EFFECTS OF DESCRIPTIVE WRITTEN FEEDBACK ON ACHIEVEMENT IN MATHEMATICS IN SECONDARY SCHOOLS IN KONOIN DISTRICT OF BOMET COUNTY

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DECLARATION

This research project is my original work and has not been presented to any other university for degree award.

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This research project has been submitted for examination with my approval as University of Nairobi supervisor.

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DEDICATION

This research project is dedicated to the Almighty God, who has taken care of me throughout my studies. My late mother Sophia Chebochok who inspired me during my early years of education and my father, Musa Chebochok, who provided me with education, to my brother Joel Kosgei for his financial support, my wife Betty Cheruiyot who offered me moral and spiritual support, and to all my children, specifically Dorcas, Asbert, Mildred, Tonny, Getrude and Gedion, for their word of encouragement.

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ABBREVIATIONS AND ACRONYMS

ANOVA----------Analysis Of Variance

DEO ----------District Education Office

DWF----------Descriptive Written Feedback

GDWF----------Goal Directed Written Feedback

KCPE ----------Kenya Certificate of Primary Education

KCSE---------- Kenya Certificate of Secondary Education

KNEC---------- Kenya National Examination Council

MDG ----------Millennium Development Goal

MOE ----------Ministry Of Education

SAT----------Student Achievement Test

SMASSE----------Strengthening Mathematics and Science in Secondary Education

ZPD ----------Zone of Proximal Development

ABSTRACT

The purpose of the study was to investigate the effect of descriptive written feedbacks on achievement in mathematics. The main objective of the study was finding the effects of DWF on achievement of mathematics in secondary school in Konoin District, Bomet County. The specific objectives are four and they include; determining the influence of the teacher's descriptive written feedback on assessment of Mathematics, examining the effect of descriptive written feedback on students' reflection of errors in Mathematics, it also includes determining if DWF influence the attitude of students towards Mathematics and finally to determine the influence of goal directed descriptive written feedback on achievement in mathematics.

Quasi-experimental design involving Solomon's Four of Non-Equivalent Control Group was used. Learners' academic achievement was determined by scores obtained by the students on undertaking the Students Achievement Tests (SAT) immediately after the topic of Gradients and equation of straight lines. Data relating to teachers' view on descriptive written feedback were collected using a questionnaire. The teachers' questionnaires capture information regarding opinion of teachers in DWF use in mathematics. Simple random sampling was used to select 10 schools of study. The data was analyzed by use of ANOVA, Chi-square, in order to test the hypotheses.

The key findings of the study were that descriptive written feedback influence achievement of mathematics greatly; it assist the students to reflect on the errors they make and hence correct misconception; descriptive written feedback change the attitude of students towards mathematics positively; delayed feedback is more effective than immediate feedback as far as achievements is concerned however the students in their opinion preferred immediate feedback; the non-goal directed written feedback can yield better results than goal directed feedback. In view of the findings the researcher recommended the use of descriptive written feedback in assessment of mathematics by teachers; Common assessment should be done in form two to encourage teachers to speed up syllabus coverage; In-service courses should be done for teachers with purpose of improving skills on assessment of students; Further research to be done in the field of DWF and teachers characteristics; A similar research should be done to cover the whole country.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Mathematics is one of the most important subjects in the school curriculum for both Primary and secondary schools in Kenya and other countries around the world. It is a very important subject which aid in learning other subjects such as; Physics, Chemistry, Biology Business Studies, Geography among others. Cockroft (1982) in his writing stated that mathematics is a strategic subject in the development of science and technology. He asserts that this subject is fundamental in the study of physical sciences and engineering of all types. It plays a significant role in character building, boosting self-esteem and providing opportunities for developing curiosity and creativity. Orton (1987) claims that Mathematics is the gate and key of science, neglect of mathematics works injury of all knowledge since he who is ignorant of it cannot view the other sciences or the things in the world. It is a core subject in tertiary institution and universities, such that there is no course of study which does not contain Mathematics, in other words Mathematics is an essential aspect of our daily life.

Despite the high attribute attached to Mathematics, the performance has been poor over the years and this trend has caused worries among the stakeholders. Several interventions have been put in place, however very little success has been realized. While releasing KCSE results for 2009, the minister for Education, Prof Ongeri expressed shock at the dwindling performance in mathematics and sciences, even with various interventions under way. He said that the decline was worrying, given the fact that Kenya Vision 2030 is anchored on the sound performance in mathematics and science subjects, the East Africa Standard, 1/3/2009. The results for KCSE 2009 and 2010 shows that mathematics is dragging behind with a mean score of 21.1 and 21.8 respectively, KNEC (2009, 2010). However, with introduction of mathematics alternative B, which was meant to cushion low achievers in mathematics, the subject improved in performance marginally; the results indicate that mathematics alternative A subject registered better performance than before. The KCSE results for 2011 shows that the mean score for Mathematics Alternative A was 28.66 while Alternative B were a mere 9.49 and in 2012 the mean

score for alternative A was 24.79 while Alternative B was 13.32. This shows that even though Mathematics Alternative A was slightly high, Alternative B was extremely poor, making overall performance in Mathematics very low as compared with other subjects.

Figure 1.1 performance of mathematics in Kenya

2009	2010	2011		2012	
21.1	21.8	Alt A	Alt B	Alt A	Alt B
		28.66	9.49	24.79	13.32

Source of the figures; *KNEC*

In Konoin district the performance of mathematics is no difference with the national mean, it is least performed. Referring to KCSE results for 2012; Mathematics means was 4.6549 and was ranked the last of all other subjects registered by candidate in Konoin District. Mathematics results for 2009, 2010 and 2011 were 3.8946, 3.4232 and 3.628 respectively and were also rank the last next to Chemistry for the three years. Since Konoin is a new district, the results for other years were combined with those of Bureti district; however the mean score were still very low when the results for the two Divisions forming the district are put together. This is clear indication that proofed that mathematics is facing challenges in the district and the country at large.

Figure 1.2 performance of mathematics in Konoin

2009	2010	2011	2012
3.8946	3.4232	3.628	4.6549

District Education Office; Konoin District

There are several challenges facing secondary mathematics and science subject, among those challenges are negative attitudes (of teachers, students, parents and education managers), weaknesses in pedagogy/methodology, teacher competencies, administrative guidance, mobilization, prioritization and utilization of resources among others (MOE,2005).

Several research and studies which has been conducted by different scholars have found that proper assessment that matches with instruction is likely to increase

learner's achievement in Mathematics, Chisholm,Volmink, Ndhlovu, Potenza, Mahomed, Muller, Lubisi, Vinjevold, Ngozi, Malan and Mphahlele (2000). There has been some blame on a lack of alignment between curriculum and assessment policy as well as clarity regarding assessment policy and practice. In view of Hattie and Timperley (2007),effective teaching not only involves imparting information and understandings to students or providing constructive tasks, environments, and learning, but also involves assessing and evaluating students' understanding of this information, so that the next teaching act can be matched to the present understanding of the students. The experience of Naroth C, (2010), who was a researcher as well as Coordinator of Mathematics in a certain Province of South Africa, raised some questions on assessment practices which resulted in very low achievement levels of Mathematics learners. His evidences was supported by Stiggins (2008), who stated that, the vast majority of teachers and school leaders carry out their assessment practices with neither the confidence nor competence needed to do so productively to support student learning.

It is a common practice in our school for teachers to give their learners some task in the form of test, home work, or written exercise for the purpose of assessing the achievement. For the task to have meaning and influence the learners positively, the teachers should mark and write descriptive feedback alongside the work of the learner where the errors are found.

The poor performance by the learners is worsened by inadequate formative assessment that is done by teachers. This claim was corroborate by Naroth C, (2010), in stating that teachers' assessment practices have been found to exacerbate poor learner performance rather than serve to provide information on the learners' strengths and weaknesses so as to modify the teaching and learning activities and ultimately improve learning.

In the current era of accountability in everything done in school and the issue of performance contracting in Kenya, and highly publicize vision 2030, that is vividly known by the leadership of this country that the only vehicle to make it a reality is education, teachers would then be required to go an extra mile by being more initiative and innovative they are able to employ a vibrant strategy in their instruction and assessment so as to be responsive to society needs. It is imperative

therefore for mathematics teachers to design a strategy that could enhance learner's achievement and greater understanding of mathematics.

Descriptive feedback is friendly, it does not insults learner self-confidence but rather informative and enables the learner to comprehend their shortcomings or errors thereby assisting to overcome them. Effective communication systems rely on descriptive feedback to support learning balanced with judgmental feedback to verify it, Stiggins R.(2008). Since formative assessment are not graded and are only used to inform the specifics as to what students needs to be re-taught and what needs to be re-learned for a student to master an objective, (Vicki J. Barry Hickman, NE 2008). Referring to the work of, Anastasiya A. Lipnevich Jeffrey K. Smith (2008), who stated that detailed, specific, descriptive feedback, which focuses students' attention on their work rather than the self, is the most advantageous kind of information that should be provided to students. The benefit of such feedback occurs at all levels of performance. Descriptive feedback is a useful technique to address the gaps between the performance and the pre-determine objective. Descriptive feedback helps an individual student improve a particular piece of work or an approach to a problem or performance, with the goal of helping him or her become a more skilled, independent learner. Learners must understand the meaning of the feedback written on their books for it to be effective.

1.2 **Statement of the Problem**

For many years mathematics and science is performed poorly in KCSE examination in Kenya,(millennium development goals in Kenya needs, (2005), this demonstrate that teaching and learning of these subjects are faced with myriad of challenges and inadequacy which result in low academic achievement.

In spite of, numerous interventions such as SMASSE and others which have been put in place with an aim of improving the performance of the subjects, very little if any have so far been realized.

By putting check mark and grades on learners work may not be adequate as they lack not only motivational power but also corrective strategy. Effective teaching needs regular physical interaction between the teacher and the learner. However,

considering amount of time available for such interaction and the pressure of work among the teachers due to the current understaffing of teachers in the country, such interaction may not be possible.

This research is carried out to determine the effect of descriptive written feedback on performance of mathematics in secondary school. More importantly whether descriptive written feedback can have motivational ingredients to learning and change the learners' attitude towards learning mathematics, hence fill the gap between the current performances and set standard.

Students challenges in mathematics and constant poor performance is uncalled for if the intended goal of mathematics teaching is to be achieved. Investigation was therefore necessary to determine the cause of challenges in mathematics and persistent poor results that have been witnessed in the past. This study therefore sought to provide the solution to the question, what is the effect of DWF on achievement of mathematics in Konoin District of Bomet County

1.3 Purpose of the Study

The purpose of the study therefore is to explore the effects of descriptive written feedbacks on performance of mathematics. In particular, to explore quality of work done by the learners after descriptive written feedback is provided. And more importantly, the expected change in attitude towards mathematics among the learners in secondary schools in Konoin District of Bomet County.

1.4 Objectives of the Study.

i. To determine the influence of the teacher's descriptive written feedback on achievement in Mathematics.
ii. To examine the effect of descriptive written feedback on students' reflection on errors in Mathematics.
iii. To determine the influence of descriptive written feedback on the attitude of students towards Mathematics.
iv. To determine the influence of goal directed descriptive written feedback on achievement in mathematics.

1.5 Hypotheses of the Study

From the foregoing objectives, the study aimed at testing the following null hypotheses in relation to the use of descriptive written feedback in assessment of mathematics in secondary schools. The hypotheses were tested at significance alpha level of 0.05.

HO1: There is no significant relationship between descriptive written feedbacks and achievement of students in Mathematics.

HO2: There is no significant relationship between descriptive written feedback and students' reflection on errors in Mathematics.

HO3: There is no significant relationship between descriptive written feedback and the attitude of students towards Mathematics.

HO4: There is no significant relationship between goal directed descriptive written feedback and learners' achievement in mathematics.

1.6 Significance of the Study

This study seeks to generate useful information regarding assessment of learning especially in Mathematics that can be useful to teachers and other education stakeholders. As Kenya strives towards attainment of the vision 2030 and the Millennium Development Goals (MDG), it is believed that the only vehicle that will actualize these goals is education, particularly Mathematics and Science as a gateway to technological compliant. This Study seeks to determine effects of corrective written feedback and make appropriate recommendation that would see improvement in achievement of Mathematics.

1.7 Basic Assumptions of the Study

It is assumed that the respondents will co-operate and provide accurate information when responding to the research questions. It is also assumed that the sample size chosen will be adequate to enable the researcher draw a valid conclusion about the population.

1.8 Limitations of the Study

Time constraint is a limiting factor because the study needs to be concluded within a short time. Availability of funds is also another limiting factor to the study since the researcher is a self sponsored. There is no assurance that the respondents will return all the questionnaires duly completed, neither is there an assurance that the interviewers will respond to all the questions put forward to them comprehensively.

1.9 Delimitation of the Study

The study is restricted within Konoin District of Bomet County. The study focuses on effects of corrective written feedback in assessment of Mathematics in Form three in Day Secondary School.

1.10 Definition of the Terms

Achievement students succeeding in acquiring new concept and knowledge by making their own efforts

Assessment: The process of obtaining information that is used for making decisions about students, curricular and educational policy.

Attitudes are feelings and beliefs that largely determine how one perceives their environment, commit themselves to the intended actions and intimately behave.

Delayed Feedback- is feedback given to students after four days

Descriptive Feedback is comments provided to an individual student to improve his or her performance

Feedback is a type of formative assessment used to improve instruction and provide mechanisms to support continued learning

Goal directed feedback written explanation to the students describing every step that the student should follow where there is an error

Immediate Feedback is feedback given to students within one days

Non-goal directed feedback short calculation showing the student how they would have solved the problem

Performance how well or badly a student does a particular task or activity.

Reflection on errors students thinking about the errors they committed when they were solving problem.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This section consists of review of related literature. The section contains: introduction, categories of feedback, influence of descriptive written feedback, timing of feedback, students' reflection on errors, attitude towards mathematics and goal directed feedback. It also includes theoretical framework and conceptual framework is at the end of the chapter.

2.2 Corrective Feedback and Assessment of Learners.

There is a wide variety of potential corrective feedback choices when dealing with written feedback. While the choice may be somewhat varied, it demonstrates the creativity and inquisitiveness of teachers and researchers who strive to find the most effective means to give feedback in an attempt to enact the greatest change, Anderson T. (2010). It is upon the teacher to choose appropriate feedback suitable for his/her class. The researcher will discuss two types developed by Ellis R. 2009 and Tunstall and Gipps (1996).

Typology developed by Ellis R. 2009 while investigating the effects of different type of written corrective feedback was able to distinguish two sets of options relating to strategy of providing feedback; the first, (direct, indirect, focus of feedback or reformulation of feedback), and the second was the response of the learners to the feedback by either revision required or attention to correction only.

The feedback typology developed by, Tunstall and Gipps (1996), was categorized into two major types: descriptive and evaluative. Positive evaluative feedback includes rewards, Positive personal expression Warm expressions of feeling and general praise. Negative evaluative feedback includes punishments, Negative personal expression Reprimands; negative generalization, general criticisms, and so on. On the descriptive side, however, all of the feedback has a positive intention. Even criticism, if it is descriptive and not judgmental, is intended to be constructive.

From the analyses of, Tunstall and Gipps (1996), the first two types of feedback mentioned, rewarding or punishing and approving or disapproving, can lead to performance-goal orientation, which is evaluative. The third and forth types of feedback, specifying attainment or specifying improvement and constructing achievement or constructing the way forward, can lead to a mastery goal orientation, which is descriptive.

The descriptive feedback should be specific and constructive, focused on individual improvement and progress, recognizable to students' effort, open to opportunities for improvement, and encourages students to view mistakes as a part of learning, (V. J. Barry 2008). When students receive this type of feedback, they will know why they have made the mistakes and will be able to improve their learning (Tunstall & Gibbs, 1996). With reference to this research, the judicious combination of both evaluative and descriptive types of feedback by the teacher creates the most powerful support for learning.

2.3.1 Assessment of Mathematics in the Classroom

Assessment of students is an important technique in teaching and learning process as it seeks to collect and interpret data regarding learner's academic achievement for decision making. (A. B. Nsamenang and M. S. Tchombe 2011), define assessment as the term generally used to refer to all activities teachers use to help students learn and to gauge student progress or the outcomes of the curriculum. The purpose of meaningful assessment is to inform instruction by providing information about student learning. This information can then be used to provide direction for planning further instruction. Assessment should occur in authentic contexts that allow students to demonstrate learning by performing meaningful tasks.

Meaningful content and contexts for assessment help students by engaging their attention and encouraging them to share their work and talk about their progress. Students need to take an active part in assessment. When students understand assessment criteria and procedures, and take ownership for assessing the quality, quantity, and processes of their own work, they develop self-assessment skills. The ultimate goal of assessment is to help develop independent, life-long learners who regularly monitor and assess their own progress. To find out learners level of

acquisition of knowledge and skills, teachers use diagnostic, summative and formative assessment.

Diagnostic assessment evaluates pre-existing knowledge before the entry or introduction of a new concept or rather new knowledge. According to (A. B. Nsamenang and M. S. Tchombe 2011), Diagnostic assessment measures a student's current knowledge and skills for the purpose of identifying a suitable program of learning. Summative assessment is used to measure achievement of the learners at the end of the term or year or at the end of the course. It is traditionally used to elicit the level of learner's achievement regarding the target course of study; Muammer Çalik (2008).Summative assessment is regularly used punitively to classify learners as successful or unsuccessful. If the learner scores highly in a test, that student is considered to have met the target and is label successful while those who score low marks are considered to be weak and label failure. This culture has compromised acquisition of desired knowledge and skills because it encourages rote learning and examination malpractices such as cheating which is witnessed during national examination. Most importantly, summative assessment has encouraged the decline in transition rate and drop out in school as most learners particularly the low achievers would not like to be embarrass with the results.

Formative assessment informs instruction and is used to determine whether at all learning really take place. It use assessment procedure that aims at improving learners' knowledge hence, enhance learning. Tunstall and Gipps (1996), describe formative assessment as a process of appraising, judging or evaluating students' work or performance and using this to shape and improve their competence. According to Sadler (1998), formative assessment refers to assessment that is specifically intended to generate feedback on performance to improve and accelerate learning.

Formative assessment improves learning in the classroom set up as opposed to grading or labeling learner's performance without any follow-up activity. Formative assessment clearly concentrates on using feedback as an interactive tool to remediate learning. Heritage, M. (2010),state that formative assessment is a process that takes

place continuously during the course of teaching and learning to provide teachers and students with feedback to close the gap between current learning and desired goals. Cathy Kinzer, Janice Bradley, and Patrick Morandi, (2013), further gave definition of feedback as a type of formative assessment used to improve instruction and provide mechanisms to support continued learning. In this connection therefore, learners receive feedback, formally or informally, as they engage in learning experiences.

Feedback is the most important component of formative assessment since it play significant role in learner's academic progress. In learning and teaching process, feedback foster learner's cognitive developments which result in improve academic achievement, (Muammer Çalik, 2008). Teachers 'transmit' feedback messages to students about what is right and wrong in their academic work, about its strengths and weaknesses, and students use this information to make subsequent improvements, D. J. Nicol andD. Macfarlane- Dick, 2006. Feedback employed by teachers in the classroom can be motivational, evaluative or descriptive, based on standards or learning goals, Cathy Kinzer, Janice Bradley, and Patrick Morandi, (2013). The main purpose of this research is to explore descriptive feedback with a clear goal of improving student achievement by guiding the learner on the steps to take in order to improve academic achievement. According to, Melanie Greenan,(2010),descriptive feedback helps students learn by providing them with precise information about what they are doing well, what needs improvement, and what specific steps they can take to improve. Its intention is to tell the learner what needs to be improved and also gives specific guidance as to how to improve the learners' reasoning.

2.3.2 Written Feedback and Achievement

Despite of several research and writing on written feedback, there are still inconsistencies in the research which make it unclear what role written feedback should play in formative assessment.

When a teacher is providing feedback to learners the purpose is to correct the errors the learners commit while performing the task. In this case there must have been the desired goal set by the teacher for the learners to achieve. However for certain

reasons learners could not performed as expected, the role of feedback then is to bridge the gap between the set standard and the current performance. This opinion was supported by Hattie and Timperley (2007) by asserting that the main purpose of feedback "is to reduce discrepancies between current understandings and performance and a goal.

There has been a lot of debate surrounding corrective feedback immediately after John Truscott (1996, 2007), denouncing the effectiveness of error correction through feedback. In his review and meta-analyses of different publication of previous research, he recommended that corrective feedback in error correction is not only ineffective but also harmful and should be abandoned. He cited the following reasons; (a) Substantial research shows it to be ineffective and none shows it to be helpful in any interesting sense; (b) for both theoretical and practical reasons, one can expect it to be ineffective; (c) it has harmful effects.

According to Truscott 1996, the previous researchers compared the writing of students who received error correction over a period of time with those of students who have not. Their conclusion would be if correction is important for learning, then the former students should be better writers, on average, than the latter. If the abilities of the two groups do not differ, then correction is not helpful. The third possibility, of course, is that the uncorrected students will write better than the corrected ones in which case, correction is apparently harmful.

After making that sensitive statement, many other researchers came forward and do more review of existing literature as well as carrying out more research in the field of feedback and error correction to learners. Among the researchers who made their contribution regarding Truscott claims are; (Bitchener, & Knoch, 2008); Sheen, 2007). Vicki J. Barry Hickman, NE Math, (2008), (Ferris, 2004; Guénette, 2007) and many others.

According to the evidence advanced by sheen 2008, corrective feedback may enhance learning by helping learners to (1) notice their errors in their written work, (2) engage in hypothesis testing in a systematic way and (3) monitor the accuracy of their writing. This opinion was reinforced by Ferris (1999, 2004) arguing that error

correction is still necessary and useful, because most students prefer, need, and trust teachers' feedback. In particular, her 1999 response to Truscott's 1996 article questioned his cynicism towards corrective feedback by referring to problems with Truscott's positions. (a) The subjects in the various studies are not comparable; (b) The research paradigms and teaching strategies vary widely across the studies; and (c) Truscott overstates negative evidence while disregarding research results that contradict his thesis.

In emphasizing her sentiment, D R Ferris 2004, made further critical analyses and review of a good number of both primary and secondary research surrounding error correction, including those reviewed by Truscott. Ferris 2004 found that only six studies actually examined error correction versus no error correction compared, of the six studies, only two made the comparison over a period of time. Three studies demonstrated evidence in favour of helpfulness of error correction, one finds positive evidence for error correction but interpret it as negative, one was inconclusive because of the missing information and finally one provided support for Truscott claim by reporting that no advantage for error correction.

Ferris 2004 attributed different results obtained to the following factors; the type of students, whether there was requirement for revision after error correction, the instructors who provided the error feedback, how the error feedback was given, whether or not particular error type was specified and operationalised for research, whether or not there was control group, whether or not there was baseline or pretest measure and the nature of posttest measure.

The review done by Ferris 2004, was in favour of error correction, but suggested further investigation on error treatment, including feedback by teachers, as a necessary component of instruction and therefore, must be done competently.

2.3.3 Timely Feedback and Achievement in Mathematics

There has been a lot of debate whether feedback should be given immediately or delayed after the learners have been given some tasks. However, the most puzzling question is how immediate should it be given? Could it be after one hour or one day?

And how long should we delayed? Is it five days, one week or one month? The solution to these questions may proof difficult to get, however by looking at the intention and the purpose of feedback may lead us closer to the answer. According to Shute 2008, immediate feedback may be defined as right after a student has responded to an item or problem or, in the case of summative feedback; right after the student has completed a quiz or test. Delayed is usually defined relative to immediately, and such feedback may occur minutes, hours, weeks, or longer after the student completes some task or test.

The supporters of immediate feedback argue that immediate feedback hinder the learner from confusion and keep the learning process efficient. Research on immediate feedback, done by Corbett and Anderson (2001), found that any type of feedback was better than no feedback. Another study of immediate feedback, performed by Lee (1992) as cited by Mathan and Koedinger (2005), showed that students given immediate feedback during instruction completed problems significantly faster that those given delayed feedback and both groups performed equally well on a posttest given the following day. The study also found that those given delayed feedback exhibited better retention as they performed significantly better on a fact transfer task.

Feedback given immediately after a test like situation is best. In general, the more delay that occurs in giving feedback, the less improvement there is in achievement. From meta-analysis made by the renowned researchers, Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001), found that feedback given immediately after a test item has a relatively low average effect size of 0.19, and providing students with feedback immediately after a test has the largest effect size of 0.72. From the study of Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001), shows that giving tests immediately after a learning situation has a very negligible effect on achievement, but giving a test one day after a learning situation seems to be optimal.

Opponents of immediate feedback argue that it may detract from individual control over the problem-solving process. One study pointed out, “Immediate feedback may reinforce the belief prevalent among many students that problem solving is an

immediate and single-step process rather than the deliberate and reflective process described by educational researchers" (Nathan, 1998 as cited by Mathan and Koedinger, 2005).

There has been a general view that immediate feedback provided to learners is effective, due to the theory advanced by Skinner, (1958), in which teaching machine was introduced. However, subsequent researchers debunked that theory and so far came up with much different results. At the dusk of 1960 and at the dawn of 1970 there was a lot of research on timing of feedback with a contrary opinion as earlier adduced. In an experiment conducted by Sassenrath and Yonge (1968), in which learners were given a test immediately after giving them feedback and then a second test 24 hours later. Their results show that the performance of learners who were given immediate test was equivalent to those of learners who had their feedback delayed. However, on the more important and realistic delayed test, learners who got delayed feedback performed better than learners who got immediate feedback, Thalheilmer (2008).

The purpose of providing learners with written feedback is to assist them to improve academic achievement, especially where they have made errors. Feedback needs to come while students are still mindful of the topic, assignment, or performance in question, Thalheilmer (2008). It needs to come while they still think of the learning goal as something they are still striving for, not something they already did. It especially needs to come while they still have some reason to work on the learning target. The longer the delay, the less likely it is that the student will find it either useful or be able to apply the suggestions (Gibbs and Simpson 2005, Freeman and Lewis 1998).

Brosvic, Epstein, Dihoff, and Cook (2005) found benefits to immediate feedback over delayed feedback in a fairly realistic classroom environment for learners taking tests.

Timing of feedback depends on the several factors; among them is the purpose and kind of task given to learners. Hattie and Timperley (2007) relates the timing of feedback to the level at which the feedback is directed. For example, if feedback is

directed at the task level, then immediate feedback can result in faster rates of acquisition; if feedback is directed at the level of processing the task, immediate feedback can detract from the learning of routine procedures and the associated strategies of learning. Similarly, in their meta-analysis of the studies, Kulik and Kulik (1988) reported that at the task level, some delay is beneficial, but at the process level immediate feedback is beneficial if the feedback is intended to elicit retrieval of the concept learnt. The experiment conducted by Neha Sinha (2012), shows that delayed feedback on multiple-choice questions improved performance on subsequent short-answer versions of those questions.

2.4 DWF, Students' Reflection and Errors in Mathematics

Learning is an active process, students learn by doing some activities, constructing and building ideas, they also learn by speaking and writing. Most importantly, they learn by thinking about experience, events and activities. This was termed as reflective thinking and was first proposed by John Dewey and defined it as an active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends, John Dewey (1933). According to Phil Race (2002) 'The act of reflecting is one which causes us to make sense of what we've learned, why we learned it, and how that particular increment of learning took place. Moreover, reflection is about linking one increment of learning to the wider perspective of learning - heading towards seeing the bigger picture. Karen H. (2004) stated that Learners construct their own meaning about situations drawing on both their cognitive skills (reasoning, knowledge) and meta cognitive skills (intuition, self awareness). When something new is experienced the learner recollects prior knowledge and tries to make a connection into the existing cognitive or meta cognitive network of ideas. The process of reflection provides a structure for these connections. Laurillard (1993) draws a distinction between mediated learning (aided by a teacher) and non-mediated learning (experiential). Reflection can help to supplement mediated learning by helping the individual to make connections between the theory and constructs they have learnt formally. In the article of (Boud, Keogh, and Walker 1985), entitled Turning Experience into Learning, identified three key phases of definition of reflection: 1) returning to experience – recalling or detailing salient

events; 2) attending to or connecting with feelings; and 3) evaluating experience – re-examining experience in the light of one's intent and existing knowledge, integrating new knowledge into one's conceptual framework.

This involves repeated thinking and searching upon encountering problems; combined with observations of the surrounding environment, understanding of the causal relationship stimulates deeper thinking. It is an important human activity in which people recapture their experience, think about it, mull over and evaluate it (Boud, Keogh and Walker, 1985). Reflection occurs in the mind of a learner and enables that individual learner to increase the way they comprehend their own thinking process. Therefore Reflection is a psychological activity that extracts and forms meaning from experience, which contributes to reorganizing and restructuring perceptions, Min Jou and Jaw-Kuen Shiau , (2012); To effectively change the notions that are incorrect in the thinking of a learner, that particular learner need to critically analyze their learning outcomes to not only get the right answer, but also to rectify their misunderstandings. To do this students engage in the Mathematics formative assessment that use descriptive written feedback provided by the teacher. In the framework of this procedure, learner analyze their work, scores, and descriptive feedback to assess their own work and identify errors, complete an analysis of their errors - identifying the specific place where the error occurred and explaining what went wrong, and self-reflect, Katharine W. Clemmer (2009). As students reflect they respond to questions that engage them in exploring what next steps are needed to achieve mathematical literacy and proficiency. Students analyze the learning targets for which they were ready to demonstrate mastery, targets for which they were not prepared, and the reasons for strengths and gaps in learning. Learning is enhanced when students are encouraged to reflect on their own learning, to review their experiences of learning, and to apply what they have learned to their future learning, Katharine W. Clemmer, (2000).

Instructions provided by the teachers is expected to influence learners behavior forever, however, the learners occasionally may forget how to solve a particular problem, if at this point in time the learner is endowed with skills of reflective thinking, then that problem will be solved. Descriptive feedback which is written on the learner s work pointing out the errors committed by the learner will evoke the

mind of the learner to remember how to solve the problem. According to the article by Min Jou and Jaw-Kuen Shiau , (2012); viewed reflection as the process of integrating experience or past perception with newly received perspectives before further internalization into personal knowledge. Therefore, reflection is thinking with the additional components of reflection. Paris and Ayres (1994) pointed out that reflective thinking motivates students to learn; applying strategies to accomplish specific objectives.

Reflection may occur before or after the action, which indicates that personal knowledge is progressively formulated during actual working action. Regarding the relationship between personal action and reflection, Elliott (1991) stated that reflection originates from action, which suggests that reflection is generated from collected information during personal action. From a teaching perspective, Schon (1983) divided reflection into two major frameworks: reflection-on-action and reflection-in-action. Reflection-on-action indicates that reflection occurs in the interval after teaching and before planning and thinking. Reflection-in-action is an attempt to adjust personal teaching and deal with responses during the process of teaching. Carver and Scheier (1998) identified self-reflection as individualistic survey, evaluation, and comprehension of personal thoughts, feelings, behavior, and self-awareness. Davis (2000) requested learners to perform self-reflection during the process of learning; the action of reflection allowed the learners to re-survey, test, and modify existing thoughts and knowledge, which further achieved improved and more structured comprehension. Costa and Kallick (2000) believed that students who could conduct self-reflection were more able to gain cognitive structure among teachers and classmates as they had a clearer understanding of their own steps in reasoning.

Learners reflect on their studies so that they are able to identify the points of weakness and strengths. Where the students are doing badly they should have remedial program guided by descriptive feedback. However, it is imperative for the success in the 21st Century that the students become reflective and meta-cognitive thinkers who are able to independently determine next steps for their own learning, Melanie Greenan 2010.

2.5.1 Attitude Towards Mathematics

Attitude is a very important component of learning, it is a belief and feelings one have towards something. According to Newstrom and Davis (2002), as cited by M'Kiambi Kinanu Jannis (2013), attitudes are feelings and beliefs that largely determine how one perceives their environment, commit themselves to the intended actions and intimately behave. Nicolaidou M. & Philippou G. (2003), refers to attitude as a learned predisposition or tendency of an individual to respond positively or negatively to some object, situation, concept or another person. This positive or negative feeling is of moderate intensity and reasonable stability; sometimes it is especially resistant to change. To change attitudes, the new attitudes must serve the same function as the old one, Akinsola & Olowojaiye (2008). Instructional design can create instructional environments to effect attitude change. In the greater realm of social psychology, attitudes are typical classified with affective domain, and are part of the larger concept of motivation (Greenwald, 1989).

For a learner to do well in mathematics he/she must have positive attitude towards it. Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. It affects students' achievement in mathematics. Students' success in mathematics depends upon attitude towards mathematics. It also influences the participation rate of learners, Muhammad S. F. and Syed Z. U. S.,(2008*)*. The teaching method, the support of the structure of the school, the family and students' attitude towards school affect the attitudes towards mathematics. Usually, the way that mathematics is represented in the classroom and perceived by students, even when teachers believe they are presenting it in authentic and contextual way can stand to alienate many students from mathematics Furinghetti and Pekhonen, 2002). Researchers concluded that positive attitude towards mathematics leads students towards success in mathematics. Several studies have shown that positive **a**ttitudes are conductive to good performance. The analysis of the data by Nicolaidou M. & Philippou G. (2003), whose basic aim was to explore relationships between students' attitudes towards Mathematics, self-efficacy beliefs in problem-solving and achievement and also the possibility of attitudes to predict problem-solving performance, revealed that a high proportion of students hold positive attitude towards mathematics. Their answers on the linear scale indicated that 50% adore Mathematics, while 21.8% consider the subject as one of their

favorite lessons. 18.1% declare neutral, choosing the middle of the scale, and only 10.1% express negative attitudes, hate and disgust.

However, an individual's attitude towards Mathematics can be influenced by many factors. It is generally held that females exhibit less positive attitudes towards mathematics than males do. The foundation of success, regardless of our chosen field, is attitude.

Attitude is a phenomenon which is learned from the social environment, it is not inborn. Students acquire positive attitude towards mathematics from their peers, parents and teachers and also negative attitude equally from the same sources.

Students who believe Mathematics to be difficult do not work hard in class and put more effort in other subjects because they are already have a believe that mathematics is difficult and are only waiting to fail in it since Mathematics is a compulsory subject in KCSE, Such students can attend Mathematics classes sluggishly. Some of these students may end up joining the teachers training college to train as teachers and transmit that negative attitude to younger generation of students. Teachers should direct their efforts towards attitude development as well as academic growth. M'Kiambi K.J. (2013), stated that teacher's own attitude is very important. A teacher is not likely to succeed in training others to enjoy what he himself does not appreciate. Therefore Mathematics teachers should avoid comments such as; Mathematics is difficult in presence of their students and also teachers teaching other subjects.

Attitudes are psychological constructs theorized to be composed of emotional, cognitive, and behavioral components. Attitudes serve as functions including social expressions, value expressive, utilitarian, and defensive functions, for the people who hold them (Newbill, 2005). In summary from the aforementioned importance attached to attitude towards mathematics the researcher intention is to determine whether the use of descriptive written feedback in formative assessment can improve the attitude of students towards mathematics.

2.5.2. Students and Descriptive Written Feedback

Since learners are material form of teaching, it is imperative to seek their opinion on how they perceive descriptive written feedback on their work. Traditionally, it is a common practice among the teachers to correct learner's misconception, after administering some task given to learners in form of assignment or written quiz, Learners would like to have the errors corrected by their teachers, however the mode of error correction, learners have varied opinion when they are Provided with written feedback which is descriptive. While carrying out the study, the participants of Ahmed Nazif, Debasish Biswas & Rosangela M. Hilbig (2005), agree that feedback is helpful to learning, they appear to differ in certain aspects regarding their preference for and attitudes towards feedback and its various form.

A good number of publication by various researchers shows that learners perceive feedback as one strategy for relearning where they misunderstood, while many other studies view written feedback as a waste of time as they do not have time to read feedback written by the teachers. The findings of the research done by Mariëtte Koen, E.M. Bitzer2 and P.A.D 2012, suggested that written feedback enabled students to read both the diagnosis of their errors and the suggestions on how to improve. They said that students believed written feedback to be meaningful because they could always go back to reread the feedback and reflect on it again, hence students are keen to receive written feedback because it is personal. Through the work of Selmen Salima,(2006), of investigating the students' attitudes to teachers' feedback in writing. The results show that the students are interested in avoiding errors in their writing, and therefore, want and expect their teachers to correct all errors in their written work.

In the study of Katrien Struyven, Filip Dochy and Steven Janssens,(2005); they found that provision of feedback on assessment was considered a valuable form of support for learning. They said effective feedback was in their view critical to 'build self confidence, their findings reports that the students were enthusiastic on receiving DWF and could be found saying, "DWF help us evaluate ourselves" and students wanted more of it. Students preferred one-to-one tutorials as a method of providing effective feedback, while recognizing that staff pressures made this difficult.

In the analyses of Santos and Pinto, (2009), who had the opinion that feedbacks have been ineffective not due to its form as such but due to the students perception of the task itself, found that student with low achievement, values more reaching a correct answer rather than the explanation of the process use to reach that answer.

Referring to the study done by Vicki J. Barry, 2008, who found out that descriptive feedback is so important for students because many of them do not have many opportunities to reflect on their learning. She said having the students to do so at first was challenging because finding how they solve a problem wrong was more difficult than just counting it wrong. But after some practice and modeling, students became more comfortable and the anxiety of feedback turned into a good thing. In her study more students started turning in more of their homework and they started showing more of their work on their assignments because they did not want to be left out of the feedback sessions. The students also went from stressing about giving feedback to begging for it when they did not receive any.

The findings of Camella Buddo 2013, suggest that collectively, the students' perceptions of the teachers' classroom practices for teaching mathematics ranged from moderately positive with a mean of 2.11 and standard deviation of 0.39. He further stated that the main purpose of assessment is to determine what the students know and can do, and to provide feedback to the students on their areas of strengths and weaknesses.

The research that was done by Grami, G. M. A. (2005), in Saudi Arabia in English language demonstrates that student writers by all means desire and expect feedback from their writing teachers. It also shows that students do believe that they benefit a lot from such feedback. This can be easily noticed through their high responses means which certainly show solid evidence that they appreciate error feedback.

The study of Rowe, A.D. and Wood, L.N. (2008), who investigated students' perceptions of feedback, when they were given an opportunity to reflect on the importance of feedback in their learning, clearly showed that improvements in the way feedback is communicated by academic staff would increase quality of the student experience.

2.6 Goal Directed Feedback and Achievement in Mathematics

Teachers in several occasions provide goal directed feedback to the learners, with the purpose of furnishing them with substantial information regarding their performance towards established standard. For the learner to remain motivated there must be close connection between the goals of the learner and the set standard. If the goals are set too high such that the learner is not able to attain, the learner will be discouraged and is likely to abandoned it altogether, and if the goals are too low such that their achievement is guaranteed, the learners loses impetus to put more effort on their work, Shute V.J., (2007). Feedback must be well defined and be directed towards goal attainment.

The attributes of quality formative assessment include established learning goals and clear explanations of the goals and criteria for students to meet those goals, Valerie J. Shute, (2008). For students to remain motivated and engaged, literature suggests that performance goals need to be personally meaningful to students, and there needs to be an expectation that they can be attained, Bransford, Brown, and Cocking (2000).

Feedback informs the learner whether the set goal has been attained or not, if the goal is achieved, it allows the learner to set a further appropriate goal. Thus redirecting learners back to the initial target hence focusing their attention on a definite goal. According to Hattie and Timperley (2007) effective feedback must answer three questions, these are; Where am I going? (the goals); How am I going? (What progress is being made toward the goal?); and Where to next? (What do I need to do to improve?). In looking for the answers to the above questions, Hattie and Timperley (2007), identified four levels at which feedback is directed to in order to influences its effectiveness.

First, when our attention is focused on the task level, we are concerned primarily about shrinking the gap between actual performance and performance goals. This is the intended outcome of most feed-back interventions, and it should ultimately result in improved performance, (Kluger, A. N., & DeNisi, 2011). Feedback can be about a task or product; these explain how a task is being performed, whether the solutions are right or wrong. At this level feedback guide the learner in acquisition of more

important information. This type of feedback is also referred to as corrective feedback. Feedback about the task has been found to be more powerful when it corrects misconceptions than when it alerts students to lack of information (Hattie & Timperley, 2007). However, one problem with feedback about the task is that it may not transfer to other tasks because it is specific to the particular assignment. In that sense, although it contributes to better learning for the task at hand, task feedback does not contribute to further learning. According to, (Hattie & Timperley, 2007), too much feedback at the task level could make the learners to use trial and error to arrive at the immediate goal rather than applying the required strategy to attain the goal.

Second, feedback can be aimed at the process used to create a product or complete a task. This kind of feedback is more directly aimed at the processing of information, or learning processes requiring understanding or completing the task, (Hattie & Timperley, 2007). For example, in a situation where a learner is given a problem like,$x^2 + x - 6 = 0$.The teacher using written feedback can ask the learners to factorize first in order to get the roots of the equation. According to (Hattie & Timperley, 2007), feedback information about the processes underlying a task can act as a cueing mechanism and lead to more effective information search and use of task strategies. Providing the cues assist learners in rejecting incorrect ideas and show direction for searching and strategizing. Charmon Naroth (2010) reiterated that, feedback is most effective when the two are combined. Feedback about processes shows students the connections between what they did and the results they got.

Third, feedback to students can be focused at the self-regulation level, including greater skill in self-evaluation or confidence to engage further on a task, (Hattie & Timperley, 2007). Self-regulation is the process students use to monitor and control their own learning. Self-regulation can lead to students seeking, accepting, and acting on feedback information or not. Hattie and Timperley (2007), identify six aspects of feedback at the self-regulation level that affects the effectiveness of feedback: the capability to create internal feedback; the ability to self-assess; the willingness to invest effort into seeking and dealing with feedback information; the

degree of confidence in the correctness of the response; the attributions about success or failure; and the ability to seek help.

Fourth, feedback can be personal in the sense that it is directed to the "self." Kluger, A. N., & DeNisi, (2011), stated that feedback interventions that focus our attention at the level of the self can interfere with subsequent performance by diverting attention away from the task to questions of who we really are. Feedback about the person is generally not a good idea, claimed by Hattie and Timperley (2007), for two reasons. First, it doesn't contain information that can be used for further learning, so it's not formative. Second, and more insidious, feedback about the person can contribute to students believing that intelligence is fixed; finally these strategies have a negative effect on learning.

For feedback to be most useful, it should be directed to a specific level of skill or knowledge. A study by, Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001), assert that feedback should be criterion referenced, as opposed to norm-referenced. When feedback is norm-referenced, it informs students about where they stand in relationship to other students. This tells students nothing about their learning. Criterion-referenced feedback tells students where they stand relative to a specific target of knowledge or skill. In fact, research has consistently indicated that criterion referenced feedback has a more powerful effect on student learning than norm referenced feedback.

2.7 Theoretical Framework

This study is based on the theory of cognitive theory postulated by Piaget, (1980) and social constructivist theory advanced by Vygotsky's (1978).

2.7.1 Cognitivist Learning Theory

Cognitive theory emphasizes on the internal mental structures of the learner, thus lending itself to abstract information processing rather than actual behaviors" (Geregae 2001), cited by Charmon N. (2010). Cognitive theorists acknowledge the importance of reinforcement; however they underscore its role in providing feedback about the correctness of responses over its role as a motivator.

According to Piaget, humans have two ways of adapting to the external world and the acquisition of knowledge: first, new information and experiences are incorporated into preexisting schemata (assimilation) or; second, if the pre-existing schemata do not exist or do not correspond to the experience, new ones must be created or old ones must be changed to accommodate the new information (accommodation). Through assimilation and accommodation, the internal mind and the external world find a balance (equilibrium), Anderson T., (2010).

In Piaget's theory of cognition, assimilation occurs when individuals integrate new information into existing knowledge. According to Piaget (1980) assimilation is just the proof that structures or schema already exist and that external stimuli can only modify behavior to the degree that it is integrated with prior structures. Hence, in accordance with cognitive theory, Anderson T, (2010), stated that abstract formal mathematical knowledge such as symbols and computational algorithms can only make sense to learners if it is related to their existing informal knowledge of mathematics. Baroody and Ginsburg (1990) state that assimilation and interest go hand in hand, therefore learners will only assimilate new information if it makes sense to them and arouses their interest. This was first proposed by Piaget when he stated that it is not the environment that stimulates the child, rather the child takes the initiative to respond to those features which are meaningful to him from the environment.

According to Katrin Rolka, Bettina Rosken and Peter Liljedahl,(2007),the new information the learners receive may form an apparent identical fit with an existing idea. This means that the students are able to make sense of the new information on the basis of their existing knowledge. The example which can be cited is when students are introduced to new concept such as raising to the power of, e.g. 5^2, the learner will deal with that problem as 5x5. In the view of approximate fit; the new information form an approximate fit with an existing idea in which aspects are seen to be related, but details may be unclear. These students encounter new ideas but do not give up old ones. However, even if contradictory, they do not reach a situation where a cognitive conflict could take place. Hence, new information is assimilated but not accommodated. For example the learner may take 5^2 to mean 5x2 instead of 5x5. But in a situation where the learner cannot find any idea closer to the new

concept, according to Katrin Rolka, Bettina Rosken and Peter Liljedahl,(2007), the new information is acknowledged as not being explained by the ideas tried so far. This incomplete fit of information results in a cognitive conflict. When students experience an incomplete fit they try to reduce the conflict by seeking information which might provide a solution. The role of cognitive conflict is a central condition for conceptual change.

For accommodation and assimilation to take place it would require constant communication between teacher and learners. In order to replace or reconstruct existing ideas learners should receive continuous feedback on their thinking processes. Assimilation and accommodation are also closely related to meta-cognition and self regulation in learning. The more the learner is responsible for the learning process, the deeper and more successful their learning will be.

Piaget also asserts that, in responding to the environment, the child engages in two types of activity – physical and logico-mathematical. Physical activity is when the child notices attributes of objects, features of situations and so forth, in the environment. This provides him with specific knowledge about the world he lives in. But there is a second logico-mathematical level of activity, which is the basis for the construction of the child's intellectual structures. Bliss (2002) as cited by Charmon N (2010), provides the following example to illustrate the point: "A child arranges a row of pebbles in a straight line, counts them and finds they are ten. He rearranges the pebbles in a number of patterns each time finding that the result is ten. What he learns is that the number does not change regardless of the pattern". Piaget emphasizes that it is the child's actions that are important not the objects. The pebbles could be replaced with any other object.

Schema can be regarded as the structure that is responsible for the interpretation of the environment (Piaget 1980). The "integration of new objects or situations or events into previous schemes" (Piaget 1980) leads to the creation of a mathematical environment in which the construction of knowledge takes place. For example, adding and subtracting two and more digit number involves only assimilation of the extra digits, at least until an algorithm is presented for dealing with large numbers, such as column addition and subtraction.

Feedback from a cognitivist perspective focuses on facilitating learning so that learners can create accurate mental representations and connections. Feedback to learners aims to focus their attention on key features of the new information, correct misconceptions, and assist learners to assimilate new knowledge with existing knowledge. As an example, when learners use their existing knowledge about subtracting whole numbers and apply the same strategy for subtracting fractions, rather than accommodating to fractions as new objects, feedback to learners must emphasize that only fraction parts that have the same denominator will have numerators subtracted.

2.7.2 Social Constructivist Theory

The adoption of constructivist learning theories in educational practice has favoured the integration of assessment, teaching and learning in a process that stresses the formative functions of assessment. Students are involved as active and informal participants, while feedback from assessments is viewed as forming an important tool in facilitating student progress in learning, Tong Siu Yin Annie, (2011). Social constructivist theory holds that a child first develops new learning during interactions with adults or more competent peers. These learning are then internalized to become part of the child's psychological world. This means that what the child is able to do in collaboration today he will be able to do independently tomorrow. According to Nicholas (2008) "social interaction is critical to learning in the zone of proximal development" and it is through feedback, suggestions and guidance from adults or competent peers that learners are supported to accomplish a task. Zone of proximal development as defined by Vygotsky's (1978) is the distance between the actual developmental levels as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. The zone of proximal development defines those functions that have not yet matured but are in the process of maturations. This applies equally to voluntary attention, to logical memory, and to the formation of concepts. Emphasis in the Vygotsky's (1978) proposed that all mental processes exist first in a shared environment and then move on to an individual plane.

In the study of Chaiklin S.,(2003), he stated that the common conception of the zone of proximal development presupposes an interaction between a more competent person and a less competent person on a task, such that the less competent person becomes independently proficient at what was initially a jointly-accomplished task and thus learning becomes properties of the learner.

From the definition of ZPD, Chaiklin S. ,(2003),categorized it into three aspect, the first aspect focuses on the idea that a person is able to perform a certain number of tasks alone, while in collaboration, it is possible to perform a greater number of tasks.

The second aspect emphasizes how an adult or teacher or more competent person should interact with a child. Sometimes this aspect is presented as the defining characteristic.

The third aspect focuses on "properties of the learner", including notions of a learner's potential and/or readiness to learn. This aspect often seems to inspire the idea or expectation that it will be possible to greatly accelerate or facilitate a child's learning, if the zone can be identified properly.

The construction of knowledge takes place as a person interacts with and explores the world, but ultimately "cognition occurs in the mind of the individual and learners make intellectual sense of the materials on their own" (Felix, 2005), as cited by Charmon N. (2010). Vygotsky (1978) theory recognize that the social and cultural worlds we inhabit play a significant role in how we view the world and acquire new knowledge; essentially, meaning and understanding of the world are products of social interaction and discovery. Instead of being passive vessels waiting to be filled with knowledge, people are social creatures who gain knowledge by their interactions with their environments. According to Origa J.O (2000), teachers have a responsibility to organize learning environment in such a way as to evoke the construction of knowledge that is objective of a socially recognizable. He stated that knowledge is objective and socially recognized if it is acceptable to others (experts) in the same knowledge domain. Vygotsky felt that "cognitive operations originate in social interactions and emphasized the role of language and culture in cognitive development as frameworks through which humans experience, communicate and understand reality".

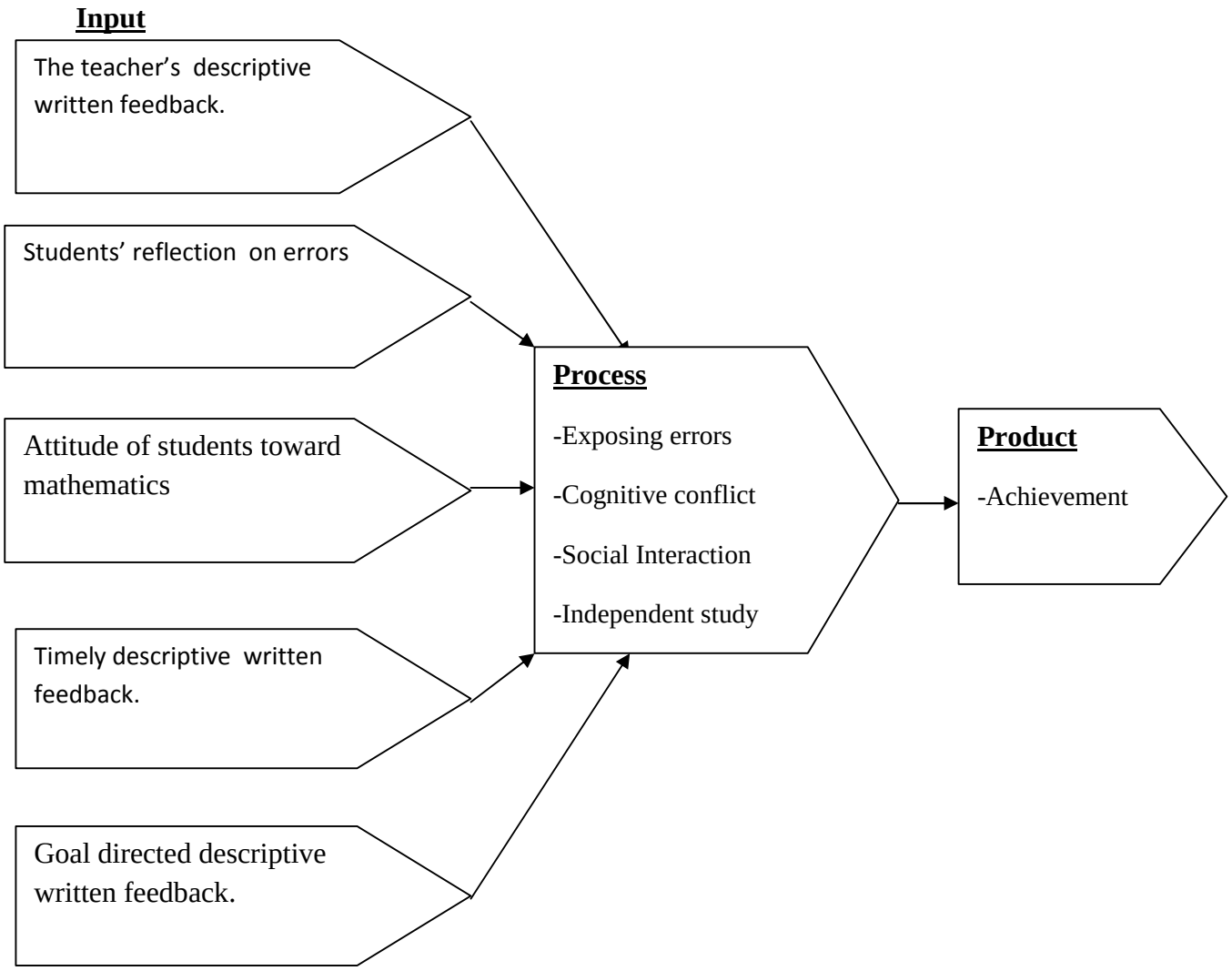
Scaffolding is a concept mostly associated with Vygotsky's social constructivism and his theory of the zone of proximal development (ZPD), which he defined as a process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. The ultimate goal of scaffolding is to provide this initial guided help which then leads to greater self-sufficiency in future tasks. As a learner is scaffold by a more able source, the process of guided learning to acquisition of new knowledge begins. Learning, according to Vygotsky (1978), takes place within the ZPD and the space between what is known and what is not yet known. To bridge this gap, a more knowledgeable teacher, parent, or peer helps facilitate learning as students build up new forms of knowledge. It is within this gap, between the actual and potential, that learning occurs.

According to Vygotsky's (1978) theory, a naive learner needs to be scaffold by more competent person through the new concept which is being introduced. As the learner continue to perform the same task repeatedly in collaboration with the teacher through descriptive written feedback interaction the learner becomes more knowledgeable, the intensity of assistance through feedback is then gradually withdrawn, eventually the learner can perform that particular task independently. At this level the learning becomes property of the learner since he can interpret his learning alone. In this study, the role of the teacher is to facilitate learning by providing learner with descriptive written feedback while the learner uses the feedback to correct the wrong work.

2.8 Conceptual Frame Work

The conceptual framework below is based on independent variables, moderating variables and dependent variables. The independent variables are; written feedback, students' reflective thinking and attitude of students towards mathematics, timing of feedback and goal directed feedback. The moderating variables are exposing errors, cognitive conflict, social interaction and independent study and dependent variable is achievement. When the independent variables are manipulated and modify by moderating variables they create an impact on the dependent variable.

Figure 2.1 Conceptual framework on DWF



Relationship between variables in the study

The figure above shows relationships between dependent and independent variables of the study. As shown in the table, input such as; the teacher's descriptive written feedback, Students' reflective thinking on descriptive written feedback, attitude of students towards mathematics, timely descriptive written feedback provided to student and goal directed descriptive written feedback, considered during assessment procedure of mathematics. The process of that input would then be exposing errors from the learners, cognitive conflict interaction between the feedback and the learners during independent study, the performance of mathematics is expected to improve.

2.9 Summary of Literature Review

The literature review that has been carried out in this study regards descriptive written feedback which is used in assessment of mathematics in particular even though in some article reviewed it was somehow general while others such as Truscott, Elis, Guannette was carrying out study in English as a second language, however education is about borrowing knowledge. There has been some inconsistent in the study of feedback, the researchers hold different views of the use of feedback in error correction with some even asserting that it should be abandoned because it is harmful. With regards to time of feedback, the researchers hold different view point. Some are for immediate feedback while others are for delayed feedback. But a greater concern is the purpose in which the feedback is applied for that make the difference.

Student attitude towards mathematics is of paramount important; it is next to impossible for students to excel in mathematics when their attitudes are negative towards mathematics. Poor performance in KCSE is attributed to attitude. Attitudes are carried by both students and teachers. A student who has lost hope in doing well in the subject will not put extra effort and is bound not to do well. A teacher whose attitude is negative will not make an extra effort to assist the students.

Student's errors and misconception should be identified and exposed as they are the sign of misunderstanding. Origa J.O. (2000) stated that the incorrect response is more useful than correct response because they are used as a symptom in the diagnosis of learner's conceptual difficulties. Achievement of high performance in mathematics is most critical in Konoin District and Kenya as a whole if the much dream vision 2030 is to be realized. The most important point is that the DWF should have impetus to facilitate better performance in mathematics.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research design, target population, sampling and sampling procedures, research instruments, validity of the instruments, reliability of the instruments, data collection procedures and data analysis techniques.

3.2 Research Design

Rosenthal and Rosnow (1991) define design as a "blueprint that provides with a detailed outline or plan for the collection and analysis of data. According to Kerlinger (1986), ‘a research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problem. The plan is the complete scheme or program of the research. It includes an outline of what the investigator would do from writing the hypothesis and their operational implications to the final analysis of the data’". For the researcher to obtain the objective of the study, quasi-experimental design involving Solomon’s Four of Non-Equivalent Control Group was used. According to Mutai (2000) as cited by M’Kiambi K.J. (2013) stated that quasi-experimental design of the non-equivalent group helps in comparison of effects of two groups, where one is treated and the other is not. Treatment in this case involved exposing the experimental group to descriptive written feedback which was provided by the mathematics teacher where as control group was not given any feedback. Among the students who were provided with written feedback they were further subdivided into two groups, one group was given goal directed feedback while the other group was provided with the general feedback. Both of the groups receiving feedback were divided into two again with the teacher giving one group feedback immediately and the other group received feedback after some delays of one week. This design was suitable for this study because the achievement of the group that received descriptive written feedback was compared to the achievement of those groups which did not received descriptive written feedback. This study was of the non-equivalent design because the learners who participated in the study varied in number and characteristics.

Experimenting with descriptive written feedback was done without affecting the existing classroom environment. Regular teachers taught the learners their usual

lessons without the presence of the researcher. This avoided a situation whereby the learners were responding to satisfy the researcher. In the study, the students were either in the experimental category or the control group. All the groups were pre-tested before putting them into treatment and control to determine the attitude they have towards mathematics. They were also post-tested to determine whether there was any change in the attitude towards mathematics.

Figure 3.1: Treatment and Control Groups

Group	Pre-test	Treatment	Post- Test
CI	P1	-	P2
C1	P1	-	P2
TM1	P1	TM2	P2
TF1	P1	TF2	P2
TG1	P1	TG2	P2
TD1	P1	TD2	P2

C1-Control group

TM1-treatment group exposed to immediate DWF

TF1-Treatment group provided with DWF

TG1-Treatmentmgroup provided with goal directed feedback

TD1 -Treatment group provided with delayed DWF

P1-Pre-test group

TM2-Treament group provided with immediate DWF after testing

TF2-Treament group provided with DWF after testing

TG2-Treament group provided with goal DWF after testing

TD2-Treament group provided with delayed DWF after testing

P2 - Post tested group

3.3 Target Population

The target population involved 10 secondary, 360 form two students and 13 form two mathematics teachers in Konoin District of Bomet County. The researcher targeted form two students and teachers of mathematics. The researcher selected form two class because they have not chosen the subjects for registration with

KNEC in KCSE which is a national examination. Form three and four have already set their minds on what to do and form one are still new in Secondary school and therefore, are not exposed to subject selection in this point in time.

3.4 Data Collection Procedures

The procedure for data collection entailed using questionnaires which was administered through drop and pick method to the units of analysis those were class teachers and students. Two sets of questionnaires tailored for the two categories of respondents were administered. In addition, a face to face interview was also used. The data was collected by the researcher with the aid of a research assistant who was the form two mathematics teachers, in all the sampled schools in Konoin District.

3.5 Sample Size and Sampling Procedures

The sample size of the study involved 30 secondary schools located in Konoin District. Out of these, a sample of 10 schools with 13 form two mathematics teachers and 360 students were sampled in a random manner with regard to location and population size. According to Mugenda and Mugenda (1999), 20% to 30 % of the population is adequate, however, the larger the better. The researcher therefore sampled 30% of the secondary schools in the District

3.6.1 Research Instruments

The study used the students' questionnaire and teachers' questionnaire and also students' achievement test

3.6.2 Questionnaires

The questionnaires were filled by Mathematics teachers and the students. The questionnaire for teachers had two sections. Section one gathers demographic information of the respondents while section two gathers information on the effects of descriptive written feedback, the option in this questionnaire was either yes or no.. The questionnaires for students were of two types; one was testing the attitude of students towards mathematics, this was open ended questions and students were required to fill those questionnaires basing on thereon experience. This questionnaire was provided to the students on the first visit to the school by the researcher i.e

before the treatment was conducted and after the two sets of achievement tests. The other questionnaires regards evaluation of DWF, the researcher selected likert scale with five points in this questionnaire. It was provided to the students after the two sets of achievement test and also the other questionnaire.

3.6.3 Student Achievement Test

SAT consisted of ten questions covering the topic under study, gradient and equation of straight lines (Appendix I). The test was used to check learners' achievement after the topic was covered. In order to ensure that the testing in the pretest had the same level of difficulty as those in the post test, the researcher ensured that the test items were the similar in both cases. However, there was need to create an impression among the learners that they were doing a different paper. This was done by changing the values of the items in questions. Since the post test (SAT) was done after one month, then the probability of the pretest influencing the performance of the post test was greatly minimized. The researcher also ensured that the students had no clue that the similar questions will be repeated. This was done by agreeing with the teachers that the pretest was not discussed in the class. The test was marked out of thirty

3.7 Validity of the Instruments

According to Kombo and Tromp (2006), validity of a test is a measure of how well a test measures what it is supposed to measure. In order to ensure the validity of the instruments, content validity of the instrument was matched with the objectives of the study, the researcher was also guided by the supervisor in ensuring that the validity was enhanced. The questions set in achievement test were from form two syllabus, the department of mathematics in the school assisted the researcher in setting the tests. The students were taught by their regular teachers using the scheme of work developed by the researcher before that test was given to students.

3.8 Instrument Reliability

Reliability is the measure of degree to which research instruments yields consistent results or data after repeated trials. The researcher used test re-test to determine students' attitude towards mathematics. To test reliability of students' attitude

towards mathematics, pre-test and post- test of their opinions towards mathematics were analyzed and Pearson moment of correlation was calculated among those students in control group. To determine the reliability of achievement test the researcher used alternate form reliability. According to Lammers, W. J., and Badia, P. (2005), alternate form reliability is the authenticity established by carrying out two different forms of the same test to the same individuals. This method was convenient because it avoided the problems that come from the test-retest method. With the alternate form reliability method, an individual is tested on one form of the test, and then again on a comparable second form. This method is used more than the test-retest method because it has fewer related problems, including an abundance reduction in practice effects. The following are reliability coefficient of control group;

Figure 3.2 reliability coefficient of control group

SAT1	SAT2
8.02	7.29
10.52	12.12
12.08	13.77
14.42	15.52
9. 81	10

The formula used is Pearson i.e.

$$R\ xy = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\{\sum(x-\bar{x})^2 \sum(y-\bar{y})^2\}}}$$

$$Rxy = \frac{30.2692}{31.109} = 0.973$$

Reliability index of 0.973 of achievement test is very high.According to Mugenda and Mugenda (1999) a coefficient of 0.80 or more will simply show that there is high reliability of data. This implies that the test was highly reliable.

3.9 Data Analysis

Data analysis is the process of bringing meaning to raw data collected (Mugenda and Mugenda, 1999). The researcher did data editing, coding, classification and tabulation. After data collection, the researcher also scrutinized the instruments for

completeness, accuracy and uniformity. Data collected was analyzed using both descriptive and inferential statistics. Descriptive statistics involved tabulating data.

3.10 Ethical Considerations

Participants were given the assurance that their identity would remain anonymous in order to uphold their privacy for the sake of any aspersions that may be cast on their institutions. The participants were also assured that the data collected will be kept confidential and only used for the purpose of the study. The researcher also ensured that the respondents were protected from any possible harm that might have risen from the study.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter presents the results of the analysis, interpretation and discussions of the findings. The presentation is done based on the five research objectives and the hypotheses of the study. The purpose of the study was to explore how descriptive written feedback affects performance of mathematics. In particular, to explore quality of work done by the learners after descriptive written feedback is provided. And more importantly, the expected change in attitude towards mathematics among the learners in secondary schools in Konoin District of Bomet County.

This chapter is divided into six sections. The first section analyses the return rate of the research instruments. This is followed by the second section which discusses the findings based on the first objective that focuses on the relationship between DWF and students achievement. The third section focuses on the findings on the relationship between DWF and students reflection on errors. The fourth section focuses on the relationship between DWF and students attitude towards mathematics. The fifth section focuses on the relationship between timing of DWF and students achievement. The last section focuses on the relationship between goal directed DWF and achievement.

4.1 Rate of Return of Questionnaires

All the thirteen teachers responded and returned their questionnaires. The questionnaires for students were three hundred and sixty one, they were all returned. The first set and second set of achievement test was also delivered and waited for the students to complete before they were collected for marking and analysis. This was made possible by the fact that the researcher delivered the questionnaires personally and waited for the respondents to fill the questionnaires and to answer the question in the test, however, there were some instances when the students were absent when the test was on or the questionnaires are being filled, though it was a small percentage.

4.1.1 Responses From Students

These are the students who were either in the control or the experimental group. Those in the experimental group were treated by being exposed to DWF which is either directed towards the goal or not and also DWF which is either immediate or delayed. The study involved 361 students drawn from 10 different schools in Konoin District. Teachers' questionnaires involve 13 mathematics teachers who teach form two students.

Table 4. 1 Number of Respondents

Respondents	Population	Sample	Percentage
Schools	31	10	32%
Students	1605	361	22%
Teachers	41	13	32%
Total	1676	373	22%

4.1.2. Response From Mathematics Teachers

The thirteen teachers who were given questionnaires from the sample schools of study filled the questionnaires as the researcher waits this means that all them were return. The responses from teachers are shown on the table 4.2;

Table 4.2, Response from mathematics teachers on use of DWF

CONTENT	YES	NO
DWF and achievement	11	2
Feedback timing	6	7
Goal directed feedback	12	1
DWF and error correction	12	1
Attitude towards mathematics	11	2

The thirteen mathematics teachers who teach form two responded to questionnaire in appendix ii, the responses are tabulated in table 4.2.From the table, 11 teachers provide their learners with written feedback whenever they give them some task in form of test, assignment or quizzes and only 2 did not provide. Those teachers who

provide feedback within 4 days were 6 while those who provide DWF after5 days were 7 teachers. The teachers who provide learners with feedback which is directed towards the goal were 12 while only 1 did not provide. The number of teachers who admitted that the DWF provided to students assists the students to reflect on errors they make were 12 while only 1 believe that it does not help students to reflect on errors. There were 11 teachers who believed that students like DWF and only 2 do not believe that students like.

4.2.1. DWF and Achievement in Mathematics

The first objective was to determine the influence of teachers DWF on achievement of mathematics in Konoin District. To achieve this objective, the sampled students were put in two groups. One group is experimental, the group which is exposed to DWF in the First test occasion and the other group, control, which was not exposed to DWF in the first test occasion, sat for common test which was marked out of 30% after one month, the two group of student sat for another SAT which is the similar to the first one. The results of the groups of students were then compared. The table below shows their performance.

Table 4.3, achievement in SAT 1 and 2 for the two groups

Groups	**SAT 1**	**%**	**SAT 2**	**%**	**Deviation**	**%**
Experimental	10.7	32.83%	17.97	51.7%	5.66	18.87%
Control	10.97	39.33%	11.74	41.33%	1.92	2%

The two groups of students were given two similar tests from the topic of Gradient and Equation of the straight lines which was marked out of 30% in both of the test. The experimental group was provided with DWF in SAT 1, while the control group was not provided with any feedback. The results show that the experimental group scored a mean of 10.7 in the first test and17.97 in SAT 2. There was an increase of a mean of 7.27 which is translated to 18.87%. The increase of performance of 18.87% is attributed to DWF that was provided in the first SAT. The DWF that was given in the first achievement test was read by the students and started practicing doing according to the written guidance on their work, where they were not correct, thus

enabling them to increase their achievement scores in the second test. The written feedback bridged the gap between the wrong answers written by students in the first test and the correct answers in the second test. The DWF scaffold the students into getting the required answers.

Whereas in the control group, the students scored a mean of 10.97 in SAT 1 and in SAT 2, the same students scored 11.74. There was an increase of a mean of 0.77 which can be converted to 2%. This small increase could have been caused by other factors such as some students making their own effort to revise the papers on their own. Both the groups of students were taught using the same scheme of work developed by the researcher, therefore almost similar approach of instruction was applied.

The mean achievement indicated that students in the experimental group performed better than those in the control group. This indicates that the DWF had a positive impact on learners' achievement in mathematics compared to those who were not given. These results concur with the opinion put forward by Hattie and Timperley (2007) asserting that the main purpose of feedback "is to reduce discrepancies between current understandings and performance.

To further investigate the stated objective, another hypothesis was developed so as to test if the difference in achievement were statistically significant or not. This hypothesis is:

Ho1a: There is no statistically significant difference between the achievements Scores of students provided with DWF and those who were not.

To test whether the use of DWF had any statistical significance on learner achievement in Mathematics, the results for all students in the experimental group was compared to the results of the students in the control group. Analysis of variance, ANOVA, was used. Table 4.4, shows the result of this analysis so as to test the null hypothesis that there is no statistically significance difference between the achievement scores of students provided with DWF and those who are not.

Table 4.4 ANOVA Results of Experimental Groups

	Sum of Squares	D F	Mean Square	F	Sig.
Between Groups	96.90769	1	96.90769		
				9.3586	5.32
Within Groups	82.83953	8	10.35494		

The results of F=9.3586 is greater than the tabled value of 5.32 (v1=8; v2=1) at.05 significant level, indicating that the overall effect of treatment was quite large. The results suggest that the null hypothesis that there existed no significance difference between scores of learners given DWF and those who were not was rejected. This suggests that there is significance difference in achievement in Mathematics between the learners who were provided with DWF and those who were not.

The researcher further analyzed the F ratio of the squares of students in control group; the results are shown on table 4.5. This was done in order to find out if pre-testing had any effect on the overall results, the data for the pre-test between the experimental and the control groups was analyzed and recorded in Table 4.5.

Table 4.5 ANOVA Results of Control Groups

	Sum of Squares	D F	Mean Square	F	Sig.
Between Groups	0.1769	1	0.1769		
				0.05346	5.32
Within Groups	26.4723	8	3.30904		
Total	26.6492	9			

Table 4.5, shows that the f value of 0.05346 is less than the tabled value of 5.32 (v1=8 and v2=1) at 0.05 level of significance, implying that there is no significant difference in performance between the groups selected to be either in the experimental or in the control groups. This means that either group had the same chance of performing well if they had been given similar treatment.

Hence, the hypothesis that there is no statistically significant difference in achievement scores between students given DWF and those who were not was rejected. The alternative hypothesis that there was statistically significant difference

in achievement between students given DWF and those who are not was accepted. This implies that DWF has positive impact in influencing the achievement of mathematics. The results of this experiment is in agreement with the report of ,Melanie Greenan,(2010), who claimed that descriptive feedback helps students learn by providing them with precise information about what they are doing well, what needs improvement, and what specific steps they can take to improve. This was further emphasized by Sheen, (2008), who asserted that corrective feedback may enhance learning by helping learners to (1) notice their errors in their written work, (2) engage in hypothesis testing in a systematic way and (3) monitor the accuracy of their writing. The improved performance by students in experimental group was guided by DWF given by their teachers during marking.

4.2.2. Timely Feedback and Achievement in Mathematics

The second part of the first objective of this study sought to find out the influence of timely descriptive written feedback on the achievement of learners in mathematics. To achieve this objective the data were organized such that the performances of students in experimental group were further put into two groups. From the two groups, one of them was provided with immediate DWF whereas the other group was exposed to delayed feedback. In this study the immediate feedback took one day and delayed feedback took one week. Then the students were the subjected to two tests occasion and their results compared.

Table 4.6 below shows the performance of the two groups.

Table 4.6 achievement of students in delayed and immediate DWF

Type	SAT 1	SAT 2		Deviation	%
Immediate	10.61	15.63	4.05	13.5%	
Feedback	10.08	22.3			
Delayed	10.43	14.16	1.57	5.23%	
Feedback	10.17	18.13			
	12.23	19.61			

From table 4.6 above the group of students who were provided with immediate feedback out performed those who received delayed feedback. Those who received immediate feedback increased their scores from 32.67% to 46.17% an increase of 13.5%, while those who were provided with delayed feedback improve their score from 35.8% to 41.17% an increase of 5. 23%.

From the face value the performance of students who were given immediate feedback, seem to have higher achievement than those who received delayed feedback. However, the researcher would like to determine whether there is statistical significance different in achievement of the two groups.

The analysis of variance for students provided with immediate feedback was done in order to compare their achievement to those who were given delayed feedback.

This enabled the researcher to test the hypothesis below;

Ho1b: There is no statistical significance difference in achievement scores between students provided with immediate feedback and those who were provided with delayed feedback.

To determine whether to accept or reject the above stated null hypothesis, it was important to calculate the F ratio of squares, shown on table 4.7;

Table 4.7 ANOVA Results of students of delayed and immediate feedback

	Sum of Squares	D F	Mean Square	F	Sig.
Between Groups	3.36667	1	3.36667	0.26489	10.13
Within Groups	38.12905	3	12.70968		
Total	41.45572	4			

The results of F=0.26489 and significance 0.05 in Table 4.7 is far less than the tabled value of 10.13 at .05 level of significance. These results suggest that the null hypothesis that there existed no significant difference between students given immediate feedback and those who were given delayed feedback in achievement of Mathematics was accepted. This implies that though the mean score of students who

received delayed DWF was higher than the mean score of students who received immediate DWF, there was no statistical significance in the achievement of Mathematics and that the increase could have been caused by chance.

The item coded nos 4, 5 and 6 in evaluation of DWF sought opinion of students regarding timing of feedback. Whether delayed feedback is effective or immediate feedback is more effective in influencing the achievement of students. The first item state preference of DWF provided immediately after mathematics assignment. The summary of student's response is shown in table 4.8;

Table 4.8 Preference of immediate DWF

Options	No	%
Strongly disagree	30	9%
disagree	18	5%
Neutral	38	11%
Agree	65	19%
Strongly agree	189	56%
Total	340	

From the summary of table 4.8 the response from students shows that 9% (n=30) of the students strongly disagree to the statement while 5% (n=18), disagree to the same statement that the students prefer DWF provided immediately after assignment in mathematics. On the other hand those who strongly agree to the statement were 56% (n=189) and those who only agree are 19% (n=65). The students who could not make any decision were 11% (n=38). This implies that the students who prefer immediate DWF are 75% (n=254). The findings support the opinion of Brosvic, Epstein, Dihoff, and Cook (2005) who found benefits to immediate feedback over delayed feedback in a fairly realistic classroom environment for learners taking tests.

The second item state the preference of delayed DWF which is provided after mathematics assignment. The summary of the response of the students is shown on table 4.9 below;

Table 4.9 Preference of delayed DWF

Options	No	%
Strongly disagree	132	38%
disagree	97	28%
Neutral	45	13%
Agree	25	7%
Strongly agree	50	14%
Total	349	

Table 4.9 above show the opinions of the students in relation to preference of delayed DWF after assignment in mathematics. From the table 38% (n=132) of the students strongly disagree to the statement in support of delayed DWF while 28% (n=97) disagree to the same statement. Those students who strongly agree to delayed DWF were 14% (n=50) and 7% (n=25) simply agree to the same statement. Those students who did not make decision were 13% (n=45). This implies that 66% (n=229) of the students do not prefer DWF which is delayed

The responses to the two items by the students contradict the earlier hypothesis that accepted the null hypothesis suggesting that timing of feedback depends on purpose and circumstance under which it is used. The results concur with the opinion of Kulik and Kulik (1988) who reported that at the task level, some delay is beneficial, but at the process level immediate feedback is beneficial if the feedback is intended to elicit retrieval of the concept learnt. The experiment conducted by Neha Sinha (2012), shows that delayed feedback on multiple-choice questions improved performance on subsequent short-answer versions of those questions. This suggests that whether the feedback is immediate or delayed, it has no effect in students' achievement. However the timing of feedback depends on the purpose and the kind of the task given to learners. This opinion was also shared by, Thalheimer, W. (2008); who claimed that research support can be found for both immediate feedback and delayed feedback, depending upon the circumstances in which that feedback is employed. In conclusion of this objective the evidence of the findings shows that there is no clear position on timing of feedback between students achievement and students opinion.

4.3 DWF and Students Reflection on Errors in Mathematics

The second objective of the study was to examine the effect of descriptive written feedback on students' reflection on errors in Mathematics. To do this the researcher used like-ert scale of five points to enable him to seek the opinion of students regarding reflection of performance triggered by DWF. In student questionnaire appendix E; named Evaluation of feedback, nos 1, 2 and 3 were seeking opinion from students. The statements are about ability of DWF to reflect in students performance in mathematics, second was that DWF could help students to think on strategy of improving performance in mathematics and the third statement concern DWF being able to assist students to reflect on the errors they make when they are solving mathematics problem.

The first item states that descriptive written feedback did not help me to reflect on my performance in mathematics. The response from the students is summarized below on table 4.10

Table 4.10 DWF and performance

Options	No	%
Strongly disagree	198	59%
disagree	65	19%
Neutral	18	5%
Agree	20	6%
Strongly agree	38	11%
Total	339	

When the above statement was made the students were cautious in responding since it was in negative form. Of the students who responded 59% (n=198) strongly disagree to the statement that DWF does not help them to reflect in the performance in mathematics, while 19% (n=65) disagree to the same statement. It is only 5% who were neutral, however 6% agree to the statement while 11% strongly agree, meaning that DWF does not help them in their studies. This shows that 77% (n=263) of students are influenced by DWF to think about their performance in mathematics

and only 17% (n=58) are not influenced by DWF while 5% (n=18) are neutral and could not make any decision.

From the above analyses regarding students opinion on ability of DWF to help students to reflect on their performance in mathematics, it can be concluded that DWF assisted students to reflect on their performance and start making effort to improve the performance. The finding support the report by Paris and Ayres (1994), who pointed out that reflective thinking, motivates students to learn; applying strategies to accomplish specific objectives. When the students are motivated to do a given task they would struggle doing it until they get the correct answer. DWF motivated the students in experimental groups, thus their achievement in second test occasion was high.

The second item states that descriptive written feedback has assisted me to think about strategies of improving my performance in mathematics, the response from the students is illustrated in table 4.11 below.

Table 4.11 DWF and strategy to improve

Options	No	%
Strongly disagree	27	8%
disagree	7	2%
Neutral	34	10%
Agree	47	14%
Strongly agree	229	67%
Total	343	

From table 4.11, 67% (n=229) of the students strongly agree and 14% (n=47) agree to the statement that DWF assist the students to focus on the strategy they should put in place so that they can improve performance in mathematics. It is only 10% (n=34) of the students were neutral, while 2% (n=7) disagree to the statement and 8% (n=27) strongly disagree. This shows that majority 81% (n=276) of the students are guided by DWF written by the teacher to design a strategy of improving their mathematics achievement. While 10% (n=34), could not be influenced by the DWF provided by the teacher and only 10% (n=34) were neutral implying that they were

not able to make any decision regarding the influence of DWF on the strategy they should put in place in order to improve their performance.

The third item states that descriptive written feedback does not help me reflect on errors in mathematics, the students responded as summarized on table 4.12 below.

Table 4.12 DWF and error reflection

Options	No	%
Strongly disagree	186	52%
disagree	94	26%
Neutral	28	8%
Agree	15	4%
Strongly agree	36	10%
Total	359	

The table above shows that 52% (n=186) of the students strongly disagree to the statement that DWF does not help them to reflect on errors in mathematics, while 26% (n=94) disagree to the statement. This implies that a total of 78% (n=290) are influenced by DWF written on their work by the teacher, assisted the students to re-look at the where they have made errors in mathematics during calculation. They are only 14% (n=51) of the students are not influenced by DWF written by the teacher on their work. The students who were neutral were 8% (n=28) and could not make decision concerning DWF being able to help them to think about the errors they commit when they are solving problems in mathematics. Learning is enhanced when students are encouraged to reflect on their own learning, to review their experiences of learning, and to apply what they have learned to their future learning, Katharine W. Clemmer, (2000). This implies that DWF help students to reflect on the errors they make and misconception, feedback enable them to make appropriate correction in time.

The above items enable the researcher to state three null hypotheses below;

H02a There is no statistical difference between DWF and students reflection on performance in mathematics.

H02b There is no statistical difference between DWF and students strategies to improve performance in mathematics

H02c There is no statistical difference between DWF and students reflection on errors in mathematics.

To check whether the given values were significant or not, the values were tested using the Chi-square. Table 4.13 indicates the value of significance which leads to the acceptance or rejection of the hypotheses. The acceptance of the Chi-square indicates that the variable was not a factor in the use of DWF while rejecting the decision implied that the variable under investigation was a factor that influenced teachers' use of DWF.

Table 4.13 chi-squares on error reflection by DWF

	Calculated x^2	Table x^2	Level of Significance	D f	Decision
Reflect on performance	96.35	0.711	0.05	4	Reject
Think on strategy to improve	85.75	0.711	0.05	4	Reject
Reflect on errors	36.46	0.711	0.05	4	Reject

Table 4.13 indicates that the calculated value of Chi-square for the item on the ability of DWF to influence students to reflect on their performance is 96.36 which are much greater than the tabulated value of 0.711 at 0.05 level of confidence. This implies that DWF has influence by making the students to reflect on their performance in mathematics.

Table 4.13 further indicates that the calculated value of Chi-square for the thinking on strategy to improve performance is 85.75 which are greater than the tabled value of 0.711 at 0.05 level of confidence. The calculated value of the chi-square of reflection on errors was 36.46 which were greater than the tabled value of 0.711 implying that DWF influences the students to think about where they made errors in mathematics.

This implies that teachers' use of DWF on the work of the students will influence the students to think on the best strategy they need to employ so that their achievement in mathematics is enhanced. Students engage in the Mathematics formative assessment that use descriptive written feedback provided by the teacher and this motivate them to study the connection in feedback critically thereby enabled the students in experimental group to score better in the next test. The finding is in agreement with the work of Mariëtte Koen, E.M. Bitzer2 and P.A.D 2012, who suggested that written feedback enabled students to read both the diagnosis of their errors and the suggestions on how to improve. They said that students believed written feedback to be meaningful because they could always go back to reread the feedback and reflect on it again, hence students are keen to receive written feedback because it is personal. The finding also concurs with the claim of Katharine W. Clemmer (2009), who stated that learners analyze their work, scores, and descriptive feedback to assess their own work and identify errors, complete an analysis of their errors - identifying the specific place where the error occurred and explaining what went wrong, and self-reflect on errors. As students reflect they respond to questions that engaged them in exploring what next steps are needed to achieve mathematical literacy and proficiency. This was further emphasized by the study done by Vicki J. Barry, 2008, who found out that descriptive feedback is so important for students because many of them do not have many opportunities to reflect on their learning. Therefore DWF motivate the students to reflect on their studies and design appropriate strategy for improving their performance because they can re-read the written feedback.

4.4 The Students' Attitude Towards Mathematics

The students' attitude in form two towards mathematics was determine by asking the respondents to list all the subjects they study in order of preference from the most favourite to the least preference. Other items that regards attitude was questions such as giving opinion whether mathematics should remain compulsory subject, whether mathematics is requirement in the target career and also if they have personal timetable. In case a respondent have a personal timetable, they were required to state the number of lessons per week and the reasons for having such a number of lessons.

4.4.1 Subjects' preference

Respondents were asked to list down all those subjects in order of preference from the most like to the least like. The response of the 361 students is stipulated in figure 4.14 below;

Table 4.14 students subject preference

Position of Maths	Experimental Group				Control Group			
	Pre;Test		Post-Test		Pre;Test		Post-Test	
	No	%	No	%	No	%	No	%
1st	68	36.56%	91	50%	68	40.24%	72	41.38%
2nd	11	5.91%	14	7.69%	8	4.73%	14	8.05%
3rd	17	9.14%	19	10.44%	22	13.01%	21	12.07%
4th	18	9.68%	20	10.99%	8	4.73%	10	5.75%
5th	10	5.38%	10	5.49%	11	6.51%	10	5.75%
6th	9	4.84%	8	4.40%	15	8.88%	9	5.17%
7th	9	4.84%	9	4.95%	9	5.23%	6	3.45%
8th	8	4.30%	4	2.20%	6	3.55%	11	6.32%
9th	10	5.38%	3	1.65%	5	2.95%	10	5.75%
10th	10	5.38%	4	2.20%	7	4.14%	4	2.30%
11th	14	7.53%	1	0.55%	10	5.91%	6	3.45%
Total	186	100%	182	100%	169	100%	174	100%

The table shows that the students who responded in both experimental and control group to pre-test questionnaire and post-test were a total of 355.

The results shows that among the students in experimental group who list mathematics as preferred subject increased from 36.56% in pre-test to 50% in post-test, after being exposed to DWF. Those whose mathematics was second preferred subject also increased from 5.91% to 7.69% while those students who had mathematics as third preferred subject increased from 9.14% to 10.44% after they were given DWF.

On the other hand the students who had Mathematics as the least preferred subject dropped from 7.53% before DWF was provided to 0.55%, while those who had

positioned mathematics as second least preferred decreased from 5.38% to 2.20% and the students who had mathematics as third least preferred also decreased from 5.38% to 1.65%.

Some item were included in the students" questionnaire, which sought information on their thinking about the importance of learning and having good performance in mathematics, and the results reflected on the following table 4.15 below;.

Table 4.15 Importance of mathematics (pre-test)2

	YES		NO	
	No	%	No	%
Mathematics as compulsory	112	31.91%	228	64.96%
N/A	11	3.13%		
Maths requirement in target career	172	48.45%	170	47.89%
N/A	13	3.66%		
Availability of personal timetable	348	98.31%	3	0.85%
N/A	3	0.85%		

Table 4.15 above shows that 31.9% of the respondent, would like to have mathematics to remain as compulsory subject in KCSE, while 64.96% do not want mathematics to remain compulsory, only 3.13% could not disclosed whether they want mathematics to remain compulsory or not. Three respondents which is equivalent to 0.85% could not give their opinion. Regarding mathematics as a requirement in the target career, 48.45% of the respondents are targeting careers which demand that a candidate must have good performance in mathematics; while 47.89% of the students do not target the careers that demands that a candidate pass in mathematics, however, 3.66% were not able to express their opinion. From table 4.15, it can be noticed that the respondents who do not wish to have mathematics as compulsory are targeting careers which require a good performance in mathematics. Those claiming to have mathematics as compulsory were 31.9% while those targeting careers requiring good grade in mathematics were 48.5%. This suggest that students acknowledged the importance of mathematics in their future responsibilities, this concurred with the opinion of Orton (1987), who claims that

Mathematics is the gate and key of science, neglect of mathematics works injury of all knowledge since he who is ignorant of it cannot view the other sciences or the things in the world.

The respondents were also asked a question concerning availability of personal timetable, since this question was open ended, the respondents were expected to give the response as either yes or no, 98.31% express that they have personal timetable and only 0.85% do not have personal timetable, while 0.85 % could not accept or reject availability of timetable for their use during private studies.

Table 4.16, importance of mathematics

	EXPERIMENTAL				**CONTROL**			
	YES	%	NO	%	YES	%	NO	%
Mathematics as compulsory	70	42.68	94	57.31	107	56.91	81	43.09
Maths requirement in target career	74	41.11	106	58.89	59	34.5	112	65.5

The first item required the students to state the subjects they would like to be compulsory in KCSE. The preceding questions had asked the respondent to state the subjects which are compulsory in KCSE this question was preparing the students to answer the next one which required them to choose the subjects which they think should be compulsory. The researcher while analyzing the responses would like to know whether the chosen subjects included mathematics or not. If the subjects included mathematics they were recorded in the category of YES and if it did not include mathematics it was recorded in the category of NO, in both experimental and control groups. In the experimental group, 70 respondents were classified as YES while 94 were in category of NO. In the control group those who were classified YES were 107 and those of NO were 81. In the next item the students were required to state whether mathematics is a requirement in the target career. The students once again were required to list down the subjects needed in the target career, if

mathematics was included it was classified as YES but if it was not included it was classified as NO, it was applicable to both experimental and control groups. in the experimental group 74 were recorded YES and106 were recorded as NO, while in control group, those who were YES were59 and NO were 112.

This shows that the number of students acknowledging that mathematics should be compulsory in experimental group increase to 42.68% from 31.91% after being provided with DWF at the same time those students in control group drop to 56.91% for those who said YES from 64.96%.this demonstrate that DWF can influence the attitude of students since by acknowledging that mathematics should be compulsory while they had a contrary opinion at first means that there must be a change in attitude and this change was caused by DWF. With regards to mathematics being requirement in the target career, the percentage of those students in experimental group and claiming yes were 41.11% while no in the same group were 58.89% this means that majority of the students choosing career demanding mathematics are lower than those who did not choose. While in control group those choosing career requiring mathematics were 34.5% compared to 65.5% who were not choosing yes, again in this group of students the percentage of students choosing career which do not need mathematics were higher than the one choosing career requiring mathematics. However, in both groups compared those who were choosing yes were higher in experimental group than in control group (41.11% and 34.5%) at the same time those who were choosing no were higher in control group than in experimental group (58.89% and 65.5%). This implies that DWF impacted positively to the attitude of students towards mathematics. The results above were further analyzed using chi-square to determine whether the increase is of statistical significance as shown on table 4.17;

Table 4.17 Importance of mathematics

items	Calculated X^2	Tabled X^2	Level of significance	df	Decision
Mathematics as compulsory	6.576	3.841	0.05	1	Reject
Maths requirement in target career	7.269	3.841	0.05	1	Reject

Table 4.17 shows Chi-square analysis on the level of significance on the attitude of students towards mathematics. It is observed that the calculated value of Chi-square is more than the tabled value for the two items. This implies that DWF influenced the attitude of students towards mathematics. The items were used to test the null hypothesis that there is no relationship between the DWF and the attitude of students toward mathematics. Based on the results in Table 4.17, the null hypothesis was rejected.

For those who chose yes, to the personal study timetable, they were further asked supplementary questions regarding the number of lessons per week and also reasons for having such a number of times of Mathematics appearing in their timetable.

Table 4.18 Number of mathematics lessons in personal time table

No of times mathematics appearing per week	Frequency	Percentages
1	7	2.05%
2	64	18.77%
3	71	20.82
4	74	21.7%
5	49	14.37%
6	27	7.92%
7	28	8.21%
8	7	2.05%
9	3	0.88%
10	3	0.88%
Others	6	1.76%

There was an item that required the respondent to state the reason why they chose such a number of times for Mathematics in the timetable. This item was an open ended question. The responses from the students are tabulated in the table 4.18 above. From the table, 2.05% of the students had mathematics once a week, 18.77% of the same student's allocated mathematics two times per week and 20.82% and 21.7% of the students allocated 3 and 4 times per week respectively. Those who

allocated mathematics 5 times per week are 14.37% and those whose mathematics lessons appear 6 times are 7.92% while those who had mathematics 7 times per week are 8.21%, this could be translated to means that these students have mathematics appearing everyday throughout the week. The remaining few percentages allocated mathematics 8 and more lessons per week and they include 2.05% for 8 lessons,0.88% for 9 and 10 lessons per week while 1.76% had more than 10 lessons per week.

To determine if there is statistical difference in the changes between control and experimental groups null hypothesis was formulated;

Ho3a; There is no significant relationship between students attitude and allocation of mathematics lessons per week in the students time table.

To check this hypothesis chi-square analysis was used to determine the null hypothesis. table 4.19 below shows chi-square analysis.

Table 4.19, chi-squares number of mathematics lessons in personal time table

items	Calculated X^2	Tabled X^2	Level of significance	df	Decision
Number of mathematics lessons	28.761	18.307	0.05	10	Reject

From table 4.19 above the calculated X^2 is 28.761 which is greater than the table value of X^2 of 18.307 with level of significance at 0.05 and 10 as degree of freedom , therefore the null hypothesis was rejected implying that there is significant relationship between students attitude and allocation of mathematics lessons per week in the students time table.

In this respect DWF influence the students to allocate the number of mathematics lessons per week. This opinion was also shared by M'Kiambi K. J. (2013); that Students who practice Mathematics often have a positive attitude towards the subject hence students increase the number of mathematics lessons considerably.

The students were also asked to state reasons which make them to allocate such a number of lessons per week for mathematics. This item was an opened ended question that required students to state their own main reasons for choosing the give

number of lessons for mathematics. The student's response is analyzed in table 4.20 below;

Table 4.20 reasons for allocating the lessons for mathematics

Reasons	Experimental Group				Control Group			
	Pre;Test		Post-8Test		Pre;Test		Post-Test	
	No	%	No	%	No	%	No	%
Career Requirement	8	4.30%	11	6.04%	13	7.69%	15	8.62%
Compulsory	12	6.45%	7	3.85%	7	4.14%	8	4.6%
Favourite	19	10.22%	25	13.74%	39	23.08%	40	22.99%
Demand Practices	42	22.58%	56	30.77%	41	24.26%	39	22.41%
Improve	32	17.20%	36	19.35%	22	13.02	24	13.79%
Challenging	20	10.75%	8	4.4%	15	8.88%	12	6.90%
Important	18	9.68%	16	8.79%	5	2.96%	8	4.60%
Understand	14	7.53%	11	6.04%	2	1.18%	4	2.30%
Stimulate mind	5	2.69%	5	2.75%	10	5.92%	10	5.75%
Others	12	6.45%	6	3.30%	13	7.69%	11	6.32%
N/A	4	2.15%	1	0.55%	2	1.18%	3	1.72%
Total	186	100%	182	100%	169	100%	174	100%

From table 4.20 the students were citing the following as the reasons that made them to have such a number of times for mathematics appearing on their personal study timetable; career requirement, compulsory, favourite, demand practices, improve, challenging, important, understand, to stimulate the mind and other reasons.

According to the table above the main reasons for student in choosing to have a given number of lessons per week is that mathematics demands a lot of practices. In the experimental group, 22.58% in pre-test questionnaire claimed that mathematics require practices and after being provided with DWF the students in the same group giving the same reason increase to 30.77%. On the other hand those who are in control group drop from 24.26% to 22.99%. This is an indication that the students realized that for them to perform well they only need to do practice every now and then and therefore allocated more lessons for mathematics in their timetable.

The students who have mathematics as their favourite subjects increase in experimental group from10.22% to 13.74% while in control group dropped from 23.08% to 22.99%.

Those who allocated Mathematics for the reason of being compulsory in KCSE were 6.45% among those who are in experimental group and after exposing them to DWF the percentage dropped to 3.85% while those in control group increase from 4.14% to 4.6%, this implies that the students in experimental group realized that mathematics is not difficult and therefore should not be feared but be enjoyed by allocating such a number of times in the timetable. Those in the control group increased in percentages and continue to allocate mathematics the number of lessons per week because they want to pass KCSE and may not enjoy doing mathematics as an important subject in the school curriculum.

Since student personal time table was made at individual level and each student did on their own discretion for the reasons stated above, the researcher would like to determine whether there is significant difference between the attitude towards mathematics and the reasons cited by the students for allocating the given number of lessons per week. To check the relationship, the null hypothesis below was formulated;

H03a: There is no significant relationship between student's attitude towards mathematics and the cited reasons for allocation of the given number of lessons per week.

Table 4.21 Reasons for allocating mathematics lessons

items	**Calculated** X^2	**Tabled** X^2	**Level of significance**	**df**	**Decision**
Reasons for allocating lessons	25.73	18.307	0.05	10	Reject

Table 4.21 indicates that the calculated value of X^2 is 25.73 which is greater than the tabulated value of 18.307 at 0.05 level of significance with df being 10, therefore null hypothesis was rejected, indicating that there was significant relationship between attitude of students towards mathematics and reasons for

allocating the lessons of mathematics. This implies that DWF influence the learners to change the attitude towards mathematics and thereby increased the allocation of lessons of mathematics per week. This concurs with the opinion of, Akinsola & Olowojaiye (2008) in stating that to change attitudes, the new attitudes must serve the same function as the old one, and that instructional design can create instructional environments to effect attitude change. This was further supported by a study done by, M'Kiambi Kinanu Jannis (2013) who asserted that students were seen from the frequency mathematics appeared in the respondents personal study time table with a quarter of them practicing mathematics once a week, twice a week and other none.

4.5 Goal Directed DWF and Achievement in Mathematics

The fourth objective of the study sought to determine the influence of goal directed descriptive written feedback on achievement in mathematics. To achieve this objective the data was organized such that the scores of students in experimental group were further subdivided into two groups. One group is provided with goal directed DWF while the other group was exposed to non-goal DWF. In this study goal directed DWF is explanation written to the learner by the teacher detailing step by step method where the learner is not correct and none goal directed DWF is short calculation written to the learner showing how the learner would have solved the problem. The two groups of student were subjected to two test occasion and there results are analyzed and compared. Table 4.22 below; shows the analyses of performance in the two groups.

Table 4.22, experimental group in goal directed and non-goal directed

Feedback	Pre;Test	Post-Test
Provided with GDWF	10.61	15.63
	10.43	14.16
Provided with non-GDWF	10.17	18.13
	10.08	22.3
	12.23	19.61

The results show that the scores of the students who were provided with non-goal directed feedback were more superior than the scores of students who did not receive goal directed feedback. Students who receive GDWF increase their scores from 10.52 in the first test occasion to 14.90, an increase of 41.63%, while those who received non GDWF increase their scores from 10.83 to 20.01 an increase of 84.76%. This shows that non GDWF is more effective.

To determine whether there is statistical significance difference between students provided with goal directed feedback and those provided with non-goal directed feedback, analysis of variance for students exposed to goal directed feedback and those who are provided with non- goal directed feedback was done in order to compare their achievement in Mathematics. This enabled the researcher to test the fourth hypothesis;

Ho4a: There is no statistically significance difference in achievement scores between students exposed to goal directed feedback and those who are provided with non- goal directed feedback.

To determine whether the above hypothesis is accepted or rejected, the F ratio is calculated whereby the sum of the squares between the group is divided by the sum of squares within the group as shown on table 4.23, below;

Table 4.23, ANOVA Results of students in goal directed against non-goal directed

	Sum of Squares	D F	Mean Square	F	Sig.
Between Groups	28.6163	1	28.6163	10.17	10.13
Within Groups	8.4385	3	2.8128		
Total	38.0548	4			

Table 4.23, shows that the results of F=10.17 is greater than the tabled value of 10.13 (v1=3; v2=1) at.05 significant level, indicating that the overall effect of treatment was present. The results suggest that the null hypothesis that there is no statistically significance difference in achievement scores between students provided

with goal directed feedback and those who were provided with non- goal directed feedback was rejected. This suggests that there is significance difference in achievement in mathematics between the students provided with goal directed feedback and those who were provided with non- goal directed feedback. The learners who were provided with non- goal directed feedback achieved more. This in effect means that the use of non-goal directed feedback had a greater positive impact in achievement in mathematics.

In order to find out if pre-testing had any effect on the overall results, the data for the group that was pre-tested was analyzed for the experimental groups, comparing their performance before the treatment. The results are shown in table 4.24, below;

Table 4.24 ANOVA Results of pre-test of Goal directed and non- Goal feedback

	Sum of Squares	D F	Mean Square	F	Sig.
Between Groups	0.1201	1	0.1201	0.1211	10.13
Within Groups	2.9743	3	0.9914		
Total	3.08712	4			

Table 4.24 shows that the F value of 0.1211 is less than the tabled value of 10.13 (v1=3 and v2=1) at 0.05 level of significance, implying that there is no significance difference in performance between the groups selected to be either in the goal directed feedback or non-goal directed feedback groups. This means that either group had the same chance of performing well if they had been exposed to similar treatment. Hence, the hypothesis that there is no statistically significance difference in achievement scores between students provided with goal directed feedback and those who were provided with non- goal directed feedback was rejected. There was statistically significance difference in achievement scores between the two groups of students. The non-goal directed feedback is more effective than goal directed feedback in achievement scores in mathematics.

In evaluation of DWF, the items coded nos 7,8 and 9 were like-ert scale questionnaire testing goal directed feedback and sought to know from students

whether goal directed feedback assist the students. The first of the three items stated the preference by students on DWF pointing out the mistakes, the second was DWF that explains to students where the mistake occurred and the third regards DWF which is not directed towards a goal. These items were stated as null hypothesis as shown below;

H04b There is no significant relationship between goal directed feedback and achievement in mathematics.

H04c There is no significant relationship between non-goal DWF and achievement in mathematics.

The above hypotheses were tested using chi-square statistics at level of significance of 0.05, as shown on table 4.25;

table 4.25 chi-square of goal DWF and non-goal DWF

	Calculated x^2	Table x^2	Level of Significance	D f	Decision
Non- goal GDWF	96.535	0.711	0.05	4	Reject
Goal DWF	85.35	0.711	0.05	4	Reject

From table 4.25 the calculated value of x^2 is 96.535 for the first item and 85.35 for the second which are much greater than the table value of 0.711 for both items at 0.05 level of significance with 4 as degree of freedom and the stated hypotheses were rejected. This implies that there is significance relationship in the two stated hypotheses meaning that short calculation showing the students the calculation is more effective than the explanation written on students work.

In view of (Hattie & Timperley, 2007), too much feedback at the task level could make the learners to use trial and error to arrive at the immediate goal rather than applying the required strategy to attain the goal. Teachers should avoid writing too much feedback in students work. In view of,Shute V.J., (2007) ,feedback must be well defined and be directed towards goal attainment. Feedback about the task has been found to be more powerful when it corrects misconceptions than when it alerts

students to lack of information (Hattie & Timperley, 2007). However, one problem with feedback about the task is that it may not transfer to other tasks because it is specific to the particular assignment. In that sense, although it contributes to better learning for the task at hand, task feedback does not contribute to further learning.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter gives a summary of the main findings, conclusions and recommendations. The findings are presented according to the research objectives and the research hypotheses formulated from the objectives, the results from achievement tests and the respondents" opinions on DWF. It also suggests recommendation on what should be done to improve assessment practices and recommendation for further research.

5.1 Summary of the Findings

The purpose of the study therefore was to investigate the effects of descriptive written feedbacks on performance of mathematics. In particular, to explore quality of work done by the learners after descriptive written feedback is provided. And more importantly, the expected change in attitude towards mathematics among the learners in secondary schools in Konoin District of Bomet County. The main objective of the study was to find out the effects of DWF on achievement of mathematics in secondary school in Konoin District, Bomet County.

The specific objectives are four and they include; determining the influence of the teacher's descriptive written feedback on assessment of Mathematics, examining the effect of descriptive written feedback on students' reflection of errors in Mathematics, it also includes determining if DWF influence the attitude of students towards Mathematics and finally to determine the influence of goal directed descriptive written feedback on achievement in mathematics.

To achieve these objectives the researcher formulated the null hypotheses below;

H_{01}: There is no significant relationship between descriptive written feedbacks and achievement of students in Mathematics.

H_{02}: There is no significant relationship between descriptive written feedback and students' reflection on errors in Mathematics.

H_{03}: There is no significant relationship between descriptive written feedback and the attitude of students towards Mathematics.

H_{04}: There is no significant relationship between goal directed descriptive written feedback and learners' achievement in mathematics.

The study was conducted in 10 schools targeting form two students and form two mathematics teachers. The study involved a total of 361 form two students and 13 mathematics teachers.

The research instruments used in the study included the student achievement tests, teachers' and students questionnaires. The data from the questionnaires was analyzed using the Chi-squares, while the mean score of each school was analyzed using the ANOVA that was used to test the hypothesis.

The study found that there was a significant difference in academic achievement between the learners in experimental group and those who were in control group. Those who were in experimental group gained higher scores than those who were in control group. The results show that the experimental group scored a mean of 10.7 in the first test and17.97 in SAT 2. There was an increase of a mean of 7.27 which is translated to 18.87%. The increase of performance of 18.87% is attributed to DWF that was provided in the first SAT. Whereas in the control group, the students scored a mean of 10.97 in SAT 1 and in SAT 2, the same students scored 11.74. There was an increase of a mean of 0.77 which can be converted to 2%.

The increase was further tested to determine whether it was of any statistical significance by testing the null hypothesis that; there is no statistically significance difference between the achievements Scores of students provided with DWF and those who were not. The results of F=9.3586 is greater than the tabled value of 5.32 (v1=8; v2=1) at.05 significant level, indicating that the overall effect of treatment was quite large. The researcher further analyzed the F ratio of the squares of students in control group, in order to find out if pre-testing had any effect on the overall results, the data for the pre-test between the experimental and the control groups shows that the f value of 0.05346 is less than the tabled value of 5.32 (v1=8 and

v2=1) at 0.05 level of significance, implying that there is no significant difference in performance between the groups selected to be either in the experimental or in the control groups. This means that either group had the same chance of performing well if they had been given similar treatment. This implies that the use of DWF improves learners' achievement and is a better way of assessment.

With regards to ability of DWF to enable the learners to reflect on the performance of mathematics, the findings showed that the results from the three items which students responded to in questionnaire were in support of DWF assisting students to reflect on their performance and further design a strategy of improving their scores. The findings also reveals the fact that DWF help students to reflect on the errors they commit during calculations and misconception and thus enable them to make appropriate error correction.

From the research findings the students show overwhelming reliance on the DWF which they claimed to have given them great help in making them to think about the errors they commit when they are solving mathematics problem. This means that whenever the students read comments written by the teacher they start designing strategy of doing appropriate correction. This in agreement with the findings of Phil Race (2002) who claim that the act of reflecting is one which causes us to make sense of what we've learned, why we learned it, and how that particular increment of learning took place. Moreover, reflection is about linking one increment of learning to the wider perspective of learning - heading towards seeing the bigger picture.

The findings showed that DWF could influence the attitude of the learners positively; the students while responding to pre-test questionnaires as compared to post- test could be noticed on table 4.14 that the number of students selecting mathematics as the most preferred subject increased. The results shows that among the students in experimental group who listed mathematics as preferred subject increased from 36.56% in pre-test to 50% in post-test, after being exposed to DWF. Those whose mathematics was second preferred subject also increased from 5.91% to 7.69% while those students who had mathematics as third preferred subject increased from 9.14% to 10.44% after they were given DWF.

On the other hand the students who had Mathematics as the least preferred subject dropped from 7.53% before DWF was provided to 0.55%, while those who had positioned mathematics as second least preferred decreased from 5.38% to 2.20% and the students who had mathematics as third least preferred also decreased from 5.38% to 1.65%.

Another point which was noticeable is the number of students who increased the number of mathematics lessons per week in their personal time table. Those students who were in control group could not make big difference on their personal time table. Personal time table is used to determine the attitude of students towards mathematics. A student whose frequency of mathematics lessons in the time table is high means that the students like mathematics most.

Regarding timing of feedback the null hypothesis that there is no significant relationship between delayed feedback and immediate feedback, the results of F=0.26489 and significance 0.05, is far less than the tabled value of 10.13 at .05 level of significance. The calculated value was much lower than the table value and therefore the hypothesis was accepted. This implies that the increased in achievement scores must have been realized through the chance and not as a result of DWF and that timing of feedback has no effect in achievement of mathematics. However when determining the hypothesis using questionnaire on students evaluation, it was clear that students prefer immediate feedback. The responses to the two items by the students contradict the earlier hypothesis that accepted the null hypothesis.

In conclusion of timing of feedback the evidence from the findings shows that there is no statistical significance in achievement of students who were provided with delayed feedback and immediate feedback, even though students prefer immediate feedback.

Concerning goal directed feedback and achievement, the findings reveals that goal directed feedback is not very effective in that the achievement of students who were provided with goal directed feedback increased their scores from a merely 10.52 in the first test occasion to 14.9 in the second test occasion an increase of 41.63%, as compared to students who were provided with non-GDWF whose scores in the first

test occasion was 10.83 and increased to 20.01 in the second test occasion an increase of 84.76%. In calculating the F value the results of F=10.17 is greater than the tabled value of 10.13 (v1=3; v2=1) at.05 significant level, indicating that the overall effect of treatment was present. The results suggest that the null hypothesis that there is no statistically significance difference in achievement scores between students provided with goal directed feedback and those who were provided with non- goal directed feedback was rejected. This suggests that there is significance difference in achievement in mathematics between the students provided with goal directed feedback and those who were provided with non- goal directed feedback. The learners who were provided with non- goal directed feedback achieved more. This in effect means that the use of non-goal directed feedback had a positive impact in achievement in mathematics. This in effects means that students are keen to read short examples written by the teachers on their papers as compared to written explanation which cause confusion among them.

However the opinion of students regarding GDWF shows that students prefer receiving goal directed feedback on every mistake they make and they also want to be provided with specific descriptive feedback to help them to solve mathematical problems, but they don't prefer descriptive feedback which is not directed toward any goal.

The chi-square analysis with regards to student's opinion of 96.535 for the first item and 85.35 for the second are much greater than the table value of 0.711 for both items at 0.05, level of significance with 4 as degree of freedom. This can be interpreted to mean that students prefer GDWF to enhance their performance.

5.2 Conclusion

After the analysis of the research results, the researcher concluded that the objectives of the research were supported by the data and the research questions answered. It is apparent that DWF when provided to students during assessment of mathematics influence the performance and thus improved results in Konoin District, Bomet County.

The study reveals that DWF influence performance of learners in mathematics greatly therefore it is an important technique in assessment of mathematics in that it

changed the attitudes of the learners towards mathematics positively when it was negative. The study showed that DWF given to students enable the students to reflect on the performance in mathematics and enable the students to design strategy of remediating the wrong calculations and start improving their work. The DWF which is directed towards the goal does guide the students to success however, showing the students short calculation where there was misconceptions appeared to be most effective. Delayed and immediate feedback is both effective however students prefer immediate feedback since it motivate the students when the minds of the students are still thinking about the performance.

Goal directed feedback is not effective in assessment of students of mathematics. The findings suggest that short calculations are more effective than explanation written on the students work. The explanations appear to cause confusion among the students hence making them to use trial and error method.

5.3 Recommendations

The research findings showed that DWF contributed greatly the improvement of mathematics performance in form two classes in sampled schools in Konoin District of Bomet County. It was also clear that the study was done in a span of about two months which was too short. Therefore, the following recommendations are necessary in light of responses from the respondents and in views of the research findings.

5.3.1 Recommendations for policy

In-service courses should be done for teachers with purpose of improving skills on assessment of students so that teachers can continuously use descriptive written feedback assessment of mathematics. Common assessment should be done in form two to encourage teachers to speed up syllabus coverage. The common test in form two encouraged teachers to match the topic they are teaching with time and no class shall be left behind.

5.3.2 Recommendation for further research

First and foremost is a further research to be done in the field of DWF and teachers characteristics. This will determine whether the gender, age, experience and teacher

qualification, can influence the use of descriptive written feedback. Secondly a similar research should be done to cover the whole country to determine whether the similar results can be found and thus use it in the whole country appropriately, and finally a further research should be done on feedback timing and the circumstance under which it is used.

REFERENCES

Akinsola M. K.& Olowojaiye F.O.,(2008). *Teacher instructional methods and student attitudes towards Mathematics*, IEJME

Anastasiya A. Lipnevich& Jeffrey K. Smith (2008);*Response to Assessment Feedback*: The Effects of Grades, Praise, and Source of Information; University of Otago, New Zealand

Anderson Timothy 2010;The *effects of tiered corrective feedback on second language academic writing;* The university of british Columbia

Ahmed Nazif, Debasish Biswas & Rosangela M. Hilbig (2005); *Towards an Understanding of Student Perceptions of Feedback*;Carleton University

Annie,T. (2011). *Exploring Students' Perception of and Reaction to Feedback in School–based Assessment Malaysian Journal of ELT Research*, Vol. 7(2), p. 104-147. www.melta.org.my

Bame Nsamenang A. and Therese M.S. Tchombe (2011*); Handbook of African educational theories and practices*: a generative teacher education curriculum

Bangert-Drowns, R. L., Kulik, C. C., Kulik, J. A., & Morgan, M. T. (1991*). The instructional effect of feedback in test-like events*. Review of Educational Research, *61*(2), 213–238.

Baroody and Ginsburg (1990*); How and when should place value concepts and skills be taught*? Journal for Research in Mathematics Education, 21 (4), 281-286.

Bitchener, J., & Knoch, U. (2008). *The value of a focused approach to written corrective feedback*. ELT Journal, 63(3), 204-211. sla.sjtu.edu.cn/thesis/2.pdf

Boud, David, Rosemary Keogh, and David Walker. "Promoting Refl ection in Learning: *A Model." Reflection: Turning Experience into Learning*. Ed. David Boud, Rosemary Keogh and David Walker. London: Kogan; New York: Nichols, 1985. 18 40. Print.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school* (expanded ed.). Washington, DC: National Academies Press

Bransford, J. (2000). *How People Learn: Brain, Mind, Experience, and School Committee on Developments in the Science of Learning*. Washington, DC:National Academies Press.

Breckler, and A. G. Greenwald (Eds.), *Attitude structure and function* (pp. 1-10). Hillsdale, NJ: Erlbaum. includes pp. 1-10 and 429-440]

Brosvic, G. M., Dihoff, R. E., Epstein, M. L., & Cook, M. L. (2006*). Feedback facilitates that acquisition and retention of numerical facts series by elementary school students with mathematics learning disabilities*. The Psychological Record, 56, 35-54.

Camella Buddo (2013) ;*Evaluating Mathematics Teaching Through the Lens of Some Grade 4 Students*

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior*. New York: Cambridge University Press.

Chaiklin, S., 2003. *The zone of proximal development in Vygotsky's theory of learning and school instruction. In*: Kozulin, A., Gindis, B., Ageyev, V. S. and Miller, S. M., eds. *Vygotsky's educational theory in cultural context.* Cambridge: Cambridge University Press, 39--64.

Chandler, J. (2003). *The efficacy of various kinds of error feedback for improvement in the accuracy and fluency of L2 student writing*. Journal of Second Language Writing, 12, 267-296. faculty.uscupstate.edu/.../Error%20Correction%20-%20Chandler.pdf

Charmon Naroth 2010; *Constructive teacher feedback for enhancing learner performance mathematics,* The University of the Free State Bloemfontein

Chisholm,Volmink, Ndhlovu, Potenza, Mahomed, Muller, Lubisi, Vinjevold, Cathy Kinzer2, Janice Bradley, and Patrick Morandi 2013; *Feedback to Support Learning in the Leadership Institute for Teachers;* New Mexico State University

Chisholm, L., Volmink, J., Ndhlovu, T., Potenza, E., Mahomed, H., Muller, J., Lubisi, C., Vinjevold, P., Ngozi, L., Malan, B. and Mphahlele, L. 2000. *A South African Curriculum for the Twenty First Century. Report of the Review Committee on Curriculum 2005*. Pretoria: Department of Education.

Clemmer, K. (2009) *How Involving Students in the Assessment Process Transforms a Culture of Failure in Mathematics to a Culture of Accountability, Self-Efficacy, and Success in Mathematics* in The Mathematics Education in the 21st Century Project

Cockcroft,W.H. (1981). *Mathematics Counts*: Report of the Committee of Inquiry into the Teaching of Mathematics in Schools

Corbett, A. T., & Anderson, J. R. (1990). *The effect of feedback control on learning to program with the lisp tutor.* Paper presented at the Twelfth Annual Conference of the Cognitive Science Society, Cambridge, MA

Costa A.L. and Bena Kallick,(2000); *Habits of Mind:* A Developmental Series Copyright © 2000

Davies, A. (2000). *Making classroom assessment work*. Courtenay, BC: Connections Publishing.

Davis, R.B., Maher, C.A. and Noddings, N. 1990. *Suggestions for the Improvement of Mathematics Education*. Journal for Research in Mathematics Education. 4(12):187-
210.

Dewey, J. (1933). *How we think: A restatement of the relations of reflective thinking to the educative process* (2nd rev. ed.). Boston, MA: D. C. Heath.

Education, National Taiwan Normal University, Taipei, Taiwan and Department of Aerospace Engineering, Tamkang University, New Taipei City, Taiwan

Elliot, J. (1991) *Action Research for Educational Change* . Buckingham: Open University Press

Ellis, R. (2009). *A typology of written corrective feedback types*. ELT J, 63(2), 97-107. escholarship.org/uc/item/2504d6w3.pdf

Fatma TÜRK and Muammer ÇALIK 2008; *Using different conceptual change methods embedded within 5E model*: A sample teaching of Endotherm ic – Exothermic reactions

Grami, G. M. A. (2005). *The effect of written feedback on ESL students' perceptions:* A study in a Saudi University-Level context. Retrieved from http://research.ncl.ac.uk/ARECLS/vol2_documents/Grami/grami.htm

Greenwald, A. G. (1989). *Why are attitudes important*? In A. R. Pratkanis, S. J.

Guennette, D. (2007). *Is feedback pedagogically correct? Research design issues in studies of feedback on writing*. Journal of Second Language Writing, 16, 40-53. Growthmindseteaz.org/files/Power_of_Feedback_JHattie.pdf

Hattie, J., & Timperley, H. (2007). *The power of feedback. Review of Educational Research*, 77(1), 81-112.

Hirashima T. Kashihara, A. Toyoda. J. (1995); *It is important for students to understand why they made errors and what would be the consequences of these errors in problem solving in order to correct and prevent them from repeating*.

Katrien Struyven, Filip Dochy and Steven Janssens,(2005); *Students' perceptions about evaluation and assessment in higher education:* a review1,University of Leuven (KULeuven), Belgium

Katrin Rolka, Bettina Rosken and Peter Liljedahl,(2007); *The role of cognitive conflict in belief change*s;University of Dortmund, Germany / University of Duisburg-Essen, Germany / Simon Fraser University Canada

Kerlinger, F.N. (1986). *Foundations of behavioral research* (3rd. ed.). Fort Worth, TX: Holt, Rinehart, and Winston.

Kluger, A. N., & DeNisi, A. (1996). *Effects of feedback interventions on performance:* A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119,* 254-284.

Kombo, D. K. and Tromp, D. L. A. (2006)'. *Proposal and Thesis Writing: An Introduction.* Paulines Publications' Africa, Nairobi.

Kulik James A & Kulik Chen-Lin C.(1988); *Timing of Feedback and Verbal Learning The University of Michigan*

Lammers, W. J., and Badia, P. (2005). *Fundamental of Behavioral Research*. California: Thomson and Wadsworth.

Laurillard, D. (1993) *Rethinking university teaching*, London: Routledge.

Margaret Heritage , (2010); *Formative Assessment and Next-Generation Assessment Systems*:Are We Losing an Opportunity? University of California, Los Angeles

Margarita Limo´n (2001); *On the cognitive conflict as an instructional strategy for conceptual change:* a critical appraisal; Faculty of Psychology, Autonoma University of Madrid, Cantoblanco, 28049 Madrid, Spain

Mariëtte Koen1, E.M. Bitzer2 and P.A.D. Beets2,(2012), *Feedback or Feed-forward*? A Case Study in One Higher Education Classroom.

Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). Setting Objectives and Providing Feedback. In *Classroom instruction that works* (pp. 92-102). Alexandria, VA: Association for Supervision and Curriculum Development

Mathan, S. A., & Koedinger, K. R. (2005). *Fostering the intelligent novic arning from errors with metacognitive tutoring*. Educational Psychologist, 40(4), 257-65.

Melanie Greenan,(2010);*The Secret of" Success Criteria*

Min Jou and Jaw-Kuen Shiau , (2012);, *The Development of a Web-Based Self Reflective Learning System for Technological Education*; Department of Industrial

Ministry of Education Science and Technology. (2005). *Kenya Education Sector Support Programme 2005-2010: Delivering Quality Education to allKenyans.* Nairobi.

Ministry of Planing C2005); MGG, Kenya chapter.

M'Kiambi Kinanu Jannis (2013);*Ccontribution of SMASSE in-service project on students' performance in mathematics in KCSE examination in Nkuene Division, Meru County, Kenya*. Kenyatta University

Mugenda, O. and Mugenda, A. (2003). *Research methods: Quantitative and Qualitative Approaches:* Nairobi. African Centre for Technology Studies Nairobi,Kenya.

Muhammad Shahid Farooq and Syed Zia Ullah Shah,(2008*); students' attitude towards mathematics*; Pakistan Economic and Social Review

Neha Sinha,(2012);*The effects of immediate versus delayed feedback after multiple-choice questions on subsequent exam performance*; New Brunswick Rutgers, The State University of New Jersey.

Ngozi, Malan and Mphahlele (2000).

Nicholas, L. 2008. *Introduction to Psychology*. 2nd Ed. Cape Town: UCT Press.

Nicol, D. J., & Macfarlane-Dick, D. (2006). *Formative assessment and self-regulated learning*: a model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199-218.

Nicolaidou Maria and Philippou George 2003*; Attitudes towards mathematics, self-efficacy and achievement in problem-solving*,University of Cyprus

Origa, J. O. (2000*). The impact of constructivism on the learning of geometry among girls in Kenyan Secondary Schools*. Unpublished PhD Thesis. University of Nairobi

Orodho, J.A. (2008). *Techniques of Writing Research Proposals and Reports in Educationand Social Sciences*.KanezjaHP Enterprises,Maseno.

Orton A (1987); *Learning Mathematics*: Issues, Theory and Classroom Practice Cassell Education.

Paris,S.G. & Ayres,L.R. (1994) . *Becoming Reflective Students and Teaching.* American Psychological Association.

Pugalee, D.K., Arbaugh, F., Bay-Williams, J.M., Farrell, A., Mathews, S., & Royster, D. (2008*). Navigation Through Mathematical Connections in Grades 6-8. Reston*: National Council of Teachers of Mathematics

Race, P (2002*); Evidencing reflection: putting the 'w' into reflection*. (ESCALATE Learning Exchange), (http://www.escalate.ac.uk/exchange/Reflection)

Rami F. Mustafa, (2011), *Feedback on the Feedback*: Socio-cultural Interpretation of Saudi ESL, Learners' Opinions about Writing Feedback.

Rosenthal, R. and Rosnow, R. L. (1991). *Essentials of Behavioral Research.* New York: McGraw-Hill.

Rowe, A.D. and Wood, L.N. (2008). *Student perceptions and preferences for feedback*. Asian Social Science, 4, 3, 78-88.

Sadler, D. (1989). *Formative assessment and the design of instructional Systems*. Instructional Science, 18, 119 – 144.
www.michiganassessmentconsortium.org/.../MAC-Resources-...

Santos Leonor and Pinto Jorge, 2009. *Lights and shadows of feedback in mathematics learning*,University of Lisbon, School of Education of Setúbal.

Sassenrath, J. M., & Yonge, G. D. (1968). *Delayed information feedback, feedback cues, retention set, and delayed retention.* Journal of Educational Psychology, 59, 69-73.

Schön, D (1983) ; The *reflective practitioner: how professionals think in action* (Boston: Arena Publishing

.

Selmen Salima,(2006);*The Students' Attitudes to Teachers' Feedback in Writing.* A Case Study of Second Year Students, University of Constantine.

Schön, Donald A. *The Refl ective Practitioner: How Professionals Think in Action*. Boston: Basic, 1983. Print.

Sheen, Y. (2010). *Differential effects of oral and written corrective feedback in the ESL classroom.* Studies in Second Language Acquisition, 32, 203-234.
www.american.edu/cas/faculty/sheen.cfm

Shute, V.J. (2008). *Focus on formative feedback*. Review of Educational Research, 78, 153-189

Skinner B. F.(1958). *Teaching Machines Science, New Series*, Volume 128, Issue 3330 (Oct. 24, 1958), 969-977.

Stiggins, R. J., Arter, A., Chappauis, J., & Chappauis, S. (2007*). Classroom assessment for students learning*: Upper Saddle River, NJ: Pearson Education

Stiggins, R.J. 2008. *Assessment Manifesto: A Call for the Development of Balanced Assessment Systems.* Oregon: ETS Assessment Training Institute

Thalheimer, W. (2008); *Providing Learners with Feedback—Part 1*: Research-based recommendations for training, education, and e-learning. Retrieved June 20, 2008, from http://www.work-learning.com/catalog/

The East Africa Standard, 1/3/2009

Tong, S. Y. A. (2011). *Exploring students' perception of and reaction to feedback in school-based assessment*. *The Malaysian Journal of ELT Research, 7(2), 104-147*.

Truscott, J. (1996). *The case against grammar correction in L2 writing classes*. Language Learning, 46, 327–369.

Truscott, J. (2007). *The case against grammar correction in L2 writing classes*. Language Learning, 46, 327-369.
www.elsevier.com/.../journal_of_second_language_Writing.pdf

Tunstall, P. & Gipps, C. (1996). *Teacher feedback to young children in formative assessment:* a typology. British Educational Research Journal, 22(4), 389-404.

Vicki J. Barry Hickman, NE Math,(2008), *Using Descriptive Feedback In a Sixth Grade Mathematics Classroom*

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
www.psy.cmu.edu/~siegler/vygotsky78.pdf

APPENDICES

APPENDIX I

TOPICAL TEST FOR FORM TWO, 2ND TERM 2014.

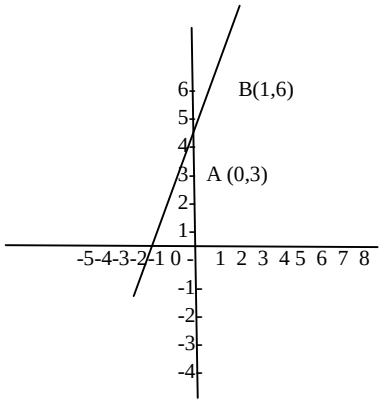
SCHOOL…….

NAME…….ADM No…….....

Time; 40 minutes.

Attempt all the questions. All your working must be shown on the spaces provided.

1. Find the gradient of a line AB. (2 marks).



2. Determine the gradient of a straight line passing through the point P(2, 3) and point Q(5,6). (2 marks).

3. Find the gradient of the line whose equation is 3y-6x+7=0. (2 marks).

4. Determine the equation of a line passing through the point L(-1, 7) and M(3, 3). (3 marks).

5. Determine the equation of a line with gradient 3, passing through the point (1, 5). (3 marks).

6. Find the equation of a line whose x-intercept is -3 and y-intercept is 6. (3 marks).

7. Determine the equation of a line parallel to $6(3x-y)+9=0$ and passing through the point (-3, -2). (3 marks).

8. A perpendicular to the line $y-4x+3=0$ passes through the point (-8, 5). Determine its equation. (4 marks).

9. A line with gradient -3 passes through the point (3, k) and (k, 8). Find the value of k and hence express the equation in the form $ax+by=c$, where a, b and c are constant. (4 marks).

10. The equation of a line L_1 is $2y-5x-8=0$ and line L_2 passes through the point (-5, 0) and (5, -4), without drawing L_1 and L_2, show that the two lines are perpendicular to each other. (4 marks).

TOPICAL TEST FOR FORM TWO, 2ND TERM 2014.

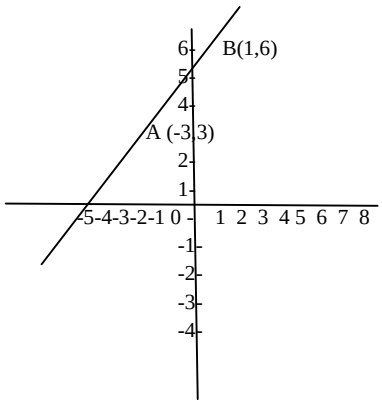
SCHOOL…….

NAME……ADM No……....

Time; 40 minutes.

Attempt all the questions. All your working must be shown on the spaces provided.

1. Find the gradient of a line AB. (2 marks).



2. Determine the gradient of a straight line passing through the point P (5, -4) and point Q (-1,2) (2 marks).

3. Find the gradient of the line whose equation is 3y+2x-5 = 0. (2 marks).

4. Find the equation of the line which passes through the points P (3,7) and Q (6,1) (3 marks).

5. Find the equation of a line through point (-2, 4) which is parallel to 3y = - 2x + 8. Express your answer in the form y = mx + c. (3 marks).

6. Find the equation of the line whose x- intercepts is -2 and y- intercepts is 5.

(3marks).

7. Determine the equation of a line passing through (-1, 3) and parallel to the line whose
Equation is 3x -5y = 10 (3 marks).

8. Determine the equation of a line which is perpendicular to the line 2x + 3y + 4 = 0 and passes through P(1,1) (4 marks).

9. A line with gradient -3 passes through the point (3, k) and (k, 8). Find the value of k and hence express the equation in the form ax+by=c, where a, b and c are constant. (4 marks).

10. The equation of a line L_1 is 2y-5x-8=0 and line L_2 passes through the point (-5, 0) and (5, -4), without drawing L_1 and L_2, show that the two lines are perpendicular to each other. (4 marks).

APPENDIX II

QUESTIONNAIRE FOR MATHEMATICS TEACHERS

The researcher is interested in investigating the effect of descriptive feedback in assessment of mathematics in secondary schools in Konoin District. Please answer all questions as honestly as possible. Do not write your name or anything that will identify you.

SECTION A: Demographic data

1. What is your gender?

Male [ ] Female [ ]

2. What is your age bracket?

25 and below [ ] 26-35 [ ] 36- 45 [ ] 26- 35 [ ] 45 and above [ ]

3. What is your academic qualification? _____

4. What is your professional qualification? _____

5. What is your teaching experience in years?

5 years and below [ ] 6-10 years [ ] 11-15 years [ ] 16 and above [ ]

6. What type of school?

Private [ ] Public [ ]

7. What category is your school?

Girls Day [ ] Girl Boarding [ ] Boys Boarding [ ] Boys Day [ ] Mixed Boarding [ ] Mixed Day Mixed boarding and Day [ ]

8. How long have you been Mathematics teacher?

Less than 1 year [ ] 1-5 years [ ] 6-10 years [ ] 11-15 [ ] years Over 15 years [ ]

9. For how long have you been the teacher in your current school?

Less than 1 year [ ] 1-5 years [ ] 6-10 years [ ] 11-15 [ ] years Over 15 years [ ]

SECTION B. Evaluation of Descriptive Written Feedback

Please put a tick on your preferred option.

10. Do you provide your learners with written feedback when you give them some task in form of test, assignment or quizzes?

Yes [ ] No [ ]

11. How long does it take you to give feedback to your learners after giving them test, assignment or quizzes?

less than 4days [ ] more than 5 days [ ]

12. Do you provide your learners with feedback which is directed towards the goal?

Yes [ ] No [ ]

13. Does the feedback provided to learners help them to reflect on their performance? Yes [ ] No [ ]

14. Do the learners like the feedback you provide?

Yes [ ] No [ ]

APPENDIX III

QUESTIONNAIRE FOR MATHEMATICS STUDENTS

A. Pre-testing on attitude of students towards mathematics

Please answer the following questions

1. How many subjects are you taking in your class?
2. Please list down all those subjects in order of preference from the most like to the least like;

   i----------
   ii----------
   iii ----------
   iv ----------
   v----------
   vi----------
   vii----------
   viii----------
   ix ----------
   x ----------
   xi----------
   xii ----------
   xiii----------

3. Which subjects are compulsory in KCSE?----------

4. Which subjects would you like to be compulsory in KCSE?----------
   ----
5. What is your target career?----------
6. Which subjects are required in your target career?----------
7. Do you have a personal study time table?----------
8. How many times does mathematics appear in your personal study time table?----------
9. Why is mathematics appearing such a number of times?----------

E. Evaluation of Descriptive Written Feedback

Please circle your preferred option.

1. Descriptive written feedback did not help me to reflect on my performance in mathematics.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

2. Descriptive written feedback have assisted me to think about strategies of improving my performance in mathematics
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

3. Descriptive written feedback does not help me reflect on errors in mathematics.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

4. I prefer descriptive written feedback provided immediately after mathematics assignment.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

5. Immediate descriptive feedback does not help me correct the mistakes in mathematics.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

6. I prefer when teachers give delayed descriptive feedback on all errors in mathematics.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

7. I prefer to receive goal directed descriptive feedback on every mistake I make.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

8. I would like my teachers to provide me with descriptive feedback explaining to me where the error occurred.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

9. I prefer descriptive feedback which is not directed toward any goal.
   A. Strongly disagree [ ] B. disagree [ ] C. Neutral [ ] D. Agree [ ] E. Strongly agree [ ]

E.Post-testing on attitude of students towards mathematics

Please answer the following questions

1. How many subjects are you taking in your class?
2. Please list down all those subjects in order of preference from the most like to the least like;

   i----------
   ii----------
   iii ----------
   iv ----------
   v----------
   vi----------
   vii----------
   viii----------
   ix ----------
   x ----------
   xi----------
   xii ----------
   xiii----------

3. W hich subjects are compulsory in KCSE?----------
4. Which subjects would you like to be compulsory in KCSE?----------
   ----
5. What is your target career?----------
6. Which subjects are required in your target career?----------
7. Do you have a personal study time table?----------
8. How many times does mathematics appear in your personal study time table?----------
9. Why is mathematics appearing such a number of times?----------

APPENDIX VI

SCHEME OF WORK

WK	LSN	TOPIC	SUB-TOPIC	OBJECTIVES	L/ACTIVITIES	L/T AIDS	REFERENCE	REMARKS
4	1	Gradients And Equations Of Straight Lines	Gradient of a straight line	By the end of the lesson, the learner should be able to: Define gradient of a straight line Determine the gradient of a straight line through known points	Drawing linear graphs Plotting co-ordinates on the Cartesian plane Reading co-ordinates of points on the Cartesian plane	Square boards Graph books Straight edged ruler Real life situation	Discovering secondary mathematics Book 2 Page 25-23 Secondary mathematics KLB book 2 page 27-34 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 174	
	2	Gradients And Equations Of Straight Lines	equation of a straight line	By the end of the lesson, the learner should be able to: Determine the equation f a straight line using gradient and a known point Determine the equation of a straight line given two points	Drawing linear graphs Plotting co-ordinates on the Cartesian plane Reading co-ordinates of points on the Cartesian plane	Square boards Graph books Straight edge/ruler Real life situation	Discovering secondary mathematics Book 2 Page 25-26 Secondary mathematics KLB book 2 page 34-35 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 171	
	3-4	Gradients And Equations Of Straight Lines	General equation of a straight line	By the end of the lesson, the learner should be able to: Express the equation of a straight line in the form of y=mx+c Interpret the equation y=mx+c	Drawing linear graphs Plotting co-ordinates on the Cartesian plane Reading co-ordinates of points on the Cartesian plane	Square boards Graph books Straight edge/rulers Real life situation	Discovering secondary mathematics Book 2 Page 27 Secondary mathematics KLB book 2 page 34 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 171	
	5-6	Gradients And Equations Of	The intercept of a straight line	By the end of the lesson, the learner should be able to: Find the x and the y	Drawing linear graphs Plotting co-ordinates on the Cartesian plane	Square boards Graph books Straight edge/rulers Real life	Discovering secondary mathematics Book 2 Page 28 Secondary	

		Straight Lines		intercept of a straight line Express a double intercept equation of a straight line	Reading co-ordinates of points on the Cartesian plane	situation	mathematics KLB book 2 page 36 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 171	
5	1-2	Gradients And Equations Of Straight Lines	The gradient of parallel lines	By the end of the lesson, the learner should be able to: Find the gradient of parallel lines Relate parallel lines in terms of their gradients	Drawing linear graphs Plotting co-ordinates on the Cartesian plane Reading co-ordinates of points on the Cartesian plane	Square boards Graph books Straight edge/ rulers Real life situation	Discovering secondary mathematics Book 2 Page 29 Secondary mathematics KLB book 2 page 43-44 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 175	
	3-4	Gradients And Equations Of Straight Lines	The gradient of perpendicular lines	By the end of the lesson, the learner should be able to: Find the gradient of perpendicular l lines Relate perpendicular lines in terms of their gradients	Drawing linear graphs Plotting co-ordinates on the Cartesian plane Reading co-ordinates of points on the Cartesian plane	Square boards Graph books Straight edge/ rulers Real life situation	Discovering secondary mathematics Book 2 Page 30 Secondary mathematics KLB book 2 page 41-43 KLB teachers' guide book 2 page 14-15 Golden tips mathematics pages 172	