a significant effect on the uptake of mathematics at Advanced level.

4.4.2 Perception that Advanced Level Mathematics is difficult

The following statements were written by students on the questionnaire answer space on challenges for low uptake of mathematics at Advanced Level:

Mimi: Mathematics is for the talented and the gifted.

Tom: This subject called mathematics makes my school life difficult. It makes my life miserable. Imagine, I have no problem with other subjects. It requires complex reasoning. I do not think I have the brain stuff that will make me pass mathematics.

Such statements show that some students have the perception that Advanced level mathematics is difficult for them to uptake.

The findings are in line with Brophy(2013), who argues that students are motivated when they are positive about their chances of success. The findings suggest that the perception that the subject was difficult to pass was a significant barrier to the uptake of Advanced level mathematics.

4.4.3 Perception that Mathematics is irrelevant to certain careers

From table 4.2, twenty seven percent of the students had the perception that Advanced level mathematics is irrelevant for the carriers they intend to pursue after school. One of the students, Tau, wrote the statement below on the questionnaire:

Tau: Why is mathematics considered so important. I hate mathematics and forcing me to do it only makes me resent it more and more. I intend to be a lawyer where mathematics is not a requirement at all. So I don’t see any reason why I should do mathematics at Advanced level.

Such students like Tau will never take mathematics for a subject in their combination at Advanced level.

Heads of department indicated that it was difficult to convince some students to take up mathematics as they would have already made their career choices at this stage. The findings are in line with the self-determination theory which postulates that students become interested in school activities when they consider them to be relevant to their lives (Brophy, 2013). The
findings suggest that the perception that mathematics was irrelevant to some careers was a significant barrier to its uptake at Advanced level.

4.4.4 Low pass rate in mathematics at the school
From the table 4.2, approximately thirty nine percent feel that mathematics at Advanced level at the school had a lower pass rate than other Advanced level subjects. One of the students even expressed that for the past three years, whilst other Advanced level subjects scored a hundred percent pass rate, mathematics has been attaining between seventy and ninety percent. Another student gave the following as a comment:

Rose: For these past three years no one combining their subjects with mathematics has ever scored all the fifteen points, hence I cannot uptake mathematics as one of my subject at Advanced level.

Heads of department were mostly of the view that enrolment in mathematics classes did not improve even when the previous intake had produced very good results. The findings contradict the cognitive theory of self-motivation which argues that individuals are likely to attempt an activity if they consider their prospects of success to be high (Walker et al 2006). The findings suggest that low pass rates in the school were not a significant barrier to the uptake of mathematics at Advanced level.

4.4.5 Lack of confidence in the teacher
As indicated in table 4.2, approximately twenty three percent argued that they were not confident with the teachers who were taking mathematics at Advanced level. They cited that the teachers who were taking mathematics had no record of making students excel in the subject. Some students expressed how the teachers who were taking mathematics at Advanced level that year had failed the students each time they take them.

Most of the respondents disagreed that lack of confidence in the teacher was a challenge to the uptake of mathematics at advanced level. According to the heads of department, there had been isolated cases whereby some teachers attract more students in advanced level mathematics classes than others suggesting that confidence in the teacher did play a role in the student’s decision. The findings are in contradiction to Cortés-Suárez and Sandiford (2008), who found that students are motivated if they are confident of their facilitator’s capabilities. The findings suggest that lack of confidence in the teacher is not a significant barrier to the uptake of mathematics at Advanced level.
4.4.6 Inadequate learning resources

As shown in the table 4.2, approximately forty one percent of the students cited lack of adequate learning resources as a challenge. They mentioned both human and material resources as a challenge to the uptake of mathematics at Advanced level. At one of the schools, some students said that our colleagues have gone for two terms without a mathematics teacher and at another school, the mathematics teacher who transferred had not been replaced. At one of the schools, the students said that there was only one mathematics textbook for ten of them. At day high schools, some students expressed how they had failed to take mathematics because of lack of scientific calculators.

4.4.7 Peer pressure

From the table 4.2 nearly thirty percent of the students indicated that they could not uptake mathematics at Advanced level all their peers had not taken mathematics also. They felt that there was nobody to discuss with if they had taken mathematics as one of their subject combination.

4.4.8 Family influence

As shown on table 4.2, almost twenty percent of the students said that low mathematics uptake at Advanced level can be due to influence from parents and siblings. One student expressed how he was prohibited to take Mathematics by his parents and another student wrote:

Paul: My parents could not allow me to take mathematics because our whole clan was not mathematical. They said, even if you have passed Ordinary level mathematics we cannot allow you to carry on with the subject to Advanced level.

With that perception of parents, a child could not take mathematics at Advanced level.

4.4.9 Influence from teachers

Almost twenty percent confirmed that influence from teachers has been a challenge to the uptake of mathematics at Advanced level. As written by Vimbai one of the students:

Vimbai: The teacher fired virulent verbal attacks on me, ‘you are not mathematics material. I do not even know where I should start from if I am to provide remediation. People like you should just drop mathematics.’
Such statements would show that students can develop anti-mathematics feeling and all interest for the subject may vanish.

### 4.4.10 Poor teaching methods

As shown on table 4.2, this challenge was given by the highest number of respondents, 77.8%. Most students put it down as the way how teachers contacted their lessons. Some even do not care whether students understood or not said:

*Petros:* *I asked my teacher to explain a concept which I had not understood and the teacher simply said, those who have understood should explain to those who did not understand.*

Generally, it is the teacher’s role to clarify issues so that pupils understand but in the above situation, the teacher was not patient enough to explain to the students, which may lead to low uptake of mathematics at Advanced level.

### 4.4.11 long complex syllabus (curriculum)

From the table, almost ten percent said that the mathematics syllabus is long and complex.

*Eliza:* *Mathematics is a dull subject. You spend the larger part of the schooling time doing mathematics. As if that is not enough, one still carries mathematics homework home.*

From the above statement, it is clear that students are bored about the content covered in Mathematics at Advanced level.

#### Table 4.3 is a summary of table 4.2

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Frequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>A inadequate learning resources</td>
<td>105</td>
</tr>
<tr>
<td>B influence from parents, peers, teachers</td>
<td>126</td>
</tr>
<tr>
<td>C poor teaching methods</td>
<td>200</td>
</tr>
<tr>
<td>D perception that mathematics is difficult</td>
<td>180</td>
</tr>
<tr>
<td>E perception that mathematics is irrelevant</td>
<td>150</td>
</tr>
<tr>
<td>F poor results at Ordinary level</td>
<td>120</td>
</tr>
</tbody>
</table>

To test at 5% significance level
H₀: The challenges have no same effects on students’ uptake of mathematics at Advanced level.
H₁: The challenges have same effects on students’ uptake of mathematics at Advanced level.

Rejection Criteria: Reject H₀ if \( \chi^2 \) calculated > \( \chi^2 \) tabulated

Chi- squared calculated

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Observed frequencies (Oi)</th>
<th>Expected frequencies (Ei)</th>
<th>((O_i - E_i)^2 / E_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>105</td>
<td>146.8</td>
<td>11.9</td>
</tr>
<tr>
<td>B</td>
<td>126</td>
<td>146.8</td>
<td>2.95</td>
</tr>
<tr>
<td>C</td>
<td>200</td>
<td>146.8</td>
<td>19.28</td>
</tr>
<tr>
<td>D</td>
<td>180</td>
<td>146.8</td>
<td>7.59</td>
</tr>
<tr>
<td>E</td>
<td>150</td>
<td>146.8</td>
<td>0.07</td>
</tr>
<tr>
<td>F</td>
<td>120</td>
<td>146.8</td>
<td>4.89</td>
</tr>
</tbody>
</table>

\[ \text{Chi-square calculated} = \frac{(O_i - E_i)^2}{E_i} \]
\[ = 46.6 \]

\[ \text{Chi-squared tabulated} = \text{Chi square} \ (6,005) \]
\[ = 1.145 \]

Since \( \text{Chi-squared calculated} (46.6) > \text{Chi-squared tabulated} (1.145) \)

Decision: We reject H₀ at 5% significant level

Conclusion: The researcher concludes that the challenges have the same effects on uptake of mathematics at Advanced level. This means that all challenges listed by the students Heads of mathematic Department, have the same effects on uptake of mathematics at Advanced level.
4.5 Regarding research question 1 on challenge to the low uptake of mathematics at Advanced level. Question 10 on the interview schedule: In your opinion, what are the barriers to mathematics uptake at Advanced level?

From the interviews carried out with the Heads of mathematics Department, a variety of responses came out. The table below shows the challenges and percentage of respondents.

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>%age of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Inadequate learning resources</td>
<td>100%</td>
</tr>
<tr>
<td>2 Influence from family</td>
<td>60%</td>
</tr>
<tr>
<td>3 Influence from peers</td>
<td>80%</td>
</tr>
<tr>
<td>4 Perception that Advanced level mathematics is difficult</td>
<td>100%</td>
</tr>
<tr>
<td>5 Perception that Advanced level mathematics is irrelevant for other carriers.</td>
<td>100%</td>
</tr>
<tr>
<td>6 Poor result at Ordinary level</td>
<td>80%</td>
</tr>
<tr>
<td>7 Lack of subject combination</td>
<td>60%</td>
</tr>
<tr>
<td>8 Gender difference</td>
<td>40%</td>
</tr>
</tbody>
</table>

From the table 4.5 above all Heads of Department concurred with students that inadequate learning resource, perception that Advanced level mathematics is difficult and perception that Advanced level mathematics is irrelevant for certain carriers. Four out of five Heads of Mathematics Department supported that influence from peers and poor results at Ordinary Level are challenges to low uptake of mathematics at Advanced level. Three fifth pointed out that influence from family and lack of subject combination was also challenges. Lastly, only forty percent said that gender difference was a challenge to low uptake of mathematics.

4.6 Analysis of documents

Analysis of documents as supporting evidence that there is low mathematics uptake at Advanced level.
Table 4.6: Total Enrolment of students at Advanced level by subject for the past five years.

<table>
<thead>
<tr>
<th>SUBJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
</tr>
<tr>
<td>MATHS</td>
</tr>
<tr>
<td>SHONA</td>
</tr>
<tr>
<td>HISTORY</td>
</tr>
<tr>
<td>GEO</td>
</tr>
<tr>
<td>ACC</td>
</tr>
<tr>
<td>BS</td>
</tr>
<tr>
<td>ECONS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YEAR</th>
<th>MATHS</th>
<th>SHONA</th>
<th>HISTORY</th>
<th>GEO</th>
<th>ACC</th>
<th>BS</th>
<th>ECONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>110</td>
<td>110</td>
<td>268</td>
<td>263</td>
<td>132</td>
<td>210</td>
<td>150</td>
</tr>
<tr>
<td>2014</td>
<td>106</td>
<td>218</td>
<td>300</td>
<td>280</td>
<td>133</td>
<td>219</td>
<td>196</td>
</tr>
<tr>
<td>2015</td>
<td>98</td>
<td>210</td>
<td>194</td>
<td>245</td>
<td>166</td>
<td>202</td>
<td>180</td>
</tr>
<tr>
<td>2016</td>
<td>90</td>
<td>226</td>
<td>302</td>
<td>204</td>
<td>160</td>
<td>200</td>
<td>188</td>
</tr>
<tr>
<td>2017</td>
<td>112</td>
<td>258</td>
<td>324</td>
<td>350</td>
<td>166</td>
<td>214</td>
<td>192</td>
</tr>
<tr>
<td>TOTALS</td>
<td>506</td>
<td>1092</td>
<td>1388</td>
<td>1372</td>
<td>757</td>
<td>1045</td>
<td>906</td>
</tr>
</tbody>
</table>

Table 4.6 shows total enrolment of subjects which were common to all schools in the study. These enrolment statistics were for the years 2013 to date. From the table it is clearly shown that mathematics, compared to other subjects had the lowest enrolment for the years 2013 up to 2017. The information was represented on the line graphs below:
Figure 4.6 Line graphs for total enrolment per subject for 5 consecutive years.

Figure 4.6 above shows the total enrolment for the 6 schools in 7 different subjects for 5 consecutive years, 2013 to date. From the graph it is clear has the lowest total enrolment as compared to all other subjects. This graph on analysis of document shows that Mathematics has not improved on uptake since 2013. The researcher only compared subjects which were common to the six schools disregarding science subjects and divinity.
4.7 Regarding Research Question 2: What are the interventions to overcome the challenges so as to improve the uptake of Advanced Level mathematics?

Table 4.7: Intervention Strategies for both students and Heads of Department.

<table>
<thead>
<tr>
<th>Initiatives by the students</th>
<th>Initiatives by the Heads Of Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction of science subjects at Day High Schools</td>
<td>1. Families to be familiarize with the importance of science subjects.</td>
</tr>
<tr>
<td>2. Teachers to improve teaching methods.</td>
<td>2. Carrier guidance to the students</td>
</tr>
<tr>
<td>3. Schools to source resources such as text books, calculators and human resources.</td>
<td>3. School to improve on sourcing of resources and Government and NGOs to support.</td>
</tr>
<tr>
<td>5. Parents are to be conscientised on importance of mathematics.</td>
<td>5. Provision of qualified teachers</td>
</tr>
</tbody>
</table>

Table 4.6 outlines interventions strategies from both students and mathematics Heads of Department. Some of the interventions strategies which came from mathematics Heads of Department were also given by the students. This information was extracted from question B3 of the questionnaire and question 12 of the interview schedule.

4.8: Discussion of Findings

Generally, the results obtained from the respondents concerning the challenges that lead to low mathematics uptake at Advanced Level revealed that almost all challenges which were put down by students also have come from the Heads of mathematics Department. However, some schools are improving quite well on the uptake of mathematics at Advanced level whilst others still have very few students who take mathematics at Advanced level. Some schools, at one point in time, enrolled one or zero students taking Advanced level mathematics, which is chaotic or unimaginable.

A general observation in this regard is that there is a very wide gap between males and female students taking mathematics at Advanced level, in favour of male students. Considering, on the questionnaire where gender was indicated and where students were supposed to indicate if they were taking mathematics or not, the results shown were pathetic.
Very few female students study mathematics at Advanced level even when their passes at Ordinary level would allow them to take mathematics at Advanced level. Hence, this remains an area of concern in regard to uptake of mathematics at Advanced Level. The findings are in line with what was in the literature review on gender differences where girls are said to develop feelings of inadequacy that result in generalized feelings of incompetence that paralyse initiative and active an expectation of failure. In the researcher’s opinion gender has an effect on uptake of Advanced level mathematics since there are fewer females than males taking mathematics as shown in figure 4.3.

In addition to the above, data collected also suggested that lack of subject combination in some day high schools may lead to low uptake of mathematics at Advanced level. The study revealed that at most Day high schools the only combination with mathematics is commercials and no other combinations. It means, therefore, that if one is not good at commercials, that person cannot take mathematics at Advanced level. Heads of mathematics Department supported what students had said about subject combination that because the only combination at their schools, with mathematics was commercials. Students had transferred to other schools where sciences were offered and thus allowing them to have option on some other combinations like sciences. The researcher also noted that at one school where sciences were introduced two years ago, the uptake of mathematics increased drastically. Schools should try at all cost to introduce many science subjects thus increasing the uptake of mathematics at Advanced level.

More so, information presented on table 4.2 on challenges has shown that students and Heads of mathematics department had an outcry on lack of resources as a challenge on uptake of Advanced level mathematics. These resources were human and material resources. Also some students have indicated that they had transferred from other schools to find schools where there are qualified and competent teachers, textbooks, internet and other relevant materials. The findings are in line with Psycharopolous et al (1985), who postulate that textbooks are a major input for performance in examinations. This view was shared by Elepchieng (1985), who observes that availability of quality textbooks in a secondary school is strongly related to achievement. This simply means schools should be well equipped with textbooks for students to achieve high in mathematics. However, Heads of Department in this research contributed by saying that their schools all offered internet access for students’ research and was no shortage of learning resources in the schools. Literature review supported the necessity of textbooks for both teachers and students since some books have
well illustrated worked examples for students to follow by themselves. The findings suggest that inadequate learning resources were a significant challenge to the uptake of Advanced level mathematics.

Also, most students and Heads of mathematics Department indicated that peer pressure is a challenge to the uptake of Advanced level mathematics. Students and Heads of mathematics Department indicated that some students would have passed mathematics at Ordinary Level with As or Bs but because their friends had taken combinations without mathematics, they also fail to take mathematics. Heads of Department who were interviewed noted also that some students who were friends often discouraged one another to take up subject combinations as they also prefer to be study partners, making subject selection, subject to peer influence. The findings are in line with Alderman (2013), who found that peer pressure played a significant role in subject selection for high school and undergraduate students. Thus, the findings suggest that peer pressure was a significant challenge to the uptake of mathematics at Advanced level.

Family influence came from students as a challenge to low uptake of mathematics at Advanced level. Heads of Department pointed out that that family nowadays give children the freedom to make their own choices of subjects although they suggested that it may be an issue in the past. Desarrollo (2007), indicated that the extent to which parents or other family members are actively engaged in a student’s education had a positive influence on student’s uptake of mathematics from this authority. Family influence was seen to be a significant challenge to mathematics uptake at Advanced level.

Moreover, influence from teachers was also given as a challenge by students. It was put down as a negative influence, not positive, as it was given by Heads of Departments. Students said teachers were harsh and impatient to the slow learners such that the learners were forced to drop instead of taking mathematics. From the comments given by students on answering question A5 on the questionnaire: if no, why did you not include mathematics in your combination? The Heads of Department came up with the view that teachers play a significant role in terms of offering carrier guidance to the students and this is invariably extended to advising them on selection of subjects. The findings are similar to Goldhaber and Brewer (2000), who found that teachers were at the forefront of advising students on careers and subject selection. The findings suggest that influence from teachers is a significant challenge to the uptake of mathematics at Advanced Level.
More to this, poor teaching methods were cited as a challenge by students. Most students suggested that teachers were at the core of teaching and learning of mathematics, hence they should apply interesting methods of teaching which leave no stone unturned, that is making all students to understand the concepts clearly. Heads of Department, when the interviewer probed further on the issue of poor teaching methods by teachers, they said they go for lesson supervision to make sure students were given relevant information thorough good teaching methods. However, teaching methods were a significant challenge to uptake of mathematics at Advanced level.

Furthermore, the mathematics Advanced level syllabus has been said to be long and complex by the majority of students. It was also complained by the Heads of Department who said that the syllabus included too many concepts in pure mathematics, statistics and mechanics, these entire in one syllabus. Students complained that a lot of working of problems was involved inclass and homework was also given daily such that the students had no time to study other subjects and also no time to rest,. Compared to other subjects, the mathematics syllabus is congested with pure mathematics, statistics and mechanics, all in under subject. Hence, the mathematics syllabus is a significant challenge to the uptake of mathematics at Advanced level.

From what they say in questionnaire, students feel that subject is of no relevance to them because they are specialists in arts. This means that when students complete Ordinary level, they already have career in mind and their choice of subjects at Advanced level will be directed towards the intended career. If their career has nothing to do with mathematics, they do not take it at Advanced level. Heads of mathematics Department indicated that it was difficult to convince some students to take up mathematics at Advanced level as they would have already made their career choices at that stage. From the literature review, the findings are in line with the self-determination theory which postulates that students are engaged in school activities when they consider them to be relevant to their lives (Brophy, 2013). From the findings, it can be argued that learners develop a positive attitude towards a subject when they see the need in doing it (Zimrig, 1999). Thus the findings suggest that the perception that mathematics was irrelevant to some certain careers was a significant challenge to its uptake at Advanced level.

Finally, students and some Heads of mathematics Department argued that mathematics is not taken up by most students because of its pass rate which is always lower than other subjects
at that school. However, some Heads of Department were of the view that enrolment in mathematics classes did not improve even when the previous intake had produced good results. The results contradict the cognitive theory of self-motivation which argues that individuals are likely to attempt an activity if their prospects of success to be high (Walker, Greene and Monsell, 2006). The theory suggests that students should be motivated to do Mathematics irrespective of its low pass rate, but should be motivated or drove by the opportunities it opens to those who would have taken it. The findings suggests that low pass rate in the school was not a significant challenge to the uptake of mathematics at Advanced level.

In addition, mathematics abuse was cited by students as one of the challenges to uptake of mathematics. Students are abused by peers and even by teachers. In the literature review, it was noted that some teachers use some abusive words in their lessons statements such as ‘You are not going to pass mathematics’, ‘You are wasting your time because you will not pass mathematics’ and ‘People like you should drop mathematics and concentrate on other subjects’. Such abusive utterances make the students not to be comfortable and they develop anti-mathematics feelings. More so, students also abuse each other by discouraging one another from taking mathematics. Some laugh at each other after giving wrong answers. Such reactions from peers make students disengaged and may end up failing to take part in lessons. Thus the findings suggest that mathematics abuse is a significant challenge to the uptake of mathematics at Advanced level.

**Regarding research question 2, on interventions or initiatives to improve the uptake of Mathematics at Advanced level.**

Results of findings are presented on table 4.6. Both respondents that are students and Heads of mathematics Department had suggestion on interventions which may be put in place to improve the uptake of mathematics at Advanced level. The following were interventions from the Heads of mathematics Department and from students: sourcing of resources, conscientisationof students and parents of the importance of mathematics, syllabus review and introduction at their schools, of science subjects at Advanced level.

Heads of mathematics Department and students suggested that there was need to source resources by the school, teachers and parents. Once internet was accessible at schools, the problem of textbooks would have been solved because students will access notes, questions and solutions on internet. Human resource was also mentioned as a lacking resource. As an
intervention, suggested by Heads of mathematics Department, there was need to develop teachers professionally. Teachers are to develop themselves by improving their professional qualifications. There are science and mathematics teachers who had degrees but with no professional qualifications, they had information or data to be to be taught to students but they had no or little experience of how to teach or give data to students these were encouraged to take up professional studies at universities.

In addition to the above, another suggestion of improving uptake of mathematics at Advanced level, is suggested by both respondents was to make known the importance of mathematics to students and to parents. Normally students just choose other Advanced level combination without considering what these subjects will benefit them in future. Students should be conscientised on importance of science subjects which include mathematics. This finding is in line with the comments below which say that students should be made clear about the wide range of careers and degree courses for which Advanced level study of mathematics would be beneficial. By so doing the uptake of mathematics can be improved.

Furthermore, schools should include Sciences in their Advanced Level curriculum. If schools offer sciences at Advanced level, students will have a wide range of subjects to select subjects from for Advanced level. Combinations with mathematics will be varied. Schools with no Sciences had only one combination with mathematics that is commercials only. From the list of careers, students had indicated that they intend to pursue, most needed mathematics and other science subjects not commercials. From the findings above, the introduction of Science subjects would increase the uptake of students taking mathematics. At one school where sciences were recently introduced, the mathematics department was overcrowded with students.

Respondents from students also suggested that teachers have to vary teaching methods to cater for different categories of students in classes. Students complained bitterly on students bitterly on teachers who rush through without explaining concepts clearly. Heads of M mathematics Department had different views in interviews. They blamed the students for not taking mathematics at Advanced level. More to this, teachers should engage methods of teaching that are interesting to students. Methods that are pupil centred than teacher centred. Methods that are more practical than being theoretical. Findings in this study suggest that varying of teaching methods may improve the uptake of mathematics at Advanced level.
The Advanced level mathematics curriculum was said to be long to be covered in two years. Even the Heads of Department complained about the mathematics syllabus which is not easy to cover as in some subjects. This will cause teachers to rush through the concepts without explaining in details. Normally teachers aim at covering the syllabus not going through it slowly. Since examination tests all components of the syllabus, teachers will stick to one method of teaching where teachers just explain whilst students just listen. Students will be recipients of information are taken to empty bags, which will be wasting to be filled with something. Teachers are not encouraged to teach for examinations only but should teach to impart knowledge and understanding in students.

Finally, administration at all schools should have a school policy on uptake of mathematics starting from Ordinary level. The administration should intervene and find strategies at schools to improve the uptake of mathematics at Advanced level. They should make the subject compulsory starting at form one to Ordinary level. At Advanced level, those teachers responsible for recruiting students should encourage all those with passes at Ordinary level mathematics even those with Cs to take mathematics at Advanced level. This may help to improve the uptake of mathematics at Advanced level.
CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The purpose of this chapter is to summarise the research problem, research methodology and the major findings of the study. This chapter draws conclusions from the previously mentioned research findings thus providing the basic answers to the main research problems. It also presents some recommendations that are directed at policy makers, academics and school administrators who have an impact or who have something to do with explaining the low uptake of mathematics at Advanced level.

5.2 SUMMARY OF THE STUDY

The present study was concerned with finding explanation for low mathematics uptake at Advanced Level.

The research questions were as follows:

- What are challenges or barriers to students’ uptake of Advanced level mathematics?
- What are the interventions to overcome the challenges so as to improve the uptake of mathematics at Advanced Level?

A qualitative approach was found to be the most appropriate design to elicit the views of both the students and Heads of mathematics Department. Quantitative approach was also used to represent the findings especially on students’ responses. Official records from Heads of Department on subject enrolment were also studied.

Two hundred and fifty-seven questionnaires were physically administered to Advanced level students. The response rate was 93.79%. The researcher also interviewed five Heads of mathematics Department. These questionnaires and interviews were found quite insightful and very effective in the collection of data.

5.2.1 SUMMARY OF FINDINGS

Regarding challenges to low uptake of Mathematics at Advanced level, the major findings of the study were as follows:
Students came up with a substantial number of challenges to low mathematics uptake at Advanced level. Heads of mathematics Department also came up with challenges and some of the challenges of Heads of mathematics Department were similar to those which came from students. Both respondents displayed some worries over the challenges to low uptake of mathematics uptake at Advanced level. These challenges range from those which emanated from parents, students and teachers to those which originated from the school. Negative attitudes towards mathematics, lack of resources, poor teaching methods and mathematics abuse were the core challenges to uptake of mathematics at Advanced Level. Also fear of failing from prior attainment and irrelevance of subject to future career were some of the challenges which came from the students and from Heads of Department. Wide curriculum and lack of knowledge on the importance of the subject were also cited by Heads of Mathematics Department as challenges.

On lack of resources, both respondents pointed out that lack of human resources was the major and worrying challenge in the uptake of mathematics at Advanced Level. At one school, students complained that there was no Advanced level mathematics teacher for two terms such that those who were taking mathematics had switched to other subjects like geography to combine it with commercials. Students had a teacher for only two terms, who transferred and the administration failed to get a mathematics teacher since then. Those other teachers who were at the school could not teach Advanced level mathematics. This means for the next two or so years, the subject is going to have a low uptake.

On textbooks, the challenge was partly solved since four of the six schools in the study, had installed internet such that students and teachers were able to access information they wanted in mathematics. The two schools with no internet said they were not far from installing the facility. On exercise books and calculators, Heads of mathematics Department were satisfied with the parents’ reaction to their request. Parents were buying exercise books and calculators on time.

Although both respondents pointed out that the perception that mathematics was irrelevant to some of careers they intended to pursue, the outcry for mathematics in the country has forced most students to take mathematics at Ordinary level. After passing mathematics well at Ordinary level, some take the subject further just to have a pass at Advanced level. Heads of mathematics Department appreciated that some students taking mathematics in their part-time
studies, pass and take the subject at Advanced level, this way, the uptake of mathematics at Advanced level can be improved.

**Regarding the interventions to improve the uptake of mathematics, the following major findings emerged:**

Both students and Heads of mathematics Department came up with suggestions on interventions to be put across in trying to increase the uptake of mathematics at Advanced level. These were divided into two, those from the students and those from the teachers but they were similar except for very few. Improving teaching methods, motivating students and avoiding mathematics abuse, those came from the students in addition to the similar interventions which were put down as sourcing resources, changing attitudes towards mathematics and receiving career guidance on the importance of mathematics and understanding the opportunities that mathematics opens in life.

It was disheartening to discover that some students who had passed mathematics did not take it at Advanced level. Some did not take it for fear that they would fail and some did not take mathematics because they had no combinations at their schools which had only one combination with mathematics that is commercials. However, some schools had just introduced sciences and some promised to introduce sciences in the near future. On careers students intend pursue most indicated that they would careers which tally with their subject combination. Very few wanted to take careers where mathematics is a requirement.

Students were asked to give reasons why they remained at the schools where they did Ordinary level or why they transferred to schools where they were, the majority had transferred to do sciences. This shows that some students, parents or guardians knew the importance of mathematics in their life. On this note, Heads of mathematics Department pointed out that they were introducing sciences and on two schools, the laboratories were under refurbishment in preparation for sciences. This move was intended to improve the uptake of mathematics at Advanced level.

Furthermore, the Heads of mathematics Department pointed out that the administration composition was not mathematics biased. The Headmaster, the Deputy, the senior lady and the senior master, all were not in the mathematics department. The Head of mathematics Department complained that the administration does not encourage students to take mathematics unlike at one school where the Deputy Headmaster and the senior lady all taught
mathematics at Advanced level. The encouragement from these two was said to yield fruits. Students were encouraged to take mathematics even if they had weak symbols at Ordinary level. On this note, the administration should have at least one member who is mathematician, who knows the importance of mathematics, to help source resources, guide students on which opportunities mathematics would open for them. Mathematics administrators would help even in the supervision of teacher, instead of Heads of Department only supervising mathematics teachers. This mathematics administrator would also help in sourcing and allocating resources.

All in all, the data gathered clearly indicated that schools are now aware of the importance of mathematics and have tried to put interventions strategies to improve the uptake of mathematics at Advanced level. Also enrolment has shown that there has been a makeable improvement in mathematics enrolment at that Advanced level.

**Regarding challenges to low uptake of Mathematics at Advanced level, the findings led to the following conclusions:**

The findings suggest that the perception that mathematics was difficult to pass and that mathematics was irrelevant to careers were significant challenges to the uptake of mathematics. Furthermore, the following were also significant challenges to uptake of mathematics at Advanced level: peer pressure, influence from parents or guardians, lack of teaching and learning resources and lack of a variety of subject combination. These challenges came out from respondents, the students and Heads of mathematics Department. Heads of mathematics Department clearly explain how the above challenges affect the uptake of mathematics at Advanced level. More to these, mathematics abuse was a significant challenge to uptake of mathematics. Students are frequently abused in lessons by teachers. Teachers abuse students until they withdraw from taking the subject.

On the other hand some of the items which were given as challenges were not significant. After considering the findings prior attainment, lack of confidence in the teacher and low pass rate at the school. These failed to be significant because it was discovered that even those students who passed mathematics at Ordinary level very well did not take mathematics at Advanced level and even if the pass rate at school increased students will fail to take mathematics in the following year.
Regarding interventions to improve the uptake of Advanced level mathematics, the following conclusions were drawn. Through supervision by Heads of Department, teachers could improve their ways of instruction. Frequent lesson observation would help teachers to use appropriate and varied teaching methods. However, it was discovered that the frequency of lesson observations by Heads of Department could not solve much but continuous upgrading, in-service and capacity professional development programmes would be a solution. As suggested by the Heads of Department, there is a great need for teachers to be professionals developed. Some teachers were trained long back to teach, there is need for them to attend workshops and even conferences such as those which are annually held at BUSE for science teachers.

More to that, it can be concluded that without sciences at Advanced level, the only combination at Advanced level with mathematics is commercials and no other. In addition to that, Heads of Department suggested that they, if possible, be ZIMSEC examiners at both Advanced and Ordinary levels.

The findings from this study also concluded that there was need for mathematicians in the administration. One Head of Department was quoted as saying “The Head and all the senior teachers, all are teaching geography and the geography department is full of resources. The administration is geography biased”. This made the researcher to conclude that if the Head been a mathematician, the mathematics Department would have been overloaded with mathematics textbooks and other resources.

5.3 Recommendations drawn from the findings and conclusions.

In light of the findings and conclusions drawn from this study, the researcher puts forward the following suggestions for further research and probable implementations by policy makers:

5.3.1 The school Headmasters and teachers should communicate with parents on the problems faced by their children in learning mathematics. On that note, they should discuss on the advantages of taking mathematics as a subject at Advanced level and the opportunities which will be opened to students through studying mathematics.

5.3.2 Teachers to attend conferences and workshops where they keep on advising one another on teaching methods which are pupil centred rather than teacher centred. Teachers are to make their lessons very interesting and exciting by offering mathematics with processes and products where students discover some of the formulae by themselves through practical
activities. Moreover, these teachers are encouraged to develop themselves professionally by taking part in capacity professional development programmes such as those which are self or Government sponsored and are offered at most Universities all over the

5.3.3 The Ministry of Primary and Secondary Education in conjunction with schools need to have coordinated career and guidance with students as early as at primary level or lower secondary level, so that students choose pathways earlier and be well informed of the careers which need mathematics as a prerequisite.

5.3.4 There is need for school Heads to perform both administrative and professional tasks equally and simultaneously. School Heads and their Deputies have rather neglected most of the responsibilities of an instructional leader such as supervising the teaching and learning process, staff development and teaching school authorities should not view the two functions as diametrically opposing responsibilities. What is needed is the strategic on balancing the two because both activities are equally important.

5.3.5 The Government should provide essential support services to schools occasionally, especially those found in vulnerable communities. Many of the Day High School require some face lifting in order to operate at normal levels. It has been discovered that Day High schools had long back aspired to have internet, computer and science laboratories for, but the flow of income at these schools makes it impossible or rather difficult to carry out such expensive projects.
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