VERBAL INTERACTIONS IN PHYSICS CLASSROOMS IN SOME SELECTED SECONDARY SCHOOLS IN MATUNGULU DIVISION, KANGUNDO DISTRICT, KENYA.

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A RESEARCH THESIS SUBMITTED FOR THE DEGREE OF MASTER OF EDUCATION IN THE SCHOOL OF EDUCATION OF KENYATTA UNIVERSITY.

SEPTEMBER-2009
Wambua, Joseph
Verbal interactions
in physics

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

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This thesis is dedicated to my loving wife Susan Nkatha for her endless support while I was preparing this work. May God bless her mightily for her patience and endurance during my long time absence both physically and mentally over this period.
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Above all, thanks to the Almighty God for granting me good health and a sober mind during the preparation of this work. Lastly, thanks to the assistant typist, Bill who worked tirelessly on this work.
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ABSTRACT

Mode of instruction used in teaching is key to the understanding of the concepts and skills to be learned. Instruction in classrooms is controlled to a larger extend by the interaction patterns involving teachers, learners and resources. Some interaction patterns seem to promote learning especially science subjects. Kenya has been recording very low performance in Physics for a long period of time. This concern prompted this study on interactions in physics lessons with the aim of determining the common patterns that can aid in drawing possible inferences on the effects of instruction in science subjects. The study was descriptive in nature and used five schools in one division of Kangundo district. The main instrument was modified Flanders’ Interaction Analysis Categories (FIAC) which was used in Physics lessons. The data was analysed using ratios, percentages and chi-square. It was observed that there exists a significant difference in the teachers’ verbal behavior patterns in the boys’ and girls’ schools. Teachers in girls’ schools used patterns related to ‘direct’ methods which created autocratic climate in class and hence limited participation in girls during lessons. On the other hand, patterns in the boys’ schools related to ‘indirect’ methods which encouraged boys to ask questions and interact with resources more, thus creating a more democratic learning climate. On the overall, most teachers leaned towards patterns that created autocratic climate which may not be suitable for learning physics and science subjects in general.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASEI</td>
<td>Activity, Student, Experiment, Improvisation.</td>
</tr>
<tr>
<td>D.E.O</td>
<td>District Education Office.</td>
</tr>
<tr>
<td>ICT</td>
<td>Information Communication and Technology.</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology.</td>
</tr>
<tr>
<td>F.I.A.C</td>
<td>Flanders' Interaction Analysis Categories.</td>
</tr>
<tr>
<td>K.C.P.E</td>
<td>Kenya Certificate of Primary Education.</td>
</tr>
<tr>
<td>K.C.S.E</td>
<td>Kenya Certificate of Secondary Education.</td>
</tr>
<tr>
<td>MoE</td>
<td>Ministry of Education.</td>
</tr>
<tr>
<td>NEPAD</td>
<td>New Partnerships for Africa's Development.</td>
</tr>
<tr>
<td>PDSI</td>
<td>Plan, Do, See Improve.</td>
</tr>
<tr>
<td>SMASSE</td>
<td>Strengthening Mathematics and Science in Secondary Education.</td>
</tr>
<tr>
<td>URL</td>
<td>Universal Resource Locator.</td>
</tr>
</tbody>
</table>
CHAPTER ONE
INTRODUCTION.

1.1 Background information.

Kenya has been aspiring to offer her people quality and relevant education. Sutherland (1997) argues that child-centered educators foster the development of an individual. She believes that an individual should enjoy education, find it as a source of happiness and fulfillment-discovering while satisfying new interests. The education offered to Kenyans should have some relevance for better industrial links to be created.

Kenya aspires to get industrialized by the year 2030. Use of proper teaching methods might be one of the crucial ways of helping Kenyans to achieve this goal. These proper methods of teaching (indirect methods) should show a move from the ‘traditional methods of teaching’ like the formal lecture method to the modern ways of teaching like role playing which ensure almost total involvement of the learner in the teaching-learning process.

Pollard (2005) suggests that classroom interaction which involves communication helps us to make best use of time and also to answer some pertinent questions to teaching and learning. Some of the questions include; how effective is teaching by telling and can it be done better? How good are we at asking questions? How can we make class discussions better?
Innovations have been done worldwide in an attempt to increase verbal interactions in the classroom. According to Draper (2002) electronic equipment for interaction in lecture halls has been designed in the United Kingdom. Using this device, classroom interaction is electronically enhanced. Verbal interaction takes a greater percentage as compared to other forms of interaction while the teaching-learning process is in progress. Verbal interaction here refers to what the teachers and the pupils say to each other, who does the talking and about what, who asks questions and who responds.

According to Sotto (1995) the way the teacher communicates is an important issue. As a result, one of the topics commonly taught in teacher training courses is classroom communication and more so the verbal communication. Verbal behaviour has some advantages when used in analyzing classroom interaction in that it is easy to observe and note whatever is happening. An observation checklist is required for this purpose.

Pollard (2005) observes that verbal communication is and will always be at the heart of teaching. Researchers have shown that teachers do much of the speaking which takes place in the classroom (ibid: 262). Flanders (1970) carried out a research in America and found out that in the teaching sessions observed, two-thirds of the time was spent in a talk and two-thirds of that talking was done by the teacher. The picture was a predominantly teacher dominated situation.
Muthwii (1981) researched on verbal interactions in Chemistry classrooms and found out that in Kenyan classes eighty percent (80%) of the total time is spent on lecturing by the teacher. Learner-centered and interactive methods of teaching lead to effective teaching and learning. He recommended that there is need to involve the learners fully while teaching.

Omar (1996) did a research in Physics, Chemistry, English and Kiswahili on variation of teaching behaviour patterns of teachers with different class levels and subjects. She found out that teachers teaching different class levels do not exhibit different teaching behaviour patterns.

Njuguna (2000) studied verbal interaction patterns in some selected secondary school Home-science teachers with their students in Nairobi province and found out that there exists a significant difference in the direct teaching behaviour patterns of Home-science teachers in girls', boys' and mixed schools. Njogu (1993) studied the implications of classroom interaction on performance in Biology and found out that learners perform better in cases where they are allowed more verbal interaction with the teacher.

In Kangundo district, no study on verbal interactions has ever been carried out and neither is a study on verbal interaction in physics classrooms. The aspect of gender and interaction patterns of teachers in physics classrooms has also not been studied and this study has focused on it.
1.2 Statement of the problem

There are some methods of teaching which teachers mostly use. The most common method they use is the lecture method. According to Maundu, et al. (1998) the lecture method has several disadvantages one of them being that it can be very boring to the learners. If learners find a subject boring at the lower levels, they might not choose to continue taking the subject in forms three and four though it should be noted that there are other factors which influence the learner’s choice of a particular subject.

There is therefore a great need to investigate the interaction patterns in different categories of schools, that is mixed, boys’ and girls’ schools. There might be a possibility that expository methods are the ones leading to the poor performance and hence low enrolment of both boys and girls in physics. It is also worth-noting that not many researches have been done on the effective interaction patterns in a physics classroom and hence there is need for this kind of study.

From Table 1.1, there are fewer girls taking physics than boys in all years (from 2001-2005). There are several factors which might have led to this low enrolment though there is need to establish from this study whether the verbal interaction patterns existing in girls’ schools might have led to it. To establish this, the researcher sought to know whether there was any significant difference in
classroom interaction patterns during teaching and learning of physics in mixed, girls’ and boys’ schools.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>GIRLS ENTRY</th>
<th>GIRLS MEAN</th>
<th>BOYS ENTRY</th>
<th>BOYS MEAN</th>
<th>TOTAL ENTRY</th>
<th>% OF GIRLS</th>
<th>% OF BOYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>16,210</td>
<td>38.36</td>
<td>38,388</td>
<td>38.62</td>
<td>54,598</td>
<td>29.7</td>
<td>70.3</td>
</tr>
<tr>
<td>2002</td>
<td>15,283</td>
<td>42.18</td>
<td>38,793</td>
<td>44.51</td>
<td>54,076</td>
<td>28.3</td>
<td>71.7</td>
</tr>
<tr>
<td>2003</td>
<td>16,094</td>
<td>42.69</td>
<td>40,386</td>
<td>44.39</td>
<td>56,480</td>
<td>28.5</td>
<td>71.5</td>
</tr>
<tr>
<td>2004</td>
<td>16,975</td>
<td>46.95</td>
<td>43,107</td>
<td>51.50</td>
<td>60,082</td>
<td>28.3</td>
<td>71.7</td>
</tr>
<tr>
<td>2005</td>
<td>19,290</td>
<td>48.64</td>
<td>50,145</td>
<td>54.77</td>
<td>69,435</td>
<td>27.8</td>
<td>72.2</td>
</tr>
</tbody>
</table>

Source: Kenya National Examinations Council (KNEC)

When learners perform poorly in a subject, their expectations in the subject go down and their motivation in the subject decreases. This leads to low enrolment in the subject. The model below can be used to illustrate this.

**Figure 1.1: A model showing how performance affects enrolment.**

1.2.1 Purpose of the study.

The purpose of this study was to determine the verbal interaction patterns which exist in physics classrooms. The study was also to establish whether there exists any significant difference in verbal interaction patterns in mixed, girls’ and boys’ schools.
1.3 Objectives of the study.

This study was guided by the following objectives:

1) To find out the kind of classroom atmosphere created by the teacher's verbal interaction patterns.

2) To find out which between the direct and the indirect methods of teaching elicits most responses from the learner.

3) To find out whether there is any significant difference in classroom verbal interaction patterns among mixed, girls' and boys' schools.

1.4 Research questions.

The research was guided by the following pertinent questions.

1) What type of teacher-pupil interaction patterns exist in a Physics classroom?

2) Are there any significant differences in classroom interaction patterns in the teaching of physics in mixed, girls' and boys' schools?

1.5 Scope and limitations of the study.

From the objectives listed above, it is very evident that the researcher concentrated more on verbal interactions in physics classrooms. He did not consider physics content and the syllabus which are equally important.

Secondly, the researcher dealt with only one level that is the Form Two classes and not the other forms. Thirdly, the study was conducted in six schools of Matungulu division and this means that a small sample was taken for the study.
Due to this, the results obtained cannot be used with a high level of confidence to make generalizations on the verbal interactions which take place in other physics classrooms. Lastly, non-verbal interaction was not focused on in the study because the major interest was on the verbal interactions.

1.6 Basic assumptions of the study.

The researcher assumed that:

1) His presence in the classroom did not greatly affect the normal interaction of the teacher and the learners.
2) The verbal behaviour patterns during the research were the same as the ones usually displayed by the teacher and the learners while teaching in the absence of the researcher.

1.7 Significance of the study.

Findings of this research might help in coming up with appropriate recommendations that will assist Physics teachers, curriculum developers and policy-makers in improving teaching and learning of Physics. Authors of physics textbooks might also find the findings of great importance. Trainers of teachers in teacher training colleges and universities will also benefit by getting to know the type of verbal interactions which increase learner participation and hence good performance. They will in turn train their learners while borrowing from the findings.
Trainers of teachers in colleges and universities might find something to adopt from this study. They will get to know the methods of teaching science which elicit more verbal interactions in the classroom for effective learning to take place. There is need for curriculum developers to be knowledgeable on the methods of teaching science effectively. Teaching of physics and science in general requires an experimental approach (Musyoka, 2004). There is therefore need for these practical activities to be included in the syllabus. The learners are trained on the process skills of discussing and reporting experimental results which are verbal in nature during these experimental activities.

Authors of textbooks are guided by the syllabus so as to know what to include in their books. The authors need to know how to increase the level of verbal interactions while writing their books either by including some role plays or discussion topics in their books. They can see the importance of including them if they get to know the power in verbal interactions while teaching.
1.8 Conceptual framework.

Flanders (1970) observes that interaction analysis is a label that refers to any technique for studying the chain of classroom events in such a fashion that each event is taken into consideration.

The conceptual framework in Figure 1.2 has two parts. Part one shows the preferred elements of verbal interaction which lead to motivated learners and as a result good learning. Part two shows the un-preferred elements of verbal interaction which leads to poor learning outcomes and un-interested learners.

Teaching is more or less effective depending on how ‘directly’ or ‘indirectly’ teachers influence the learner’s behaviour while teaching. Flanders built his general ideas into ten categories, so that some would be used to record direct influence and others indirect influence. He then developed a simple way of analyzing the resulting observations to give teachers scores reflecting “directness” or “indirectness” of their teaching styles.

Direct teaching is where the teacher behaves as the know it all. His/her work is to transmit the knowledge to the passive learners. Indirect teaching makes use of the heuristic (discovery) methods of teaching while direct teaching behaviour makes use of the expository methods of teaching.
Figure 1.2 Preferred and un-preferred instructional behaviour.

**PART I: PREFERRED INSTRUCTIONAL BEHAVIOUR.**

In-direct instructional behaviour
- Accepts feelings of the learner
- Praises and encourages the learner
- Accepts/uses the learner
- Asks the learner questions

Democratic climate in the classroom.

The learners:
- a) Have greater interest.
- b) Learn more.
- c) Performance goes up.

Learner develops positive attitude towards:
- the teacher
- the subject

Learners participate more.
Learners respond to the teacher's questions more.
The learners' initiation increases during learning.

**PART II: UN-PREFERRED INSTRUCTIONAL BEHAVIOUR.**

Direct instructional behaviour
- Lecturing
- Giving directions
- Reciting facts
- Criticizing

Autocratic climate which leads to:
- Poor learning outcomes.
- Loss of interest which influences the choice of the subject.

Learner develops a negative attitude towards:
- The teacher
- The subject
- The school and Learning

Adapted from Njuguna (2000)
The teacher engages the students in one-way kind of communication that is communication from the teacher to the learner. The learners are always passive while receiving knowledge. They do not internalize it (Munywoki, 2004:6).

Indirect instruction (teaching) is learner – centered approach to teaching that facilitates practice of a range of skills and encourages learners to take responsibility for the enquiry process. Learner-centered approaches lead to two-way communication. The teacher’s role is to guide the learners by clarifying instructions. There is a lot of student initiation. The teacher is a facilitator and he/she helps the learners in acquiring the required knowledge and skills. In so doing, the learners are able to construct cognitive skills which are applicable in acquiring other required skills and knowledge (Munywoki, 2004:7).

1.9 Definition of terms used.

Active Participation - Overt or observable involvement in a learning activity.

Communication - The sharing of thoughts and feelings through words or symbols that have approximately the same meaning for all involved.

Classroom Climate - The atmosphere and environment in which students and teachers work and relate to one another.

Direct teaching method - A direct instructional strategy best suitable for memorizing basic information and mastering of well –
defined performance skills. It emphasizes systematic organization using small steps, checking for understanding and ensuring active learner-participation and learner success.

E-learning - Computer enhanced learning
In-direct teaching - A learner centered ‘open approach’ to education that facilitates practice of a range of skills and encourages learners to take responsibility for the enquiry process.

Instructional behaviour - These are acts by the teacher, which occur in the context of classroom interaction. They are basically teaching behaviours.

I/D Ratio - The ratio of in-direct instructional behaviour to direct instructional behaviour.

Learning - Acquisition of knowledge, skills and attitudes that results in observable change in behaviour or capability.

Learning Strategies - These are the instrumental strategies; specific methods of promoting learners achievement of planned learning goals.

Rhetoric questions - Questions asked for rhetorical effect, and not to elicit a response.
Verbal interaction - What teachers and pupils say to each other, who does the talking and about what, who asks questions and who responds.

7-4-2-3 system- A system of education where the learner takes seven years in primary school, four years in “O” level secondary school education, two years in “A” level secondary school education and at least three years of university education.

8-4-4 system- A system of education where the learner goes through eight years of primary education, four years of secondary education and four years of university education (for a basic degree).
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction.

Literature review means locating literature in a variety of sources, reading it carefully and thoroughly, evaluating the content, breaking it down into themes and organizing it along the themes of the study. For this purpose, the literature in this study was reviewed under the sub-headings; classroom interaction analysis, teaching behaviour, approaches of teaching Physics and review of related studies done in Kenya and elsewhere. It is very important to look at the views of other researchers on the issue of verbal interactions in the classroom.

2.2 Classroom interaction analysis.

Interaction analysis is a label that refers to any technique for studying the chain of classroom events in such a fashion that each event is taken into consideration. Classroom events include classroom talk which is of course, that verbal interaction which takes place between the teacher and the learner and between a pupil and a pupil (Amidon, 1966).

It is through this analysis that teachers can know their instructional styles. An individual cannot easily tell whether he uses the indirect teaching styles or the direct instructional styles. The indirect instructional styles are preferred because they cultivate positive attitudes in the learner towards
the subject, and the teacher. In addition, they also enhance learner participation in the classroom.

For a teacher to know whether he/she is using the direct or indirect methods, observation during lessons becomes very important. These observations can be done by use of a modified FIAC observation sheets. Nachmias, C. and Nachmias, D. (1992: 35) consider social science research as being rooted in observation. They assert that, in a sense all social science researches begin and end with observations. They argue that:

*The main advantage of observation is directness; it makes it possible to study behaviour as it occurs. The researcher does not have to ask people about their own behaviour and the actions of others; he or she can simply watch them do and say things. This in turn is un-contaminated by factors standing between the investigator and the object of research.*

Their argument implies that the data collected by observation may describe the observed phenomena as they occur in their natural settings.

Allwright (1988) observes that the obvious radical alternative to methodological comparisons was to be found in general educational work where observation was already the key procedure for a number of researchers, notably by Flanders.
Bell (1993) notes that in observation studies, careful planning and piloting are essential, and it takes practice to get the most out of this technique. She says that however, once mastered, it is a technique that can often reveal characteristics of groups or individuals which would have been impossible to discover by other means. Direct observation, she argues, may be more reliable than what people say in many instances. It can be particularly useful to discover whether people do what they say or behave in the way they claim to behave. An effective teacher can increase learner participation by using an interaction analysis system (teacher-student and student-student interaction analysis).

Lang, *et al.* (1995) note that all students should have chances to contribute to their own and their peers learning experiences. They further comment that discussion should not be left for the aggressive students who dominate and make others passive. Interaction analysis on the part of the learner can help the teacher in balancing the contributions of learners while making sure that all of them participate.

### 2.3 Teaching behaviour/instructional strategies.

Allwright and Bailey (1991) agree with Flanders (1960) that observations of many different classes both in content area, subject and in language instruction consistently show that teachers typically do between one half
and three quarters of the talking done in classrooms. Allwright and Bailey (1991) argue that talk is one of the major ways that teachers convey
information to learners. It is also the primary means of controlling learner
behaviour. They argue that it is necessary for teachers to ask themselves
what their talk is like.

Teaching behaviour can either be direct or indirect (Lang, et al., 1995).
They further argue that direct instruction is teacher centred while indirect
instruction is learner-centred. Some examples of direct instructional
strategies include lecture, practice and drill. Indirect instructional
strategies commonly involve inquiring instruction which consists of
guided and unguided inquiry. Inquiry greatly promotes verbal interaction
in the classroom.

Lang, et al. (1995) further argue that no single learning strategy is equally
effective for promoting all domains of knowledge. Both direct and indirect
instructional strategies have their place in the repertoires of effective
teachers and in the well managed classrooms.

Flanders (1970) observes that teaching behaviour by its very nature exists
in a context of social interaction. The acts of teaching lead to reciprocal
contacts between the teacher and the pupils, and the interchange itself is
called teaching. Delamont (1983) reckons that it is hard for any one of us
to think that teaching and learning can take place without talking. She further argues that teaching and talking are closely bound in our culture and if in doubt, try to imagine a silent teacher and quiet learners. Flanders contends that techniques for analyzing classroom interactions are based on the notion that these reciprocal contacts can be perceived as a series of events which occur one after another. According to Flanders (1970:1):

In research, systematic analysis may help to discover laws that explain the variations that exist, within the claim of classroom events, giving special attention to the actions of the teacher. Such laws would express nature of classroom interaction. In the long run, such knowledge should help to explain differences in educational outcomes that are associated with teaching. Each person who analyses classroom interaction has his own reasons, but those who think deeply about teacher pupil contacts are challenged by the task and often disturbed by what they find.

2.4 Approaches to the teaching of physics.

A teaching approach involves all the ways and steps a teacher uses when presenting lesson content. According to Ornstein (1995: xix):

The key role of teachers is to teach students how to learn- that is, learning strategies that will increase students' chances for achievement and reduce the loss of human potential so pervasive in our society today. Coming to know is the goal of the learner; helping students learn how to learn is the goal of the teacher. The extent students come to know and learn how to learn is influenced by how well the teacher can select suitable
Maundu, et al. (1998) suggest that the two common approaches of teaching sciences are the expository approach and the inquiry approach. This somehow contradicts with Sutherland (1997) who argues that there are three teaching approaches in science: problem solving, informing and enquiring approaches, though enquiries and problem-solving can be categorized under learner-centered approaches while informing falls under teacher-centered approaches.

**Expository approach.**

This involves the kind of classroom teaching which is characterized by the predominance of the teacher (Maundu, et al., 1998:75). The teacher gives facts, explains concepts, gives illustrations and applications. The learner's participation in learning is in listening and answering teachers' questions. This approach limits the verbal interaction in the classroom and therefore it is not useful in the presentation of Physics as a practical Science Subject.

Lang, et al. (1995) agree with Maundu, et al. (1998) that there are some cases which call for the use of this method while teaching. Rurigi and Magondu (2004) assert that the expository approach is not very effective in teaching sciences although some topics call for its use because of their very nature, that is they are difficult to teach practically. Lang, et al. (1995) observe that direct instruction can draw on largely teacher-centered
strategies that are particularly effective for presenting declarative information in a step-by-step way, through lecture, explanation and provision of guided practice through oral drills or written seatwork. Twoli (2006) though reckons that there should be less emphasis on the expository type of methods while teaching Sciences and hence more emphasis should be put on the discovery/heuristic approaches.

**Inquiry approach.**

Lang, et al. (1995) observe that inquiry approach encourages learners to investigate a range of topics, thus taking responsibility for their own learning. They also argue that this approach consists of two main branches which are the guided inquiry and the unguided inquiry. Maundu, et al. (1998) argue that the inquiry approach is also referred to as the Scientific or the Discovery Approach. Learning is by discovery. It trains the learners to follow instructions carefully and it is characterized by development of scientific skills such as the ability to make observations, collecting and presenting data, drawing conclusions, inferring and the ability and skills to manipulate apparatus.

**Advantages of guided inquiry.**

The guided inquiry has its own advantages. Lang, et al. (1995) assert that guided inquiry is a useful strategy for moving students gradually from direct to indirect instruction. The teacher asks questions and uses prompts,
cues and probes to obtain thoughtful responses. This creates adequate verbal interaction in the classroom. Maundu, et al. (1998) suggest that this interaction motivates the learners because of their co-operation with the expert that is, the teacher. The presence of the expert also makes work proceed on relatively fast and this saves time.

Twoli (2006) notes that heuristic/discovery approaches put a high demand on resources and time but this cannot be compared with the rewards it brings to learners in terms of meaningful learning with more motivational orientation. He further adds that, in the teaching of Chemistry and any other science, application of inquiry approaches should be done.

**Un-guided inquiry.**

Lang, et al. (1995) assert that unguided inquiry is an open-ended teaching strategy that targets raising both students' interest in learning and the degree of personal responsibility they take for the learning process. While using the unguided approach, the teacher gives the learners some opportunities to interact verbally through making discoveries and then questioning and exploring what they have observed. Lang, et al. (1995) agree with Maundu, et al. (1998) that the unguided inquiry approach sharpens the students skills on how to plan their own investigations and how to solve problems with less dependence on the teacher. Challenging
inquiries can stimulate classroom discussions in a Physics classroom as well as every other school subject.

Sutherland (1997) advocates for learning by experience as this gives the learner a better base for later thinking since the concepts will be accurate and there will be a room for further development. She further argues that scientific principles are not learned from a textbook or by watching other people’s experiments but they are what the individual has discovered by initiating activities, observing and interpreting their results.

Although most of the writers come to a consensus that the inquiry approach is better placed in the teaching of sciences, they again agree on the fact that the approach is time consuming. Teachers should try as much as possible to increase verbal interactions during the teaching-learning process. The in-direct instructional strategies involve the learners more as compared to the direct instructional strategies.

Use of computers in the teaching and learning of physics.

Computer technology for school purposes has been available since the 1950s, but it is in the last few years that computers have begun to have a major impact on classrooms and schools (Ornstein, 1995:248). According to IPSnws (2007) computer education was started in Kenya in 1998. According to wikipedia (1994) e-learning is a general term used to refer to computer enhanced learning. It is used interchangeably in so many
contexts that it is critical to be clear what one means when one speaks of e-learning.

According to Mwangi (2004) in Kenya there was a workshop held in Kenyatta University on 20th September 2004 whose aim was to chat the way forward in trying to start e-learning in African Universities. According to Kariuki (2006) other major international conferences are also taking place in Africa like the conference by the title “e-learning Africa” which has so far held two meetings in two different countries. The first meeting was held in Addis Ababa in May 2006 under the patronage of the Ethiopian minister for capacity development, H.E. Ato Tefera Waluwa. This event attracted 830 participants. The second meeting was held in Kenya in May 2007 which attracted more than 1406 participants of which more than 80% were from Africa. The third meeting was held in Accra, Ghana from 28th-30th May 2008. The reports out of these workshops and conferences are of great benefit to policy-makers, e-learning instructional designers, developers and administrators involved in higher education in Africa.

The report by Mwangi (2004) talked of existence of e-learning in universities and this is a clear indication that at lower levels of learning, e-learning has not yet taken its roots. Sankale (2006) argues that a lot of efforts have been put by NEPAD to assist the Kenyan government in its
efforts to introduce e-learning in primary and secondary schools. He further states that it has already started working with six pilot schools which will serve as demonstration schools for the implementation of the e-schools project.

Kariuki (2006) does not agree with Mwangi (2004). He argues that though the universities in Kenya may argue that they are compliant in terms of e-learning, there is little in their URLs. He further argues that the URLs are inaccessible because the addresses given are within the local internet domain.

The ministry of education is now very busy trying to bring in ICT in Kenyan institutions at all levels. According to Sankale (2006) the MoE in Kenya has come up with an ICT-Policy which recognizes the young people as the future work-force and leading creators and adopters of ICTs. According to Ngare (2007) Kenyan teachers might face sacking if they do not make themselves conversant with ICT. This means that in the near future, Kenyan schools might be using computers in the teaching and learning process in all subject areas. Students will be using computers to generate and retrieve information from the four sources of information inclusive of information utilities, data banks, bibliographic reference services and computerized books. Introduction of ICT in the teaching and learning of physics might improve efficiency in its teaching by a great
extent. Ornstein (1995) argues that teachers are waking up to the fact that computers are with us to stay and can be effective tools of instruction.

2.5 Related studies done in Kenya and elsewhere.

Most of the research in Kenya has dwelled on the teaching methodology, resources used and attitude towards teaching and learning of Physics. The education commissions such as Ominde (1964) and Gachathi (1976) have laid more emphasis on content. The Mackay Commission (1981) which brought in the present changes in the education system from the previous 7-4-2-3 system to the current 8-4-4 system was intending to offer learners education which was relevant. The goal of making it relevant was achieved by making the curriculum practical, vocational oriented and broad-based so that the school leavers would be all rounded and hence self-reliant. After suggesting that teaching should be learner-centered, it did not take any further measures in addressing learner needs and specifically in the learning of Physics.

Muthwii (1987) studied the teacher/pupils discourse events and teaching styles of Chemistry teachers in Machakos District in Kenya. He found out that there existed some considerable differences in teaching styles between teachers. He also found that teacher-talk was more dominant with pupil-talk accounting about sixteen percent of the talk.
Njogu (1993) researched on the implication of classroom interaction on performance and found out that learners performed better in cases where they were allowed more verbal interaction with the teacher. Instead of allowing this, teachers concentrated more on asking closed questions which constrain the pupil's thinking processes.

This study was aimed at investigating the effective verbal interactions in a Physics classroom which lead to quality learning and hence good performance from the learners. This is based on the conviction that the major players in any classroom are the teacher and the learner. Thus, whatever goes on between these two during the classroom interaction process is of importance since the solution might be in the way the interaction is conducted and more so the verbal interaction.

The next chapter addresses several aspects of the methodology used including the research design, instruments, sample and sampling techniques among other aspects of the same.
CHAPTER THREE
RESEARCH METHODOLOGY.

3.1 Introduction.
This chapter focuses mainly on the methodology used in this study. The research
design, locale, population, sample selection, choice of research instruments, data
collection procedures, methods used in the analysis and presentation of data are
discussed.

3.2 Research design.
Kombo and Tromp (2006) define research design as the structure of research.
They give it an impression of the glue which holds all the other elements in a
research proposal together. Orodho (2003) defines research design as the scheme
outline or plan that is used to generate answers to research problems. It is an
arrangement of conditions for collection and analysis of data in a manner that
aims to combine relevance and the research purpose.
The descriptive survey research design was used for this study since the
researcher was to observe the verbal interactions taking place in a Physics
classroom. Kathari (2002) says that descriptive survey constitutes the blue print
for the collection, measurement and analysis of data. Kerlinger (1973) points out
that descriptive studies are not only restricted to fact findings, but may often result
in the formulation of important principles of knowledge and solutions to
significant problems.

Figure 3.1 shows a summary for the research design used in this study.
Figure 3.1 A survey research design process for the study.

Research population
Public sec. schools, physics teachers and students

Sampling techniques
- Stratified random sampling
- Simple random sampling

Design

Data collection instruments

Pilot sample

Sample size
- Teachers
- Students

Piloting, evaluating and adjustment of the instruments:
- FIAC
- Interview schedule.

Data collection, analysis, presentation and interpretation.

Summary and conclusions

Recommendations.

Source: Adapted from Kwaka (2003).

Figure 3.1. Shows the population from which the research sample was selected and the methods of sampling. It also shows the research instruments used and the process of the entire research study is outlined.
Descriptive surveys have the following characteristics according to Best and Khan (1992):

1) They deal with relationships between non-manipulated variables in a natural rather than an artificial setting.

2) They use the logical methods of inductive-deductive reasoning to arrive at generalizations.

3) They often employ methods of randomization so that error may be estimated when inferring population characteristics from observations of samples.

4) The variables and procedures are described as accurately and completely as possible so that the study can be replicated by other researchers.

Orodho and Kombo (2002) argue that it can be used when collecting information about people’s attitudes, opinions, habits or any of the variety of education or social issues. Descriptive survey is therefore considered as the best for this particular research.

3.2.1 Variables in the study.

In research, there are two types of variables. These are the independent and the dependent variables. In this study, the independent variable is verbal interaction patterns existing in a physics classroom. The dependent variables are students’ performance in physics and the number of students who take physics in forms three and four.
3.3 Locale

This study was done in five schools in Matungulu division, Kangundo district, Eastern province, Kenya (See Appendix VI for the location of Kangundo District in the Kenyan map). Matungulu division is one of the two divisions of Kangundo district. It has nineteen public secondary schools. Among them, two are boys’ schools, four are girls’ schools and thirteen are mixed schools. This type of study has never been conducted in the region.

3.4 Target population.

Population here refers to the larger group from which the sample is taken. This study targets form two physics teachers and students. The estimated number of form two students who are taking physics in the division is 1105.

3.5 Sampling techniques and sample size.

3.5.1 Sampling techniques.

The nineteen public secondary schools in the division were categorized into three strata namely; girls’ schools, boys’ schools and mixed schools. Boys’ schools are only two and both were picked using purposive sampling. There are four girls’ schools and the names of these four were written on small pieces of paper; each school on its own piece of paper. Later, each piece was folded keenly to hide the identity of the school. The four pieces were shuffled and the researcher then picked two papers and included the schools written on them in his sample. For the thirteen mixed schools which are all district schools, the procedure similar to the
one followed in choosing the two girls' schools was followed and the researcher got two more schools which were included in the sample. By the end of this process, the researcher had obtained a total of six schools for the sample.

3.5.2 Sample size.

A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Webster, 1985). The sample for the study constituted five physics teachers and two hundred and five form 2 students. Some schools had more than one stream. For each school, only one stream of about 40 students was used. Physics teachers of the entire form two classes were met in each school and random selection was done to get only one teacher. The selected teacher was then observed during data collection.

Table 3.1 shows the sampling grid used in the selection of the sample.

Table 3.1 A sampling grid for the study.

<table>
<thead>
<tr>
<th>Category of school.</th>
<th>Total number of schools.</th>
<th>Sample population of schools.</th>
<th>No. of students involved</th>
<th>No. of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>2</td>
<td>2</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>4</td>
<td>2</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Mixed</td>
<td>13</td>
<td>1</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>5</td>
<td>205</td>
<td>5</td>
</tr>
</tbody>
</table>
Justification for the Sample.

The sample was taken from the three categories of schools such that girls' schools, boys' schools and mixed schools were represented. By so doing, a true representative of the total population was obtained. Again the researcher did this in order to meet one of the objectives of the study which was to find out whether there was any significant difference between verbal interaction patterns in girls', boys' and mixed schools.

Justification for the Class Level.

Teachers teaching Form two classes were selected. The level of form two learners chosen in this study is considered as suitable because the learners at this level are used to their teachers. They have also adapted appropriately to the school environment. Form One's are not suitable for this study because they might be very new in the school and again not used to their teachers. There is a reason for not involving the Form Fours in the study; being a candidate class, teachers will be very busy preparing them for the national exam (K.C.S.E). Form Threes are considered unsuitable for the study because they are potential candidates since they have only one year to sit for their national examination.

3.6 The instruments.

The researcher used two instruments for this study; an interview schedule for Physics teachers and the modified FIAC.
3.6.1 A modified Flanders’ Interaction Analysis Categories.

Ned Flanders devised a neat two-dual display for FIAC data which preserves the sequence of events in pairs. The display consists of a $10 \times 10$ matrix observation checklist giving a total of one hundred cells. Each pair of events is tallied in one cell. The modified FIAC consists of a $13 \times 13$ matrix observation checklist, giving a total of one hundred and sixty-nine cells.

According to Wragg (1997), the display of classroom interaction in this form allows the teacher or observer to see not only how much the lesson was a ‘talk’ by the pupils or the teacher, but also quite a bit about the nature of the talk. A great deal of other information is also revealed, but as in the case of quantitative approach, a considerable amount is also lost with such reductions, so care must be exercised as there are no omni-purpose ‘good’ or ‘bad’ patterns.

This study used a modified Flanders Interaction Analysis Categories (FIAC) (see Appendix III). Flanders used this term for his ten category observation checklist. He designed it for general educational purposes, to be relevant to a variety of subjects rather than any subject in particular. According to Flanders (1970: 7):

> Techniques for interaction analysis capture selected elements of classroom verbal communication which have proven to be helpful in the analysis of teaching behaviour; first for the improvement of instruction; second, for the preparation of future teachers; and third for the prediction of educational outcomes.

He argued that teaching was more or less, effective depending on how ‘directly’ or ‘indirectly’ teachers influenced the learner’s behaviour. Flanders built his general ideas into his ten categories, so that some would be used to record direct
influence. He then developed a simple way of analyzing the resulting observations to give teachers scores reflecting “directness” or “indirectness” of their teaching styles. It is designed to help teachers move away from tradition and blind experimentation in the words of Dewey, towards intelligent control of their verbal behaviour (Amidon, 1966).

The reason that FIAC is used here is not because it is the best system, indeed there have been many refinements and modifications of it, but rather because it is an example of a simple category system that has been widely used in its original or modified form in teacher training, lesson analysis and research (Wragg, 1997: 36).

Development of the FIAC system.

This system was developed by Flanders in 1965. He developed it to categorize both the teacher and the pupil. He had three objectives when he developed these categories. These are:

1) To help the individual teachers develop and control their teaching behaviour.

2) To study teaching behaviour by keeping track of selected events which occur during classroom interaction.

3) To focus on teaching behaviour and its relationship to classroom interaction and educational outcomes.

The FIAC system used (Appendix III) has some modifications on some categories like category five. This category was modified because Physics being a science, many are the times when the teacher will be giving facts (telling). It was modified
so as to make some distinctions between the many kinds of information that can be given. There is need to specify the kind of teacher talk and the way it takes place; is it the use of chalk-talk method purely or it is accompanied by some modifications? The modifications here refer to use of teaching aids and demonstrations to enrich the chalk-talk method. Category ten was modified because physics is a science and when students and the teacher are quiet, it does not always mean that there is silence or confusion. The students can be busy making observations, recording values or drawing graphs.

Advantages of the FIAC system.

This system has the following advantages:

1) The FIAC System is not difficult to learn (Wragg, 1997:36).
2) It can be learned with a lot of ease.
3) It is also easy to apply.
4) It is easy to analyze the data collected
5) Construction of the observation checklist is easy.

Disadvantages of the FIAC.

According to Wragg, (1997), the FIAC System has the following disadvantages:

1) Tallying every three seconds becomes quite demanding and the observer may be fatigued after about half an hour.
2) It does not distinguish between cursory praise which may be as regular and frequent as rain drops, and enthusiastic or effusive praise.
3) It does not distinguish between the many kinds of information that can be given.

4) Category ten is a catch all category which is not designed either for detailed analysis of people talk, or for non-verbal aspects of classroom interaction. Many other systems sub-divide this category into ‘noise’, ‘confusion’, ‘complete silence’ and whatever else seems appropriate.

5) It is hard to classify some verbal behaviour even after a long experience of using the instrument.

3.6.2 An Interview schedule for physics teachers.

An interview schedule (see Appendix V) for the teachers was used to collect data from the teachers. It assisted in giving reasons as to why teachers prefer using certain methods while teaching and not others. According to Kombo and Tromp (2006) an interview schedule requires one to identify respondents and request them to answer certain questions. Interview schedules are considered to be good because the interviewer can get an opportunity of clarifying the questions to the interviewee in case some questions are not clear unlike the case of a questionnaire.

3.7 Pilot study.

During the pilot study, two schools which are not included in the main study were randomly selected from Matungulu division. From the two schools, two form two Physics teachers were randomly selected from the two schools. The researcher
arranged to visit the selected two schools and sought permission from the respective administrators. The researcher tried to create good working relationship and a good rapport with the selected teachers and their learners. Each teacher was observed four times in his/her physics lessons.

Observations were tallied on a 13 by 13 matrix observation checklist based on a modified FIAC. The researcher recorded the lesson after seeking permission from the concerned physics teachers using an audio radio tape. During the pilot study, coding of the observations was very tiring an experience which prepared the researcher psychologically for what he was to go through during the main study.

3.7.1. Validity of the instruments.

The researcher established the suitability of the instruments by engaging another observer who coded his observations on a different 13 by 13 matrix observation check list based on the modified FIAC as he listened to the playback of the recorded lesson from a radio tape recorder. The instruments were found to be valid because the researcher was able to gather the required data.

3.7.2 Reliability of the instruments.

The researcher listened to the playback of the recorded lesson and coded the observations in the 13 by 13 matrix observation checklist. From this, he was able to compare the coding on the two observation sheets and found out that there was
a high level of consistency from the two sets of the observations made. The instruments were found to be reliable.

3.8 Data collection Techniques.

The researcher sought for a research permit from the Ministry of Education and later on visited the sampled schools to collect data. Afterwards, he talked to the respective head teachers of the sampled schools so as to be allowed to meet the teachers. The researcher agreed with the selected teachers on the convenient time of making the observations. After planning all these, the researcher then met the teachers and the learners during their respective lessons and made observations while seated at the back of the classroom. In addition to this, the researcher sought permission from the concerned physics teachers to tape record the lesson as it progressed.

To reduce the observer's effect (Hawthorne Effect), the researcher had to visit the sampled classrooms for two days before the actual data collection. These visits helped in reducing the fear of the observer by the learners and also in putting the teachers at ease. The researcher also benefited from these visits because he was able to acquaint himself with the school settings. In addition, he got some time to create a good rapport between himself and his subjects. The entire data collection in the five schools was done in two weeks. In secondary schools, one week has four Physics lessons; two single lessons and one double lesson. The researcher made four observations of forty minutes (single lessons) in each of the selected
Form Two Physics classes. Single lessons were preferred to double lessons because they gave the researcher time to move from one school to another while collecting data. Also, coding the observations in a double lesson would be extremely tiring.

3.9 Data analysis and presentation.

The collected data was analyzed using descriptive and inferential statistics namely percentages, i/d ratios, frequencies and the chi-square, $\chi^2$. The chi-square was used in making comparisons of the verbal interactions which took place among mixed, girls’ and boys’ schools. I/d ratios were used to determine the extent to which the teacher was using the indirect and the direct methods of teaching. Data was presented using frequency distribution tables and bar graphs.

The researcher then discussed the findings. Conclusions and recommendations were made from the findings.
CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND DISCUSSION.

4.1 Introduction.

The main aim of this study was to determine the verbal interaction patterns that exist in physics classrooms. The variation of verbal interaction patterns that exist among physics teachers and their students in boys’, girls’ and mixed secondary schools in Kangundo district was also determined.

Frequency distributions and percentages have been used in this chapter in the analysis of data. To determine the variation of verbal interaction in different types of schools (girls’, boys’ and mixed schools) inferential statistics have been used. The frequency distributions were extracted from the coded modified FIAC system after processing the collected data. The frequency distributions are displayed using frequency tables. Data was collected from five teachers namely teachers P, Q, R, S and T with their learners.

4.2 Challenges met in the field during the observation period.

Some of the teachers were not willing to be observed and this posed a great challenge to the researcher. The researcher had to take some time to explain to them that the data to be collected was meant for research purposes only. Some thought that the researcher was an educational inspector coming to inspect them on the way they teach an idea which took the researcher a lot of time to convince them that he was doing an educational research.
Another challenge was loss of time for making the observations. Some teachers were spending a lot of time while preparing themselves to attend to their lessons. Others left their classes early and this reduced the time meant for the lesson making some lessons to be extremely short. The researcher observed single lessons of 40 minutes because during the pilot study he discovered that observing double lessons of 80 minutes was very tiring and this could lead to incorrect coding or failure to code. The total tallies out of the observations were expected to be 800 but this was not the case because the lessons did not take exactly 40 minutes. After collection of data, its processing was very tiring and this also proved to be one of the challenges.

4.3 Findings

Presentation of data.

In total, 20 lessons were observed in the five schools since each teacher in each of the schools was observed four times using the modified FIAC system. The percentages of the observations for each category were calculated for each teacher and the data presented in tables 4.1, 4.2, 4.3, 4.4 and 4.5.
Table 4.01 The verbal interaction patterns of teacher P with his students (boys' school).

<table>
<thead>
<tr>
<th>Time/lesson</th>
<th>Lesson 1 (25min.)</th>
<th>Lesson 2 (34min.)</th>
<th>Lesson 3 (35min.)</th>
<th>Lesson 4 (38min.)</th>
<th>Total observations</th>
<th>% of total observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified FIAC categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (accepts feelings)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>17</td>
<td>0.79</td>
</tr>
<tr>
<td>3 (accepts or uses student's ideas)</td>
<td>18</td>
<td>4</td>
<td>16</td>
<td>8</td>
<td>46</td>
<td>2.13</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>57</td>
<td>49</td>
<td>99</td>
<td>123</td>
<td>328</td>
<td>15.20</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>68</td>
<td>76</td>
<td>92</td>
<td>157</td>
<td>393</td>
<td>18.21</td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>21</td>
<td>128</td>
<td>145</td>
<td>179</td>
<td>473</td>
<td>21.92</td>
</tr>
<tr>
<td>5c (lecture with demonstrations)</td>
<td>19</td>
<td>74</td>
<td>-</td>
<td>31</td>
<td>124</td>
<td>5.75</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>18</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>41</td>
<td>1.90</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td>7</td>
<td>23</td>
<td>1.06</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>55</td>
<td>42</td>
<td>105</td>
<td>95</td>
<td>297</td>
<td>13.76</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>14</td>
<td>20</td>
<td>0.93</td>
</tr>
<tr>
<td>10a (silence When students are busy)</td>
<td>27</td>
<td>50</td>
<td>34</td>
<td>31</td>
<td>142</td>
<td>6.58</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>24</td>
<td>96</td>
<td>69</td>
<td>65</td>
<td>254</td>
<td>11.77</td>
</tr>
<tr>
<td>Total</td>
<td>315</td>
<td>532</td>
<td>581</td>
<td>730</td>
<td>2158</td>
<td>100</td>
</tr>
</tbody>
</table>
From table 4.01, the frequencies shown that the teacher used more of category 5b (lecture with teaching aids) more than any other category. Category 5a (lecture with neither aids nor demonstrations) followed closely. The teacher was also involving the learners into the lesson and this is shown by his use of category 4 and the responses obtained from the learners as seen in category 8.

The teacher made slight use of categories 1, 2, 3, 6 and 7. The learners did not involve themselves in asking questions that much. Category 9 is proving this. The teacher used a lot of demonstrations in this chapter (Measurement II) which was appropriate because it was about measurement and measuring instruments were being used. This means category 5b was the most used (lecture with teaching aids) with 21.92 %.

The teacher did not make much use of categories 1, 2 and 3 because their total percentage is only 2.92 %. This is because the teacher used mostly lecture method and he was not praising the learners even after they answered the questions correctly. Lack of motivation also led to low initiation from the learners making category 9 (student-talk initiation) low.

Lesson 1 was shorter than the other lessons because the teacher took some time before attending the lesson. He also left the class before the lesson was over. The teacher was trying to look for the relevant teaching and learning materials including the vernier calipers and the micrometer screw gauges.
Table 4.02 The verbal interaction patterns of teacher Q with her students (boys’ school).

<table>
<thead>
<tr>
<th>Time/Lesson modified</th>
<th>Lesson 1 (39min.)</th>
<th>Lesson 2 (36min.)</th>
<th>Lesson 3 (32min.)</th>
<th>Lesson 4 (30min.)</th>
<th>Total observations</th>
<th>% of total observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIAC Categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (accepts feelings)</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0.01</td>
</tr>
<tr>
<td>2 (praises/encourages)</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>16</td>
<td>0.60</td>
</tr>
<tr>
<td>3 (accepts or uses student’s ideas)</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>-</td>
<td>10</td>
<td>0.37</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>29</td>
<td>21</td>
<td>32</td>
<td>34</td>
<td>116</td>
<td>4.33</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>282</td>
<td>217</td>
<td>387</td>
<td>241</td>
<td>1127</td>
<td>42.02</td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>141</td>
<td>81</td>
<td>98</td>
<td>63</td>
<td>383</td>
<td>14.28</td>
</tr>
<tr>
<td>5c (lecture with demonstrations)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>9</td>
<td>52</td>
<td>1</td>
<td>19</td>
<td>81</td>
<td>3.02</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>18</td>
<td>0.67</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>21</td>
<td>21</td>
<td>39</td>
<td>61</td>
<td>142</td>
<td>5.29</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>5</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>11</td>
<td>0.41</td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>224</td>
<td>231</td>
<td>28</td>
<td>32</td>
<td>515</td>
<td>19.20</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>65</td>
<td>63</td>
<td>66</td>
<td>66</td>
<td>260</td>
<td>9.69</td>
</tr>
<tr>
<td>Total</td>
<td>788</td>
<td>704</td>
<td>666</td>
<td>524</td>
<td>2682</td>
<td>99.89</td>
</tr>
</tbody>
</table>
Teacher Q used mostly categories 5a (lecture with neither teaching aids nor demonstrations) and 5b (lecture with teaching aids) mostly. This was probably due to the nature of the topic she was teaching. She was solving some numerical problems and she spent most of the time making some explanations. Category 10a (silence while the students were copying the solved problems) was also highly used. The teacher did not use category 5c (lecture with demonstrations) probably because there was nothing to demonstrate according to her.

The students had no initiative of asking questions and that is why students' initiation (category 9) was amounting to 0.41%. Category 1 (accepts feelings) was also very low. There was some little use of category 6 (giving directions) which was totaling to 3.02%. There was little praising done by the teacher towards the students and probably this is why the students' initiation was low.

As the teacher was solving the numerical problems during the lesson, some periods of silence and confusion (category 10b) were noted because the students had no answers to the questions the teacher was asking. The total percentage of categories 1, 2, 3 and 4 was adding up to 5.31%. This means there was little of indirect influence from the teacher. The teacher was not motivating the learners enough during the lesson. Categories 5a, 5b and 5c were totaling to 56.3% meaning that the teacher was mostly using the direct methods of teaching at the expense of the indirect methods of teaching.
Table 4.03 The verbal interaction patterns of teacher R with his students (Girls’ school).

<table>
<thead>
<tr>
<th>Time/lesson Modified FIAC Categories</th>
<th>Lesson 1 (27min.)</th>
<th>Lesson 2 (43min.)</th>
<th>Lesson 3 (36min.)</th>
<th>Lesson 4 (32min.)</th>
<th>Total observations</th>
<th>% of total observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (accepts feelings)</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>-</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>16</td>
<td>0.68</td>
</tr>
<tr>
<td>3 (accepts or uses student’s ideas)</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>14</td>
<td>14</td>
<td>40</td>
<td>25</td>
<td>93</td>
<td>3.93</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>67</td>
<td>116</td>
<td>308</td>
<td>110</td>
<td>601</td>
<td>25.42</td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>53</td>
<td>200</td>
<td>180</td>
<td>105</td>
<td>538</td>
<td>22.76</td>
</tr>
<tr>
<td>5c (lecture with demonstrations)</td>
<td>-</td>
<td>208</td>
<td>-</td>
<td>-</td>
<td>208</td>
<td>8.80</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>11</td>
<td>82</td>
<td>5</td>
<td>11</td>
<td>109</td>
<td>4.61</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>12</td>
<td>22</td>
<td>0.93</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>13</td>
<td>14</td>
<td>37</td>
<td>78</td>
<td>142</td>
<td>6.01</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>-</td>
<td>3</td>
<td>18</td>
<td>1</td>
<td>22</td>
<td>0.93</td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>97</td>
<td>102</td>
<td>54</td>
<td>40</td>
<td>293</td>
<td>12.39</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>98</td>
<td>109</td>
<td>45</td>
<td>64</td>
<td>316</td>
<td>13.37</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>357</td>
<td>850</td>
<td>707</td>
<td>450</td>
<td>2364</td>
<td><strong>99.99</strong></td>
</tr>
</tbody>
</table>
Teacher R did not praise the learners at all during the first lesson and this probably led to the low student-initiation (category 9) whereby the students did not ask any question. During the second, third and fourth lessons, the teacher was praising the learners and probably this led to the increased student initiation. This means that there is a high correlation between motivation of the learner and student talk initiation (category 9). During the third lesson, the teacher motivated the students eleven times through praises and out of this motivation, the learners were able to initiate talk more like never before with tallies totaling to 18. When the learners were highly motivated very few tallies in category 10b (silence and confusion) were recorded unlike when the learners were lowly motivated.

The first lesson had fewer tallies because some of the time allocated for the lesson was consumed by the teacher who was in the class before the physics lesson started. The teacher who was on duty also interrupted the lesson while trying to get some students who were supposed to be doing her punishment. The fourth lesson had fewer tallies due to lack of a place to conduct an experiment since the laboratory was occupied by another class. This led to loss of a few minutes from the lesson time hence reducing the time for making the observations.
Table 4.04 The verbal interaction patterns of teacher S with his students (Girls' school).

<table>
<thead>
<tr>
<th>Time/lesson</th>
<th>Lesson 1 (20min.)</th>
<th>Lesson 2 (28min.)</th>
<th>Lesson 3 (34min.)</th>
<th>Lesson 4 (27min.)</th>
<th>Total observations</th>
<th>% of total observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified FIAC Categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (accepts feelings)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>0.15</td>
</tr>
<tr>
<td>3 (accepts or uses student's ideas)</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>8</td>
<td>31</td>
<td>46</td>
<td>22</td>
<td>107</td>
<td>5.38</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>63</td>
<td>85</td>
<td>279</td>
<td>178</td>
<td>605</td>
<td>30.43</td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>35</td>
<td>33</td>
<td>76</td>
<td>103</td>
<td>247</td>
<td>12.42</td>
</tr>
<tr>
<td>5c (lecture with demonstrations)</td>
<td>14</td>
<td>18</td>
<td>57</td>
<td>39</td>
<td>128</td>
<td>6.44</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>13</td>
<td>25</td>
<td>24</td>
<td>32</td>
<td>94</td>
<td>4.73</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>5</td>
<td>0.25</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>7</td>
<td>33</td>
<td>43</td>
<td>21</td>
<td>104</td>
<td>5.23</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>5</td>
<td>0.25</td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>24</td>
<td>56</td>
<td>49</td>
<td>44</td>
<td>173</td>
<td>8.70</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>45</td>
<td>279</td>
<td>96</td>
<td>96</td>
<td>516</td>
<td>25.96</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>215</strong></td>
<td><strong>563</strong></td>
<td><strong>673</strong></td>
<td><strong>537</strong></td>
<td><strong>1988</strong></td>
<td><strong>99.99</strong></td>
</tr>
</tbody>
</table>
Teacher S did not make use of category 1 (accepting students’ feelings). There was little use of category 2 (reinforcing). Generally, there was little use of categories 1, 2, 3 and 4. There was much use of categories 5a and 5b which added up to 42.85%. Category 10b (silence and confusion) yielded 25.96%. Categories 1, 2 and 3 added up to 0.2%. Categories 6 and 7 added up to 4.98%.

In lesson 1, the teacher did not use categories 1, 2 and 3 at all and this led to lowly motivated learners because at the same time there was very little use of categories 8 (student talk response) and 9 (student talk initiation). Category 9 (student-talk-initiation) had only 0.25% in the four lessons taught by this particular teacher. These two categories added up to 9%. The students were not free enough to participate in the lesson. The teacher spent most of the time lecturing without using teaching aids.

The teacher lost a lot of time before attending lesson 1. This was because the teacher was not willing to attend the lesson a possible indication that he was not fully prepared for the lesson. The teacher informed the researcher that very few students choose to continue with physics up to form four in the school. The teacher used to leave early in most of the lessons and this led to fewer tallies than the expected (800).
Table 4.05 The verbal interaction patterns of teacher T with his students (Mixed school).

<table>
<thead>
<tr>
<th>Time/lesson</th>
<th>Modified FIAC categories</th>
<th>Lesson 1 (36min.)</th>
<th>Lesson 2 (24min.)</th>
<th>Lesson 3 (23min.)</th>
<th>Lesson 4 (44min.)</th>
<th>Total observations</th>
<th>% of total observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (accepts feelings)</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>17</td>
<td>6</td>
<td>10</td>
<td>23</td>
<td>56</td>
<td>2.23</td>
<td></td>
</tr>
<tr>
<td>3 (accepts or uses student’s ideas)</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>20</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>67</td>
<td>36</td>
<td>43</td>
<td>64</td>
<td>210</td>
<td>8.36</td>
<td></td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>306</td>
<td>212</td>
<td>171</td>
<td>437</td>
<td>1126</td>
<td>44.84</td>
<td></td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>33</td>
<td>62</td>
<td>36</td>
<td>81</td>
<td>212</td>
<td>8.44</td>
<td></td>
</tr>
<tr>
<td>5c (lecture with demonstrations)</td>
<td>21</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>22</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>25</td>
<td>6</td>
<td>9</td>
<td>14</td>
<td>54</td>
<td>2.15</td>
<td></td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>21</td>
<td>35</td>
<td>1.39</td>
<td></td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>60</td>
<td>43</td>
<td>44</td>
<td>65</td>
<td>212</td>
<td>8.44</td>
<td></td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>9</td>
<td>-</td>
<td>10</td>
<td>4</td>
<td>23</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>58</td>
<td>37</td>
<td>31</td>
<td>39</td>
<td>165</td>
<td>6.57</td>
<td></td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>105</td>
<td>63</td>
<td>88</td>
<td>117</td>
<td>373</td>
<td>14.85</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>708</strong></td>
<td><strong>479</strong></td>
<td><strong>453</strong></td>
<td><strong>871</strong></td>
<td><strong>2511</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>
There was little use of categories 1, 2 and 3 because they added up to 3.15%. The teacher used a lot of lecturing with neither use of aids nor demonstrations (category 5a). Category 5a alone contributed 44.84% to the total percentage of verbal interactions taking place in the four lessons. This led to a low use of category 9 (student-talk initiation) adding up to 0.92%. In lessons 2 and 3, there was no use of category 5c. This might be due to the nature of the topic (Measurement II) where the teacher was only involved in solving some numerical problems. The oil-drop experiment was not performed and the teacher explained to the researcher that it was not possible for him to perform because talcum powder was missing.

Lesson 4 was longer than the other lessons and this is because the teacher delayed in the classroom for about four minutes. Categories 1, 2 and 3 added up to 3.15 while categories 6 and 7 added up to 3.54%. The teacher did not utilize the time allocated to lessons 2 and 3 fully. The teacher left the class before the time was over. In lesson 1, there was greater use of category 10a. This was so because the teacher used to give the learners time to write notes after his explanation. Category 10b had a high percentage (14.85%). This was so because the teacher sometimes used to ask the learners somehow difficult questions and they seemed not to get what the teacher was asking. It was also noted that the teacher directed most of the questions to the boys as compared to girls hence boys were more active than girls.
Table 4.06 Verbal interaction patterns across boys' schools.

<table>
<thead>
<tr>
<th>Teacher Modified FIAC Categories</th>
<th>Teacher P</th>
<th>Teacher Q</th>
<th>Cumulative frequency of teacher P &amp; Q</th>
<th>% of Cumulative Frequency for teachers P &amp; Q for the Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (accepts feelings)</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>0.06</td>
</tr>
<tr>
<td>2 (praises/encourages)</td>
<td>17</td>
<td>16</td>
<td>33</td>
<td>0.68</td>
</tr>
<tr>
<td>3 (accepts or uses student’s ideas)</td>
<td>46</td>
<td>10</td>
<td>56</td>
<td>1.16</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>328</td>
<td>116</td>
<td>444</td>
<td>9.17</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>393</td>
<td>1127</td>
<td>1520</td>
<td>31.4</td>
</tr>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>473</td>
<td>383</td>
<td>856</td>
<td>17.69</td>
</tr>
<tr>
<td>5c (lecture with Demonstrations)</td>
<td>124</td>
<td>-</td>
<td>124</td>
<td>2.56</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>41</td>
<td>81</td>
<td>122</td>
<td>2.52</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>23</td>
<td>18</td>
<td>41</td>
<td>0.85</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>297</td>
<td>142</td>
<td>439</td>
<td>9.07</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>20</td>
<td>11</td>
<td>31</td>
<td>0.64</td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>142</td>
<td>515</td>
<td>657</td>
<td>13.57</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>254</td>
<td>260</td>
<td>514</td>
<td>10.62</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2158</td>
<td>2682</td>
<td>4840</td>
<td>100</td>
</tr>
</tbody>
</table>
Teachers P and Q used category 5a (lecture with neither teaching aids nor demonstrations) and 5b (lecture with teaching aids) most of the time. These two categories took 49.09% of the total time allocated for the lessons. Category 5a (lecture with neither aids nor demonstrations) was the most dominant. Category 10a (silence while the students were busy writing notes) also had a high percentage. At times, there were short periods of silence and confusion as category 10b yielded 10.62% of the total lesson time. The teachers were rarely motivating their learners since category 2 (reinforcing) had only 0.68%. The teachers were asking the students questions. Category 4 yielded 9.17% and this was complemented by category 8 which had 9.07%. There was little of student talk initiation (category 9) as this had only 0.64%. The learners were lowly motivated and this is probably one of the reasons why the students were not free enough to contribute to the lesson.

Table 4.07 Verbal interaction patterns across girls’ schools.

<table>
<thead>
<tr>
<th>Teacher Modified FIAC Categories</th>
<th>Teacher R</th>
<th>Teacher S</th>
<th>Cumulative Frequency of teachers R &amp; S</th>
<th>% of Cumulative Frequency for teachers R &amp; S for the Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (accepts feelings)</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>16</td>
<td>3</td>
<td>19</td>
<td>0.44</td>
</tr>
<tr>
<td>3 (accepts or uses student’s ideas)</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0.07</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>93</td>
<td>107</td>
<td>200</td>
<td>4.60</td>
</tr>
<tr>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>601</td>
<td>605</td>
<td>1206</td>
<td>27.71</td>
</tr>
</tbody>
</table>
In girls' schools, there is still much use of category 5a (lecture with neither teaching aids nor demonstrations) which had 27.71% of the total lesson time. The teachers rarely motivate their learners since category 2 (reinforcing) has a percentage cumulative frequency of 0.44% for the two teachers. There is little use of category 7 (criticism) amounting to 0.62% for the two teachers. There was also a low frequency in category 9 (student talk initiation). The use of lecture method without teaching aids or demonstrations might be one of the reasons leading to this among many other reasons. There is a very low frequency on the use of categories 1, 2 and 3 which added up to 0.56%. There was high frequency

<table>
<thead>
<tr>
<th>Category Description</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5b (lecture with teaching aids)</td>
<td>538</td>
<td>247</td>
<td>785</td>
</tr>
<tr>
<td>5c (lecture with Demonstrations)</td>
<td>208</td>
<td>128</td>
<td>336</td>
</tr>
<tr>
<td>6 (gives directions)</td>
<td>109</td>
<td>94</td>
<td>203</td>
</tr>
<tr>
<td>7 (criticizes)</td>
<td>22</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>8 (student talk response)</td>
<td>142</td>
<td>104</td>
<td>246</td>
</tr>
<tr>
<td>9 (student talk initiation)</td>
<td>22</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>10a (silence when students are busy)</td>
<td>293</td>
<td>173</td>
<td>466</td>
</tr>
<tr>
<td>10b (silence when students are passive)</td>
<td>316</td>
<td>516</td>
<td>832</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2364</strong></td>
<td><strong>1988</strong></td>
<td><strong>4352</strong></td>
</tr>
</tbody>
</table>
of category 10b (silence and confusion) amounting to 19.12%. The teachers were either not communicating to the learners or communication was not clear.

4.4 Summary of the findings.

On the use of direct methods of teaching and the indirect methods, the i/d ratios have revealed that teachers in the sampled girls’ schools use mostly direct methods of teaching. The i/d ratio for boys and mixed schools in this sample are comparatively higher showing that teachers in these types of schools use the indirect methods relatively more compared to the teachers in girls’ schools.

The researcher also found that there was a relatively higher use of categories 5a, 5b and 5c as compared to the other categories. This observation was cutting across all categories of schools (boys’, girls’ and mixed schools). Physics is a practical subject and instead of using lecture method while teaching, heuristic methods should be used because they foster creativity and discovery of new theories, laws and principles. By doing this, the students will get ample time to participate in the lesson and increase their initiation during the lesson.

Generally, there was a relatively low use of categories 1, 2, 3 and 4. Girls’ schools were the most affected by this. This may mean that, teachers teaching in girls schools rarely reinforce their learners. They also appear to be weak in building on the learner’s ideas. This de-motivates the learners and reduces their participation.
in the lesson and hence reducing their initiation. Teachers in boys’ and mixed schools made a relatively higher use of these four categories.

High use of categories 6, 7, 5a, 5b and 5c is more likely to create an autocratic climate in the classroom. With this kind of climate in classroom, students are not free to participate in the teaching-learning process. This hinders their creativity and reduces the chances of discovering new things. High use of categories 1, 2, 3 and 4 leads to the creation of a democratic climate in the classroom where students are free to participate during the teaching-learning process.

4.5 Discussion and analysis of data.

This section discusses the findings and does some analysis of the data obtained from the study.

4.5.1 General comments on verbal classroom interaction of physics teachers in girls’, boys’ and mixed schools.

In all categories of schools, category 5a was the most dominant. Teachers whether males or females were using lecture method most of the time. This means that the teachers were teaching physics theoretically. In most cases, category 9 (student talk initiation) was having a high percentage when there was a high percentage in category 2 (reinforcing). Students participated more when the teachers were reinforcing them. From the tables 4.05, 4.06 and 4.07, the bar graph below shows that category 9 has a high percentage when category 2 has a high percentage and vice-versa. Figure 4.1 shows the comparison between categories 2 and 9.
From the bar graph above, the data represented shows that reinforcement is proportional to the level of students'- talk-initiation.

In Girls' schools, reinforcement is at the minimum level followed by Boys' schools and lastly Mixed schools. Teachers teaching in Girls' schools do not motivate their learners as teachers teaching in mixed schools.

Figure 4.2 below shows comparison of the percentages of tallies of the teachers and students verbal interactions for different categories across the three categories of schools.
The bar graph above is used to show the general outlook of the verbal classroom interaction patterns. The categories which fall under the indirect influence by the teacher while teaching the students that is categories 1, 2, 3 and 4 have been grouped together for easier comparison of indirect and direct methods of teaching.

Percentages of categories 5a, 5b, and 5c have been summed up together to show the extent to which lecture method has been used. Categories 6 and 7 have been added up for matters of plotting since their percentages are relatively small. They also show the use of directions given to the learner from the teacher. Categories 8 and 9 have been combined to show the extent of student-talk-initiation during
the lessons. Categories 10a and 10b which happen to be periods when the students are writing notes, doing experiments, drawing graphs and in short periods of silence or confusion have been grouped together since there is no much interaction between the teacher and the students.

From the bar graph, teachers in boys' and mixed schools used categories 1, 2, 3 and 4 relatively more than the teachers teaching in girls' schools. This implies that teachers in girls’ schools did not praise their students like their counterparts in boys’ and mixed schools. They also did not consider students’ personal feelings and neither did they use students’ ideas or modify them like their counterparts in boys’ and mixed schools.

Teachers in girls’ and mixed schools spent relatively more time lecturing as compared to teachers in boys’ schools. Generally, in all school categories, there is high use of the lecture method. It should also be noted that there is a relatively low use of category 5c (lecture with demonstrations). In girls’ schools, teachers used more commands and criticisms than in the boys’ and mixed schools. This discouraged girls from participating in the lesson. The students’ initiative was relatively low in girls’ schools (6.27 %) as compared to mixed schools (9.36%) and the boys’ schools (9.71 %).
Category 10a and 10b are also highly used as compared to the other categories with the teachers teaching in girls’ schools having the highest percentage in the two categories combined. Categories 10a and 10b recorded highest values when the teachers used the lecture method relatively more.

4.5.2 Calculation and interpretation of i/d ratios.

Teacher’s teaching behaviour can be determined after knowing the kind of classroom climate which prevails in the classroom. According to Njuguna (2000) there are three types of classroom teachers categorized according to the classroom climate they create. First, there is an autocratic teacher; this teacher does not consider the students’ feelings. He/she dominates the classroom talk. The work of the students in the classroom is to listen and obey orders. Secondly, there is a democratic teacher. This one allows the students to share and contribute in the classroom freely. Lastly, there is the Laissez-faire teacher who allows the students to do as they wish. This teacher is not in control of the class at all.

Calculation of the i/d ratio of the different teachers teaching in the three categories of schools is one way of knowing the kind of classroom climate the teacher creates while teaching. The i/d ratio is calculated by adding the sum total of indirect behaviour (represented by categories 1, 2, 3 and 4) divided by the sum total of direct behaviour (represented by categories 6 and 7). The type of classroom behaviour set by the teacher affects students’ participation either positively or negatively. A democratic climate enhances learning because it
encourages the students to be actively involved in the lesson. An autocratic teacher creates an environment full of tension where the learners are not free to participate. This hinders the learning process. Teachers should try as much as possible to use the indirect methods of teaching so as to maximize the freedom of the learners to participate during the teaching-learning process.

Table 4.08: i/d ratios of physics teachers in boys’ girls’ and mixed schools.

<table>
<thead>
<tr>
<th>Type of School</th>
<th>FIAC categories</th>
<th>Categories 1,2,3 &amp; 4 (i)</th>
<th>Categories 6 &amp; 7 (d)</th>
<th>i / d ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys’</td>
<td></td>
<td>92</td>
<td>163</td>
<td>0.56</td>
</tr>
<tr>
<td>Girls’</td>
<td></td>
<td>24</td>
<td>230</td>
<td>0.10</td>
</tr>
<tr>
<td>mixed</td>
<td></td>
<td>79</td>
<td>235</td>
<td>0.34</td>
</tr>
</tbody>
</table>

key:

i – Indirect teaching methods

d – Direct teaching methods.

The table above shows that i/d ratios in all categories of schools are below 1. Comparing the i/d ratios in the three categories, it can be seen that teachers in boys’ school are creating a relatively more democratic classroom climate. The students are free to participate during lesson time. The i/d ratio in this category (boys’ schools) can be increased if the students are engaged in group discussions, debates and role plays in the classroom as the teacher teaches. Mixed schools are
a little bit more democratic than girls' schools. Teachers teaching physics in girls' schools did not allow a lot of freedom for the girls to be able to participate freely. The teachers were somehow autocratic as compared to boys and mixed schools. It can be said that they created an autocratic climate in the classroom.

4.5.3 Calculation and interpretation of chi-square results for different school categories.

One of the aims of this study was to find out whether there exists any significant difference in verbal interaction patterns among mixed, girls' and boys' schools. The chi-square was the most convenient tool to use to determine this. The chi-square results helped to determine whether the observed difference in teaching patterns among teachers in girls', boys' and mixed schools were statistically significant or not. The researcher used 0.05 level of significance obtained from the chi-square tables to determine this. If the results were giving values which were above this level, then the difference would be statistically significant.

For the purposes of analysis, the different types of direct and indirect teaching behaviour patterns were extracted from tables 4.05, 4.06 and 4.07. The formula

\[ \chi^2 = \sum \left( \frac{(f_o - f_e)^2}{f_e} \right) \]

where \( f_o \) is the observed frequency and \( f_e \) is the expected frequency.
In the calculation of chi-square, the test was administered to the direct and the indirect influence of the teacher while teaching and also to the students' talk initiation. Table 4.09 shows the values of the observed frequencies \((f_o)\) and their calculated expected frequencies \((f_e)\). The expected frequencies were calculated by multiplying the number of frequencies contained in the entire row, \(R_T\) by the number of frequencies contained in the entire column, \(C_T\). The product of these two was then divided by the total number of observed frequencies \((G_T)\).

\[
f_e = \frac{R_T \times C_T}{G_T}
\]

Table 4.09 Observed and expected frequencies for categories 1, 2, 3 and 4 in boys', girls', and mixed schools.

<table>
<thead>
<tr>
<th>Modified FIAC categories</th>
<th>Boys' (f_o)</th>
<th>Girls' (f_o)</th>
<th>Mixed (f_o)</th>
<th>Total (f_o)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (accepts feelings)</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>2 (praises /encourages)</td>
<td>33</td>
<td>19</td>
<td>56</td>
<td>108</td>
</tr>
<tr>
<td>3 (accepts or uses Student's ideas)</td>
<td>56</td>
<td>3</td>
<td>20</td>
<td>79</td>
</tr>
<tr>
<td>4 (asks questions)</td>
<td>444</td>
<td>200</td>
<td>210</td>
<td>854</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>536</strong></td>
<td><strong>224</strong></td>
<td><strong>289</strong></td>
<td><strong>1049</strong></td>
</tr>
</tbody>
</table>
Table 4.10 Nature of the in-direct teaching behaviour patterns of teachers in Boys', Girls', and Mixed schools.

<table>
<thead>
<tr>
<th>Type of school</th>
<th>Modified FIAC Categories</th>
<th>Total $\chi^2$ of 1,2,3 &amp; 4 (i)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (accepts feelings)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (praises /encourages)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (accepts or uses student's ideas)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 (asks questions)</td>
<td></td>
</tr>
<tr>
<td>Boys'</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Girls'</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Mixed</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
</tbody>
</table>

At 6 degrees of freedom (df) the $\chi^2$ results for i is 55.35. The critical value of $\chi^2$ at the 0.05 level of significance is 12.59. This means that the $\chi^2$ value at 6 df is statistically significant because it is more than the critical value. This means that there exists a significant difference in the indirect teaching behavior patterns of physics teachers in boys’, girls’ and mixed schools. This difference can be clearly seen in the i/d ratio for categories 1, 2, 3 and 4 of the girls’ schools which is 0.1 while the i/d ratio for the boys’ and mixed schools are above 0.3. Teachers in boys’ and mixed schools made a relatively higher use of the indirect methods of teaching compared to their counterparts in girls’ schools.

Table 4.11 Calculation of the expected frequencies for each of the categories 6, 7, 5a, 5b, and 5c.

<table>
<thead>
<tr>
<th>Type of school</th>
<th>Modified FIAC Categories</th>
<th>Total $f_o$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 (gives directions)</td>
<td>$f_o$</td>
</tr>
<tr>
<td></td>
<td>7 (criticizes)</td>
<td>$f_o$</td>
</tr>
<tr>
<td></td>
<td>5a (lecture with neither aids nor demonstrations)</td>
<td>$f_o$</td>
</tr>
<tr>
<td></td>
<td>5b (lecture with teaching aids)</td>
<td>$f_o$</td>
</tr>
<tr>
<td></td>
<td>5c (lecture With Demonstrations)</td>
<td>$f_o$</td>
</tr>
<tr>
<td>Boys'</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Girls'</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Mixed</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Total</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
</tbody>
</table>
To determine whether there exists any significant difference in the direct teaching behaviour pattern of the teachers in the three categories, $\chi^2$ values were again calculated for category 6, 7, 5a, 5b and 5c in the table 4.12 below.

**Table 4.12 Calculation of $\chi^2$ values for categories 6, 7, 5a, 5b, & 5c**

<table>
<thead>
<tr>
<th>Type of school</th>
<th>Modified FIAC Categories</th>
<th>6 (gives directions)</th>
<th>7 (criticizes)</th>
<th>5a (lecture with neither aids nor demonstrations)</th>
<th>5b (lecture with teaching aids)</th>
<th>5c (lecture with Demonstrations)</th>
<th>Total $\chi^2$ for 6, 7, 5a, 5b &amp; 5c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys'</td>
<td>f_6</td>
<td>f_7</td>
<td>f_8</td>
<td>f_9</td>
<td>f_10</td>
<td>f_11</td>
<td>f_12</td>
</tr>
<tr>
<td>Girls'</td>
<td>122</td>
<td>41</td>
<td>1520</td>
<td>1538</td>
<td>856</td>
<td>740</td>
<td>124</td>
</tr>
<tr>
<td>Mixed</td>
<td>54</td>
<td>82</td>
<td>1206</td>
<td>1477</td>
<td>785</td>
<td>710</td>
<td>336</td>
</tr>
<tr>
<td></td>
<td>$\Sigma (f_{i}-f_{e})^2$</td>
<td>$\Sigma f_{e}$</td>
<td>$\Sigma f_{i}$</td>
<td>$\Sigma f_{e}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>37.38</td>
<td>11.9</td>
<td>149.7</td>
<td>116.6</td>
<td>212.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The chi- square results obtained from table 4.11 can be used to test if direct teaching patterns of the teachers in boys’, girls’ and mixed schools differ significantly. From the table, the chi-square results at 8 df is 528.5. The critical value of chi- square at the 0.05 level of significance is 15.5. This shows that there exists significant difference in the direct teaching patterns of teachers in boys’, girls’ and mixed schools. Teachers in boys’ and mixed schools made a relatively lower use of the direct methods of teaching compared to their counterparts in girls’ schools. Again, this can be confirmed from the results in table 4.08 which gives the i/d ratios for the three school categories.

It was considered important to determine the nature of Students Talk (ST) in boys’, girls’ and mixed schools. Categories 8 and 9 have been used to determine this.
Table 4.13 Chi-square values for the nature of students' talk in boys',
girls' and mixed schools.

<table>
<thead>
<tr>
<th>Type of school</th>
<th>Modified FIAC Categories</th>
<th>8 (student talk response)</th>
<th>9 (student talk initiation)</th>
<th>Total of $\chi^2$ categories 8 &amp; 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$f_o$</td>
<td>$f_e$</td>
<td>$f_o$</td>
<td>$f_e$</td>
</tr>
<tr>
<td>Boys'</td>
<td>439</td>
<td>431</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>Girls'</td>
<td>246</td>
<td>250</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>Mixed</td>
<td>212</td>
<td>216</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>$\sum \frac{(f_o-f_e)^2}{f_e}$</td>
<td>0.28</td>
<td>3.1</td>
<td>3.38</td>
<td></td>
</tr>
</tbody>
</table>

At 2 df, the $\chi^2$ results for categories 8 and 9 (students' talk) is 3.38. The critical value at the 0.05 level of significance is 5.59. This means that there is no significant difference in the patterns displayed by the students in their talk during the physics lessons.

The students are not given ample time to ask questions or to participate in the lesson. This further implies that the teachers mostly used the lecture method. Inquiry methods of teaching were rarely being used. This is further proved by the fact that categories 1, 2, 3 and 4 are having very low percentages. This observation was cutting across all categories of schools. In general, the chi-square results have shown that teachers display significantly different teaching behaviour patterns with their students while teaching.
4.6 Responses from the interview with Physics teachers.

Physics teachers in the sampled schools were interviewed and their responses were analyzed and noted. Table 4.14 shows the personal information of the interviewed teachers.


<table>
<thead>
<tr>
<th>Teacher</th>
<th>Bio – data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sex</td>
</tr>
<tr>
<td>Teacher P</td>
<td>M</td>
</tr>
<tr>
<td>Teacher Q</td>
<td>F</td>
</tr>
<tr>
<td>Teacher R</td>
<td>M</td>
</tr>
<tr>
<td>Teacher S</td>
<td>M</td>
</tr>
<tr>
<td>Teacher T</td>
<td>M</td>
</tr>
</tbody>
</table>

It was revealed that all of the physics teachers interviewed face problems in covering the wide physics syllabus. Most of the times, teachers are forced to cover as many sub-topics as possible in one lesson. They do this by using the direct methods of teaching for example, the lecture method. One teacher stated that he does not cover the syllabus in time due to the absenteeism of the learners due to fees problems while another teacher argued that the syllabus is too wide.

100 % (all) of the respondents asserted that they prefer using the lecture method while teaching and attributed this to the wide syllabus to be covered and in some
cases lack of some required teaching aids to aid in teaching some topics such as Modern physics.

When responding to the question about the gender he prefers teaching most, one teacher responded that, “I can teach any student regardless of his/ her gender as long as he / she is co- operative”.

It was also found that all (100%) of the sampled schools lack some teaching and learning resources. Three (60 %) of the sampled schools have only one laboratory for the three sciences and this creates some inconveniences whenever the physics teachers plan a practical lesson and find it occupied by other students performing an experiment in a different science subject. This tempts the teachers to teach practical lessons theoretically.

It was also revealed that some teachers do not feel comfortable while teaching some topics. For example topics which are abstract. These were defined as topics which cannot be approached practically like the atom, photoelectric effect, radioactivity among others. Topics whose apparatus are very expensive such that schools cannot afford to purchase were also not liked by most of the teachers and in most cases they teach them theoretically. On this issue of topics preferred while teaching, one teacher responded that, “I find some topics more interesting to teach
than others because they are easy to teach and learners understand them with much ease”.

After interpreting, analyzing and discussing the data collected, the next chapter has dealt with conclusions and recommendations.
CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS.

5.1 Introduction.

This chapter deals with conclusions and recommendations for future implementation and research in education. The conclusions have been drawn from the objectives of the study and the research questions.

5.2 Conclusions.

The researcher sought to determine whether there exists any significant difference in verbal interaction patterns in mixed, girls’ and boys’ schools. To achieve the objectives of the study, tools to gather the following information were designed.

i) The kind of classroom atmosphere created by the teacher’s verbal interaction patterns.

ii) The type of teaching methods which elicit most responses from the learner.

iii) The differences in verbal interaction patterns as displayed by teachers and their students while in the classroom.

The data collected from the chosen sample was used to achieve the objectives and answer the research questions stated to guide the study.

It was revealed that there was a lot of use of direct methods of teaching for example the lecture method. This was more dominant in girls’ schools than in boys’ and mixed schools. Teacher’s talk dominated most of the lessons. The direct methods create an autocratic climate in the classroom. It also emerged that,
teachers in all categories of schools rarely use the in-direct methods of teaching rarely while teaching Physics. Girls' schools were the most affected by use of direct methods. Students are rarely praised during physics lessons. It should be noted that praising of students motivates them and helps them develop a positive attitude towards the subject.

From the results obtained, there exists a significant difference in the verbal interaction patterns in boys', girls and mixed schools. Teachers display different interaction patterns while teaching depending on the gender of the students they are teaching and the sex of the teacher. For example, male teachers appeared to be more comfortable while teaching boys. The female teacher observed was not very comfortable while teaching boys. It is also worth-noting that female physics teachers are very few compared to their male counterparts.

The study has also revealed that categories 1, 2, 3 and 4 elicited the most responses from the students as compared to the use of categories 6 and 7 which discouraged the students. Teachers who used categories 1, 2, 3 and 4 mostly while teaching motivated their learners during the lesson. Note that, the sample used in this study was small and therefore cannot be used to make generalizations concerning Physics classes.
5.3 Recommendations.

The following recommendations have been made for future implementation. They are based on the findings of the study.

1) There is need to avoid much use of the lecture method while teaching physics. Trainers of teachers need to emphasize this during their training sessions. The trainers should train the trainees on how to integrate some student-centered approaches in the teaching of physics.

2) Teachers need to try as much as possible to boost creativity in their learners by using the discovery methods of teaching. By doing this, they will give the learners room to discover laws, theories and principles on their own.

3) There is need for the policy makers to look for ways and means of campaigning for attitude change towards physics in students. This will probably lead to an increased number of girls taking physics up to form four. This will possibly lead to an increased number of ladies who will be willing to train as physics teachers.

4) There is need for teachers should avoid criticizing their learners answers or giving them a lot of directions (steps to follow) while teaching because this hinders learner participation in the lesson and destroys creativity.

5) Universities and colleges should look for a way of encouraging female students to train as physics teachers. One way can be by reducing the
cluster points for ladies who are to join the teaching profession as physics teachers.

6) School heads should try as much as possible to provide the necessary teaching and learning materials to their teachers. Laboratories should be well equipped to encourage the teachers teach practical lessons using the right method (the experimental approach).

7) Classroom interaction analysis should be taught at under-graduate level and post-graduate level to ensure that the graduate teachers know exactly what is expected of them while teaching.

5.4 Suggestions for further research.

1) This study was conducted in only one division among many in Kenya. Other similar studies should be conducted in other divisions in Kenya.

2) The sample used was small and there is need for a larger sample to be used in a similar study.

3) There is need for a study relating interaction and performance in Physics to be done.


REPUBLIC OF KENYA
MINISTRY OF SCIENCE & TECHNOLOGY

APPENDIX I

AUTHORIZATION LETTER FROM THE MINISTRY OF EDUCATION,
SCIENCE AND TECHNOLOGY

Telegrams: “SCIENCE TEC”, Nairobi
Telephone: 02-318581
E-Mail:ps@scienceandtechnology.go.ke

When Replying please quote
Ref. MOST 13/001/38C76/2

2nd May 2008

Wambua Joseph Muteti
Kenyatta University
P.O. Box 43844
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, ‘Verbal Interactions in Physics Classrooms in Some Selected Secondary Schools in Matungulu Division Kangundo District Kenya’

I am pleased to inform you that you have been authorized to carry out research in Kangundo District for a period ending 30th November, 2008.

You are advised to report to the District Commissioner, the District Education Officer Kangundo District and the Principals of the Secondary Schools before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.

M. O. ONDIEKI
FOR: PERMANENT SECRETARY

Copy to:
The District Commissioner
Kangundo District

The District Education Officer
Kangundo District

The Principal
Secondary Schools
Kangundo District
APPENDIX II

A LIST OF PUBLIC SECONDARY SCHOOLS IN MATUNGULU DIVISION.

1. TALA HIGH SCHOOL BB
2. TALA GIRLS' HIGH SCHOOL GB
3. FR. HEERAN SECONDARY SCHOOL MD & MB
4. MATUNGULU GIRLS' HIGH SCHOOL GB
5. SENGANI GIRLS' HIGH SCHOOL GB
6. KINYUI BOYS' HIGH SCHOOL BB
7. KINYUI GIRLS' HIGH SCHOOL GB
8. KISUKIONI HIGH SCHOOL MD & MB
9. KALANDINI SECONDARY SCHOOL MD
10. ITHEUNI SECONDARY SCHOOL MD
11. KATWAYAA SECONDARY SCHOOL MD & MB
12. KIBOKO SECONDARY SCHOOL MD
13. KATULYE SECONDARY SCHOOL MD
14. KUSYOKIMANZA SECONDARY SCHOOL MD
15. KATHEKA SECONDARY SCHOOL MD
16. MATUU SECONDARY SCHOOL MD
17. NGULUNI S.A. SECONDARY SCHOOL MD
18. SYANTHI SECONDARY SCHOOL MD
19. KITHUANI SECONDARY SCHOOL MD

Source: DEO'S office, Machakos district.
KEY:
BB- BOYS BOARDING
GB- GIRLS BOARDING
MD- MIXED DAY
MB & MD- MIXED BOARDING AND MIXED DAY
### APPENDIX III

**A MODIFIED FLANDERS’ INTERACTION ANALYSIS CATEGORIES.**

<table>
<thead>
<tr>
<th>TEACHER TALK</th>
<th>INDIRECT INFLUENCE</th>
<th>1. ACCEPTS FEELING. Accepts and clarifies the feeling tone of the students in a non-threatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2. PRAISES OR ENCOURAGES. Praises or encourages student action or behaviour. Jokes that release tension, not at the expense of another individual; nodding head or saying “um hm?” or “go on” are included.</td>
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<tr>
<td></td>
<td></td>
<td>3. ACCEPTS OR USES IDEAS OF STUDENTS. Clarifying, building, or developing ideas suggested by a student. As a teacher brings more of his own ideas into play, shift to category five.</td>
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<td>4. ASKS QUESTIONS. Asking a question about content or procedure, based on teacher ideas, with the intent that a pupil will answer.</td>
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<tr>
<td>DIRECT INFLUENCE</td>
<td></td>
<td>5. LECTURES: This category is divided into:</td>
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<td></td>
<td>(a) Lecture by involving only talk by the teacher without any aids to enhance the ideas.</td>
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<td></td>
<td>(b) Lecture with illustrations or aids. The lecture here uses charts, diagrams, real objects and chalkboard illustrations.</td>
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<tr>
<td></td>
<td></td>
<td>(c) Lecture with demonstrations where the teacher performs an experiment or a practical to enhance the lesson.</td>
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<td>6. GIVES DIRECTIONS. Directions, commands, or orders to which a student is expected to comply.</td>
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<td>7. CRITICIZES OR JUSTIFIES AUTHORITY. statements intended to change student behaviour from non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.</td>
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<td><strong>8. STUDENT TALK-RESPONSE:</strong> a student makes a predictable response to teacher. Teacher initiates the contact or solicits student statement or structures the situation. Freedom to express own ideas is limited.</td>
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<tr>
<td><strong>9. STUDENT TALK-INITIATION:</strong> Talk by students which they initiate. Expressing own ideas; initiating a new topic; freedom to develop opinions and a line of thought, like asking thoughtful questions; going beyond the existing structure.</td>
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<td><strong>10. SILENCE OR CONFUSION:</strong> This category is divided into:</td>
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<tr>
<td>(a) Students performing experiments, making observations, recording measurements and drawing graphs.</td>
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<tr>
<td>(b) Short periods of silence and confusion when communication cannot be understood by the observer.</td>
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</tbody>
</table>

**NOTE:** There is no scale implied by these numbers. Each number is classificatory; it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.
## APPENDIX IV

**Systematic observation sheet.**

Teacher's name:  
Gender:  
Date:  
Class size:  
Time:  
Topic:  
Form:  
School:  

2<sup>nd</sup> event

<table>
<thead>
<tr>
<th>1&lt;sup&gt;st&lt;/sup&gt; event</th>
<th>Total</th>
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<th>Total</th>
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INTRODUCTION:
This schedule has two parts; Part A- Bio-data (personal information) and Part B- Questions on classroom teaching and learning.

PART A: BIO-DATA.
Sex:
Age:
Teaching experience:
Academic qualifications:
Name of the school:

PART B: QUESTIONS ON CLASSROOM TEACHING AND LEARNING.
1. Do you find problems with syllabus coverage while teaching the physics content?
2. Which measures do you take to ensure that the syllabus is covered within the given time?
3. Are there some teaching methods you prefer most so as to move faster as far as coverage of the syllabus is concerned?
4. Does the school have enough teaching and learning resources?
5. What is your feeling about the entry behaviour (K.C.P.E. marks of the learner) of your students?
6. Which sex/gender do you prefer teaching most?
7. Are there some topics you find more interesting to teach than others in the physics syllabus?
APPENDIX VI

A MAP SHOWING THE LOCATION OF KANGUNDO DISTRICT IN THE KENYAN MAP

INSET: Kangundo District (marked).