A COMPARATIVE STUDY OF LECTURE AND INTERACTIVE METHODOLOGIES IN THE TEACHING OF NEWTONIAN MECHANICS AT ‘A’LEVEL PHYSICS AT A HIGH SCHOOL IN MAKONI, DISTRICT MANICALAND PROVINCE

BY

MAPFUMO COSMAS

B1129977

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APPROVAL FORM

The undersigned certify that they have read and recommended to the Bindura University of Science Education for acceptance; a research project entitled ‘A Comparative Study of Lecture and Interactive Methodologies in the Teaching of Newtonian Mechanics at ‘A’ Level Physics at a high school in Makoni District, Manicaland Province’ submitted by Mapfumo Cosmas in partial fulfilment of the requirements for the degree of Bachelor of Science Education Honours in Physics.

----------------------------------------
SUPERVISOR

----------------------------------------
PROGRAMME/SUBJECT COORDINATOR

----------------------------------------
EXTERNAL EXAMINER

DATE ----------------------------------------
BINDURA UNIVERSITY OF SCIENCE EDUCATION

RELEASE FORM

NAME OF AUTHOR: MAPFUMO COSMAS
B 1129977

TITLE OF PROJECT:
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SIGNED -----------------------------

PERMANENT ADDRESS: HOUSE No 1214 MABVAZUVA
RUSAPE
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DEDICATION

This research is dedicated to my wife Saita, my children Sisindisiwe, Dawn Tafadzwa, Tinotenda and Takudzwa Solomon for their moral and financial support. I also dedicate this project to my late maternal grandmother MaziverwanguMushangwe (nee Usheuwokunze) for her never ending support and sense of security she gave me when I needed it most. Granny you installed in me the determination to follow my dreams and purse my goals against all odds.

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ABSTRACT

The overall students’ performance in ‘A’ Level Physics at Zimbabwe Examinations council (ZIMSEC) has been poor coupled with low student enrolment. The preferred mode of delivery by physics teachers in Zimbabwean schools is the expository approach. This approach is dominant despite growing evidence that it is not effective in incalculating the content knowledge, conceptual knowledge and science process skills that are part of quality physics teaching. Available literature shows that the interactive methodology approach is capable of promoting these attributes among students. However there is little documentary evidence on the extent of one mode over the other. The interactive and lecture method of instruction were compared. The lecture method is an economical way of teaching large numbers of students, at the same time syllabus coverage is very quick. It trains students in note taking skills. However a number of students especially those with poor listening and note taking skills will be left out. The interactive methodology is very appropriate in teaching physics as the subject requires hands-on for pupils to benefit. However it requires resources which might be out of reach for many Zimbabwean schools. To authenticate findings triangulation was employed using three tools self-administered questionnaires, personal interviews and non-participant observations. Data was collected at C high school in Makoni district, Manicaland province, study was carried out with lower sixth physics students and their teachers after a pilot study was carried out with upper sixth maths students and their teachers at F high school in Makoni District, Manicaland province to validate the instruments. From the studies carried out it became evident that students perform better if the mode of instruction is the interactive one. This study recommends to the education authorities in Zimbabwe that science teacher training colleges emphasise in their curriculum interactive methodology skills.
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CHAPTER 1 INTRODUCTION

1.0 Introduction

This chapter introduces the research topic “A comparative study of lecture and interactive methodologies in the teaching of Newtonian Mechanics at ‘A’ level physics at C high school in Makoni District, Manicaland Province.” It contains the background of the study, the statement of the research problem, the research questions, the research objectives, the hypothesis statement, the significance of the study, the limitations of the study, and the delimitations of the study, the definitions of terms and eventually the structure of the study.

1.1 Background of the Study

The overall students’ performance in ‘A’ Level Physics at Zimbabwe Examinations Council (ZIMSEC) has been skimpy coupled with stumpy student enrolment. The preferred mode of delivery by physics teachers in Zimbabwean schools is the expository approach. This approach is dominant despite growing evidence that it is not effective in incalculating the content knowledge, conceptual knowledge and science process skills that are part of quality physics teaching. Available literature shows that the interactive methodology approach is capable of promoting these attributes among students. However there is little documentary evidence on the extent of one mode over the other.

The lecture method and the participatory methodology are all teaching methods that can be employed by a physics teacher in a classroom situation. Science educators and in particular; physics teachers need to embrace effective teaching methods to make ourselves more effective and relevant to a much larger proportion of the student population than in the past due to a rapid scientific and technological innovation over the past years.
Wieman and Perkins (2007) propounds that a modern knowledge based economy will flourish only if it hasa workforce with high level of technical understanding and skills. The Kenyan Certificate of Secondary Education Examination (KCSE) (2008) report cited that most students shun physics and considered concepts too abstract and difficult to understand and performance has been low due to among many other reasons poor teaching methods by physics teachers.

Kumar (1996) postulated that the lecture method of teaching is considered to be the simplest and is the traditional way of teaching. The teacher can cover large amounts of material in a short period of time. In this teaching method the teacher engages in the presentation of material based on one way communication. Jacobs et al (2004) postulates that the interactive methodology claims that there is a shift from a teacher centred classroom to a learner centred classroom. This teaching method enables pupils to be participatory learners rather than passive recipients of knowledge; hence they end up shifting from being spoon fed to taking responsibility for their learning.

Therefore; it is the aim of this study to compare the impact of the lecture methodology and the interactive methodology in the performance of ‘A’ level pupils in physics.

1.3 Statement of the Problem

Generally, students’ performance in ‘A’ Level Physics at Zimbabwe Examinations Council (ZIMSEC) has been skimpy coupled with stumpy student enrolment. The preferred approach of delivery by physics teachers in Zimbabwean schools is the expository approach. This approach is dominant regardless of growing evidence that it is not effective in incalculating the
content knowledge, conceptual knowledge and science process skills that are part of quality physics teaching. Available literature shows that the interactive methodology approach is capable of promoting these attributes among students. However there is little documentary evidence on the extent of one mode over the other. As a result, the quest of this research is to compare the impact of the lecture methodology and the interactive methodology in the performance of ‘A’ level pupils in physics.

1.4 Objectives of the Study

By the end of this project, the researcher must be able to:

1. Identifying the methods commonly used by teachers in teaching Newtonian Mechanics at ‘A’ level physics.
2. Explore the impact of using both the lecture and the interactive methods on pupils’ performance in physics.

1.5 Research Questions

1. What are the methods adopted by ‘A’ level Physics teachers when teaching Newtonian Mechanics?
2. What are the impacts of both the lecture and the interactive methods on pupils’ performance in physics?
3. Which method can best be recommended to Physics teachers in conducting Newtonian Mechanics studies?

1.6 Significance of the Study

Researches on teaching methodologies in relation to performance of pupils are barely limited. This is a topic where a small number of researchers have resorted their time, effort and resources to embark into. So, by having answered the proposed questions, the researcher looks forward to:

1. Benefiting the education department in choosing the best teaching method which suits their content to be covered and which also contributes to better pupil performance.
2. Helping the Physics teachers in choosing the best method of teaching which suits their environment.
3. Helping the pupils in their learning that is, the best method used to deliver lessons.

1.7 Assumptions of the Study

1. The relevant ministry (Ministry of Education, Sports, Arts and Culture) through the school heads will allow the research to be carried out.
2. Physics teachers and pupils will co-operate; that is; both teachers and pupils will be truthful.
3. The respondents are going to understand the researcher and would not undermine the research.
1.8 Definition of Terms

*Teaching Methodologies* – ways of teaching

*Performance* – it is the ability levels of pupils

*Lecture Method* – it is a teaching method which involves passive learning to create knowledge.

*Teacher Centred Learning* – Refers to situations in which the teacher asserts control over the material that students study and the ways in which they study that is to say when, where, how and at what pace they learn it.

*Learner Centred Learning* – Refers to forms of instruction that for example give students opportunity to lead learning activities, participate more actively in discussions and design their own learning projects.

1.9 Limitations of the Study

1. Some respondents may not tell the truth.
2. Some teachers may not see the significance of the study and may not co-operate.
3. The small sample size may lead to the generalisability of facts.

1.10 Delimitations of the Study

The study is going to be carried out in Makoni District.

See map (appendix)
1.11 Summary

The introduction of this research paper introduces the research topic “A comparative study of lecture and interactive methodologies in the teaching of Newtonian Mechanics at ‘A’ level Physics at C high school in Makoni District, Manicaland Province.” It contains the background of the study, the statement of the research problem, the research questions, the research objectives, the significance of the study, the limitations of the study and the delimitations of the study and the definitions of terms. The remainder of this paper is organised as follows: the literature review to put together the relevant concepts of the research; followed by the description of the research methodology; then a presentation of the results and findings of the research study; and eventually the summary, recommendations and conclusion of the study.
CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

In order to develop some insight into the research problem concerning the lecture method and the interactive methods of teaching, a review of related literature was done. Some authorities have listed and cited a multiple of advantages and disadvantages of using each of the teaching methods in the classroom. This chapter seeks to have a deeper understanding of the impact of the lecture methodologies and the interactive methodologies on the performance of pupils in the teaching of Newtonian Mechanics in ‘A’ level Physics. It also aims at looking closely at what had been said by other researchers and authors in respect of these two methodologies of teaching Newtonian Mechanics studies in A’ level Physics.

2.1 Sources of literature review

In this chapter the researcher is going to make use of professional journals, magazines, newspapers, published textbooks, the internet and other related authorities.

All authors and researchers whose literature is quoted will be acknowledged as per the requirements of the copyright laws.

The researcher also acknowledges the authors as his gesture of gratitude and appreciation.
2.2 Interactive Methodology

The interactive methodology is defined by Heppner (2007) as the engagement of all students in learning, physically, mentally and spiritually in active learning. This means that it is active learning to create knowledge.

Davies (1993) concur with Heppner (2007) as he explained that this interactive method of teaching motivates students and helps them to improve not only their performance but their communication skills with people so that they can be more active during class. Furthermore it would allow teachers to make effective use of laboratory resources. This method would best suit the teaching of Newtonian Mechanics in physics since there is more of pupil interaction with apparatus and with each other.

As agreed by the above two authors interactive methodology is simply active learning in order to create knowledge. Active learning may include the use of group work and discussions.

Students learn better from each other than they do from teachers. Encouraging co-operative learning among students through group work would encourage a more relaxed classroom environment, while also allowing the teacher to act as a facilitator instead of a lecturer.

Oyoo (2009) reports that in response to the low students achievement and motivation to learn physics the Kenyan Ministry of Education organised National and District inservice training for physics and maths teachers emphasising the need to adopt Activity Student Experiments and Improvisation (ASEI) and Plan Do See and Improve teaching approach (PDSI). The ASEI and PDSI clearly advocated a shift from teacher centred to student centred physics teaching approaches.

Approaches used in teaching physics have been identified as one of the factors contributing to the low student achievement in physics among other factors as concurred by the American
Association of physics Teachers (AAPT) (2009). This means the teaching approach a teacher adopts may motivate students to learn and affect their achievements in physics.

Kahn and O’Rourke (2008) postulates that interactive methodology is a teaching strategy that is driven by scientific inquiry. The approach is deeply rooted in constructivism teaching practises. It is student centred rather than teacher centred and offers students opportunities to be actively involved in experimenting, questioning and investigation. Gibson et al (2002) agrees to this and says the approach has been considered as being capable of promoting motivation among students since it creates interest in the process of acquiring scientific knowledge and skills.

Interaction and cross fertilisation of ideas brings about socialisation as agreed by Barker (2000) as he says the principle of socialisation is the most important teaching principle. Heppner (2007) said that discussion in a class is one of the interactive learning during lectures, when the teacher asks his pupils to discuss about a specific topic in class. It will help to motivate pupils towards further learning to allow them to apply information in new settings; hence this discussion is preferable to a lecture.

Heppner (2007) furthermore went on to explain that the only way to tackle the problems that exists in a lesson is by making pupils part of the solution. The pupils need to be part of the way so that they all go together. These ideas were also agreed upon by Sharma at http://www2.unescobkk.org.com (2002) as she said that the best way to bring solutions to problems in a lesson is by using the interactive methodology.

Terry (1984) researched on this interactive method and found out that “through the use of participatory methods most pupils felt comfortable and at ease, most of them invested more in the work they did in class.”
It can be noted that the above three authors have all agreed on the fact that participatory or interactive methodology is a teaching method that shifts from a teacher centred type of learning to a pupil centred one. Students are also able to express their own opinions during the lesson. They will have a chance to talk in front of their friends and the teacher. So it helps to build self-confidence to express themselves. Interactive environment is also good for the learners to present themselves in front of others which afford them to build on their self-esteem, an aspect vital in their future as adults.

Gunekpo at [http://www.biog.gunekpo.com](http://www.biog.gunekpo.com) (2013) commented on interactive methodology and said that if the teacher gives students information, they do not know whether the pupils are interested or have understood what they have said. Instead learners have to be actively involved in the teaching – learning process in order to satisfy their learning needs.

The above author tries to explain the idea of satisfaction of learning needs which has been agreed upon by Killen (2007) who said that the development of true critical thinking skills requires just an open and honest exchange of ideas, this method maintains a teaching style; like the socratic method that encourages healthy debate between students and the teacher hence critical thinking.

C.A.C.C.(2000) also explained that the interactive learning method is helpful not only to those who receive assistance but also to those who will be helping others in the learning process .It helps students to prepare more successfully for the outside world than those who do not. Engaged learners who actually actively participate in their own education are more apt to remember more from a lesson and then transfer newly acquired skills to different situations.Jacobs *etal* (2004) also agreed that pupils learn most when they explain things to others and when they get information from peers, thus making abstract concepts in Newtonian Mechanics more understandable.
Tashi(2012) in his book “Less Lecturing More Learning” attended two training courses. One on integrated pest management where many lectures were given work in classroom environment where the learners sat down on their seats and just listened. He wanted to share ideas but he did not have the opportunity to do so. He did not enjoy it and wondered, “is there a better way for learning? Another one the second training course was on new planting techniques. This course started new discussion about the expectations of the participants. The first part of the training course consisted of presentations followed by questions and answer sessions. The second part consisted of the demonstrations in the field and small group discussions to explore how the participants could adopt to the new knowledge for their own work. The facilitator asked some questions from time to time to help the group think of things that they might have missed. At the end of the training, each group presented feedback from the demonstrations. Tashi(2012) concluded his findings saying that learning is not about the teacher giving information but is an active process where a learner goes through an experience and learns from it. He said that he engaged the second training course and did enjoy the first course because it was teacher centred but enjoyed the last part as it was participatory learning.

From the above contributions it can be seen that interactive methodology will inevitably result in a transformation of pupils in the classroom from being passive recipients of information to active participatory learners, from only answering questions to asking questions. As a result they end up not wanting to have their own say only but advocating their pupils’ opinion. However although this interactive method can be very effective and efficient method of teaching it may be time consuming and expensive since apparatus and associated materials will be needed. This type of teaching method needs to be monitored in small manageable groups, which may be a luxury in most Zimbabwean schools. There may be limited class time whilst there may be possible need for preparation time. To successfully carry out this teaching method there is need for a lot of materials, equipment or resources which might not be available at
times. More so, it may be difficult to use this method in large classes as compared to the lecture method.

This research seeks to compare the impact of lecture method and interactive methods in the teaching of Newtonian Mechanics in ‘A’ level physics at a rural boarding school. It might not be reflected in this literature, that is the findings may be quite different because of the differences in languages that were used in the research done as they were done in developed countries like the United Kingdom.

2.3 Lecture Method

Carbon (1989) clearly defined the lecture method as a teaching method where an instructor is central focus of information transfer. The University of Pittsburg at http://www.cirde.pitt.edu.com(2012) is of the same opinion on the definition of the lecture method but they went on expanding on this definition saying that teachers have a greater control over what is being taught in a classroom because they are being seen as sole sources of information.

It is quite clear that these two authors agreed on the same point that the teacher will be doing the talking whilst the pupils will be doing the listening throughout the lesson. This explains that an instructor will stand before a class and present information for the students to learn. Usually, very little exchange of information occurs between the teacher and the students during the lessons, and this may lead to the process of learning not being undertaken on the side of pupils. However this method in reality saves time and as a result a lot of syllabus content will be covered.
Barker (2004) says “lecture method refers to the explanation of the topic to the students.” Killen (2007) supported this statement as he further explained that the lecture method is a means by which the expert presents the materials of the course in an organised manner to the learners going from theory to the examples and back again.

In other words if the teacher or the expert clarifies the content matter to the students by using gestures, simple devices, by changing voice projections, change of position and facial expressions, the performance of the pupils may be better. More so since the teacher is the expert, it means the pupils will be receiving quality information there by a remarkable improvement in the teaching of Newtonian Mechanics in Physics.

Kelly (2009) vehemently postulates that lectures are a straight forward way to impart knowledge to students quickly. She went on to describe how this teaching method is conducted as she said:

“Typically an instructor will stand before a class and present information for the students to learn”

As clearly explained by Kelly (2009) only the teacher will have great control over what is being taught in the classroom. As a result the method may provide economical and efficient method for delivering substantial amounts of information to a larger group of pupils. Using this method, the teacher is able to give a synthesis or a summary of information from different sources, consequently pupils will be filled with recent, relevant and quality data and information.

Jackson and Prosser (1989) explain that:

“The lecture method if handled correctly can have a great impact on pupils as it affords a necessary framework or overview for subsequent learning for example reading, assignments, small group activities and discussions”.
This method offers current information that is more up to date than most texts from many sources since teacher will be referring to most recent information via the internet, because there is a lot of dynamism in physics brought about by new technology.

However some authorities tend to disagree on the positive impact of the lecture method on pupil’s performance. Kuma (1996) argues that:

“the lecture method is the oldest method of teaching based on the philosophy of idealism.”

Killen (2007) also supported this idea and went a step further and says:

“it refers to the explanation of the topic to the students whilst emphasis will be a presentation of the content, as a result teachers may not get a real feel of how much students are understanding because there is not much opportunities of exchanges during lectures.”

This lecture method as explained by those two authors become difficult to carter for individual differences as the teacher may not concentrate on the ways to provide students with individual feedback.

Roy (2002) did a research on the impact of the lecture method on performance of pupils and he concluded that “it limits the amount of student participation”. Lecture is inadequate for teaching hands-on skills and it is not an effective method of maintaining students interest. Killen (2007) also agree on this notion as he explained that the lecture method does not provide teachers with an opportunity to estimate progress before an examination within a single lecture period, the teacher can present more information than what students can internalise and have little accurate means during lecture of determining what they have learnt.
Roy (2002) tends to agree on the fact that there is limited students’ participating in lecture methods. This will result in passive learning; the teacher will be the one who will be doing the talking all day long with little or no input from the students. This becomes a problem as physics is a practical subject which requires hands on for pupils to internalise information effectively.

Killen (2007) also agrees that the “lecture method is unstimulating such that it becomes very difficult to seat for a long time and listen to a teacher.” Newer learning methods involve hands on learning of objects as they work in groups to learn the lessons objectives in a stimulating way.

As clearly cited at www.circle.pitt.edu.com (2009), during lecture delivery, elaborate language and syntax, which are apt to be difficult to follow when orally delivered, are used. There is also insufficient attention to students pre-knowledge or level of competence such that the teacher ends up using inappropriate example or irrelevant examples to students experiences. As a result being ignorant on pupils pre-knowledge, the lecture may result in negative impact on pupils performance.

Roy (2002) further explained that too often the lecture makes no provision for participation by student. As a result many students willingly allow the instructor to do all the work. Learning is an active process but the lecture method tends to foster passiveness and dependence on the instructor, thus hindering the scientific inquiry of phenomena which proves to be ideal for teaching Newtonian Mechanics in Physics.

Jacob et al (2004) explained the effect of the lecture method and says “only a few students will be sailing together with the teacher, auditory learners (those who learn best by listening for a long time), most of the pupils may be strong in practical learning styles”.

This statement tries to explain that learning may become too difficult to those who learn best if there is an exchange of information not only listening from what the teacher is saying and
taking down note. Students who are weak in note taking skills will also have a problem in understanding what they should remember from lectures. As a result they may find lectures very boring causing them to lose interest hence their performance may be compromised.

However as clearly cited by Jacob et al. (2004) “there is no teaching method that can work alone without being assisted by another method,” These two methods can therefore be used to complement each other to have a more practical lesson delivery.

This research seeks to explain the impact of the lecture method on performance of pupils in A ‘level Physics and compare it with interactive method of teaching Newtonian Mechanics in physics. The research is going to be carried out at a rural mission boarding school; hence the results may not necessarily be the same to those done in developed countries.

2.4 Summary

In this chapter the purpose of literature review was given. This was followed by a list of sources of literature review and a detailed discussion and review of related literature.
CHAPTER 3 METHODOLOGY

3.0 Introduction

This chapter outlines the methodology adopted in the collection, presentation, interpretation and analysis of the data. It explains the procedures that were taken to come up with the data as well as to present, interpret and analyse it. It also helps to explain the difficulties encountered in the data collection. In order to illustrate the mixture of research activities undertaken at some stage in this study, the data collection activities and related analysis techniques will be systematically examined in distinct phases. For simplicity purposes, the study activities will be described in the order in which the researcher completed them.

3.1 Research Design

Shastril (2008) defines a research design as a plan that shows which individuals were studied and when, where and under what circumstances they were studied. Cohen et al (2011) defines a research design as a plan for selecting objects, research sites and data collection procedures to answer the research questions. Luttrell (2009) give the definitions of a research as a plan that follows an ongoing set of principles that guide decision making throughout a qualitative study. From all these authorities a research design can be defined as a plan for selecting objects, research sites and data collection procedures to answer the research questions.

3.3 Target population

The population in this research was made up of 63 Secondary schools that are in Makoni District of Manicaland Province.
3.4 Sample Size and Sampling Technique

According to Roy (2002), a sample is a subset of the larger population. For the purpose of this study, 5 schools were selected from the 63 secondary schools in Makoni District. The purposive sampling approach was utilised. This type of non-probability sampling was chosen in order to provide the researcher with the most useful data upon which to evaluate the relationship between lesson delivery methodologies and the performance of pupils. Of all the 5 schools involved in the research, only ‘A’ Level pupils doing Physics and their respective teachers were utilised in compiling this document.

3.5 Research Instruments

This section of research design spells out the techniques used to present the data.
The research tools were the self-administered questionnaires, face to face interviews and non-participant observation by the researcher.

3.5.1 Self-administered Questionnaires

Questionnaires are documents which contain printed questions to which information is replied in writing. In other words these are collection of questions formulated with more details about the subjects.

**Advantages of Self-administered Questionnaires**

One relative advantage of the questionnaire over other instruments is that it has a high degree of anonymity which according to Shastril (2008) facilitates the obtaining of honest responses. The instrument gives the respondents a chance to independently provide their own views and feelings freely without interference.

When compared with the interview the questionnaire has an advantage as it guaranties confidentiality of collected responses. It enlists more truthful responses. The questionnaire can also be used to collect data from respondents in a wide geographical area since it can be mailed to respondents or respondents telephoned, e-mailed or faxed, and thus saving money and time. It is also useful in that it avoids embarrassment on the part of the respondent if too personal questions are asked.

**Disadvantages of a Self-administered Questionnaire**

The researcher found out that this method suffers in that some respondents failed to understand the requirements of the questions and gave wrong responses, because it is difficult to formulate questions whose meaning are clear to every respondent. This means extra care had to be taken
to come up with questions that are meaningful to every respondent. However the researcher went a step further to explain to his recipients the requirements of the questions.

Another disadvantage is that the respondent may simply lay down the questionnaire and forgets about it. Care must be taken to follow up questionnaires so as to minimize cases of non-returns.

Shastril (2008) also agrees by saying that there is no control over who completes it and it is not possible to a high assumption of no literacy problems.

It is not possible to give assistance if required. Respondent can read all questions before hand and then decide whether to complete or not, for example perhaps it is too long, complex, uninteresting or too long.

3.5.2 Interviews

Shastril (2008) defines an interview as technique primarily used to gain an understanding of the underlying reasons and motivation for pupils’ attitudes, preference or behaviour. CACC(2000) sees the interview as a direct method of gathering data from informants. Interviews can be undertaken on a personal, one to one basis or in a group. Interviews can be conducted at work, home or in the streets.

Advantages of Interviews

The researcher has a chance of getting much of what the respondents tend to expose. Best etal(2008) agreed and say “it encourages conversation between the researcher and respondent to explain the question which the respondents do not understand.”

Upon consent with the respondent recording equipment may be used, it gives the researcher an opportunity to assess respondent characteristics for example tone of voice, facial expressions and hesitations. Interviews can be a quick way to pilot other methods of data collection.
**Disadvantages of Interviews**

The respondents may not be free to give true responses to some questions which may be sensitive. It is time consuming, expensive and has geographical limitations.

According to Ary (2010) “there can be respondent bias where the respondent may tend to want to please researcher and thereby create false personal image”.

However the researcher used a variety of questioning techniques to probe and solicit more accurate responses from respondents.

**3.5.3 Observations (Non- participants)**

Cohen et al (2011) defines non-participant observation as a powerful tool for gaining insight into a situation.

**Advantages of Non participant Observations**

It gives researcher first hand information

**Disadvantages Non participant Observations**

It may take a long time to catch the required behaviour or phenomena.

It can be costly on time and effort. It is prone to difficulties of interpreting or inferring what the data mean.

**3.6 Data collection procedure**

Questionnaires, interviews and non-participant observations in natural settings were used to provide corroboration and triangulation. To authenticate findings triangulations from different methods was employed. Jacobs et al (2004) explains triangulations from different methods as
“looking at the same question/topics but trying to answer them using different research methods (often blending qualitative and quantitative methods)

3.6.1 Questionnaires
The researcher constructed self-administered questionnaires. Before using them he took them to the supervisor for evaluation.

3.6.2 Interviews – (Personal)
Questions for interviews were drafted and shown to the supervisor for evaluation purposes.

3.6.3 Observations Non – participant
A non-participant schedule was used to note interactions between students and students and teacher and students and students and teacher.

3.6.4 Performance of Pupils
To assess the performance of the pupils in the 5 schools selected; a uniform question paper was set by the researcher. To ensure consistency in the allocation of marks; the researcher marked all the answer scripts of the 5 schools. Eventually the percentage pass rate for each school was calculated.

3.6.5 Pilot study
The instruments being in place were put to test, to test their validity and reliability a pilot study was conducted at F high school in Manicaland Makoni District using form 6 Mathematics students, 5 questionnaires were distributed to the upper sixth Mathematics students and 2 ‘A’ level Mathematics teachers. Interviews were also done with 5 form 6 Mathematics students and 2 ‘A’ level Mathematics teachers.
One lesson was observed in session. The results of the pilot study were analysed. No adjustments were made on the questionnaire, interview questions and observation rating scale. Having been perfected questionnaires were then distributed, interviews conducted and observations done at the 5 schools inclusive of C high school.

3.6.6 Data Collection Plan.

Having been granted permission by the District Education Officer and the School authority the researcher went ahead with distribution of questionnaires and after five days collected the completed questionnaires. All questionnaires through a lot of effort were returned.

The researcher had a day to interview teachers. The teacher also had an opportunity to observe 1 lesson from each of the 5 schools.

3.7 Data Presentation and analysis procedures

The study involved both qualitative and quantitative research using questionnaires, interviews and observations.

The quantitative analysis aided in determining statistically the teaching method frequently used by teachers.

The qualitative analysis helped to solicit from the respondents their attitudes and perceptions regarding the most beneficial teaching method.

The data was processed and grouped into manageable units for analysis, this included tables, graphs and calculation of percentages.

3.8 Ethical consideration

This article is not for publication but rather for scholarly purposes. Every effort was made to keep all research data undisclosed and confidential. The data that was gathered will be kept
private and confidential except when participants consider it necessary to have the document published.

3.9 Summary
This chapter described the research design, research instrument, data collection procedures, data presentation and analysis. However, the research was not done without problems especially delay in the provision of information sought. When researcher visited the schools to collect questionnaires some students had gone for Districts Athletics completions and researcher had to visit the school on more than one occasion. Despite the above problems, the study collected enough data for analysis.
CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPETATION

4.0 Introduction

In this chapter, the researcher is going to present data, interpret and analyse data emerging from questionnaires, observations and interviews carried out.

4.1 Methods Commonly Used by Teachers in Teaching Newtonian Mechanics at ‘A’ Level Physics

The bar (conical) graphs above shows the different teaching methodologies that are utilised by ‘A’ level teacher when Newtonian Mechanics in Physics. Five distinct methods namely;
demonstrations, discovery learning, group work, question and answers and the lecture method were found to be relevant when delivering lessons on Newtonian Mechanics in Physics.

The four methodologies namely demonstrations, discovery learning, group work and question and answers were taken to be all interactive methodologies. From the research findings, it was noted that the interactive methodologies were cumulatively taking precedence over the lecture methodologies. It was noted that an average of 30% of the time was allocated for lecture methodologies and the remaining 70% on interactive methodologies.

A cumulative total of 6000 minutes (80 min/ lesson * 15 lessons/ 3 weeks * 5 schools) was utilised to determine the methodologies applied by different teachers when teaching when Newtonian Mechanics in Physics at ‘A’ level. The time was distributed as 2400 minutes (40%) was spent on discovery learning, 900 minutes (15%) was spent on demonstrations, 600 minutes (10%) was spent on group work, 300 minutes (5%) was spent on question and answers and the remaining 1800 minutes (30%) was spent on lecture methodologies.
4.2 Percentage Pass Rates of the 5 Schools

The bar graph above shows the respective percentage pass rates of the 5 school that were considered in this research. It shows that A high school was the best with approximately 89% pass rate and E high school was the least with approximately 55% pass rate.
2.2.1 ‘A’ high school

The bar graph above shows how the different teaching methodologies were being applied at A high school. It clearly shows that discovery learning was dominant (50%) and the other approaches were equally distributed (12.5% each). That is; out of the 1200 minutes for the lessons, 600 minutes were utilised in discovery learning and the other methods utilised 150 minutes each.
2.2.2 ‘B’ high school

The bar graph above shows how the different teaching methodologies were being applied at B high school. It clearly shows that discovery learning was dominant (40%), followed by demonstrations (25%), then lecture methods (20%), afterwards group work (10%) followed and lastly the question and answer approach (5%). That is; out of the 1200 minutes for the lessons, 480 minutes were utilised in discovery learning, 300 minutes on demonstration, 240 minutes on the lecture method, 120 minutes on group work and the remaining 60 minutes were utilised on the question and answer approach.
The bar graph above shows how the different teaching methodologies were being applied at C high school. It clearly shows that discovery learning was dominant (40%), followed by lecture methods (27.5%), then demonstrations (17.5%), afterwards group work (12.5%) followed and lastly the question and answer approach (2.5%). That is; out of the 1200 minutes for the lessons, 480 minutes were utilised in discovery learning, 330 minutes on the lecture method, 210 minutes on demonstration, 150 minutes on group work and the remaining 30 minutes were utilised on the question and answer approach.
2.2.4 ‘D’ high school

The bar graph above shows how the different teaching methodologies were being applied at D high school. It clearly shows that lecture methods was dominant (42.5%), followed by discovery learning (40%), then demonstrations (10%), afterwards group work (5%) followed and lastly the question and answer approach (2.5%). That is; out of the 1200 minutes for the lessons, 510 minutes on the lecture method, 480 minutes were utilised in discovery learning, 120 minutes on demonstration, 60 minutes on group work and the remaining 30 minutes were utilised on the question and answer approach.
2.2.5 ‘E’ High School

The bar graph above shows how the different teaching methodologies were being applied at E high school. It clearly shows that lecture methods was dominant (47.5%), followed by discovery learning (30%), then demonstrations and group work (10% each) and lastly the question and answer approach (2.5%). That is; out of the 1200 minutes for the lessons, 570 minutes on the lecture method, 360 minutes were utilised in discovery learning, 120 minutes on demonstration, 120 minutes on group work and the remaining 30 minutes were utilised on the question and answer approach.

From the research findings, a positive correlation between integrative approach and the percentage pass rate and a negative one between the lecture method and the percentage pass
rate was observed. The graphs for the respective schools above show that when the rate of applying the lecture method is high the corresponding percentage pass rate is low and vice-versa.

### 4.3 Analysis for Non-Participant Observations

With non-participant observations data was analysed qualitatively where meaning is the main concern. Differentiation was made between observations that needed to be noted from those that simply occurred but was noted. Information from chapter 2 on literature review also was helpful in tying themes together. Non-participant observation is very systematic and this enabled the researcher to generate numerical data from the observations. Numerical data in turn facilitated the making of comparisons between situations and frequencies. The researcher adopted a passive non intrusive role merely noting down the incidence of the factors being studied. Observations were entered on an observational schedule. Cohen (2011) propounds that an observational schedule is used to monitor student and teacher conversation over a period. For the observational schedule below the upper seven categories indicate who is speaking to whom, whilst the lower four indicate the nature of talk. Categories for observations are discrete meaning there as no overlap between them. Each of the columns represented a thirty second time interval that is to say movement from left to right represents the chronology of sequences and the researcher had to enter data in the appropriate cell of the matrix every thirty seconds. As the researcher there are so many categories which had to be scanned at every thirty seconds, the researcher had to practise to fill the schedule in order to more proficient and consistent in entering data, achieving reliability. The researcher used V and a forward / for entries.

### 4.4 Summary

The chapter presents, analyses and interprets the data on the topic ‘A comparative study of lecture and interactive methodologies in the teaching of Newtonian Mechanics at ‘A’ level
physics at C high school in Makoni District, Manicaland Province.’ Excel was used to draw the graphs. The methods that were identified to be adopted when teaching Newtonian Mechanics at ‘A’ level Physics are group work, discovery learning, demonstrations, question and answer and the lecture methods. The first 4 methods were taken to be all under the interactive methodology. Discovery learning was taken to be the most dominant approach in teaching of Newtonian Mechanics at ‘A’ level physics. The question and answer method was the least utilised in the teaching of Newtonian Mechanics at ‘A’ level physics. A positive correlation between the interactive method and the percentage pass rate of student was noted whereas a negative one was noted between the lecture methods and the percentage pass rate of student.
CHAPTER 5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

In the previous chapter the researcher presented the data collected from the study done and analysed it. In this chapter the researcher shall present the summary, conclusion and give recommendations based on scientific findings.

5.1 Summary

The question of the problem was dealt with in chapter 1 and brought out the background of the problem, purpose and objectives of the study.

Chapter 2 looked at work that has been done in relation to the interactive methodology, lecture method and non-participant observation.

Authorities were quoted and their works referred to, to show the need for the problem to be solved.

Chapter 3 showed the way they intended to tackle the problems. The methodology was based mainly on the use of questionnaires, face to face interviews and non participant observations.

The results were presented and analysed in chapter 4.

These were results obtained from the three instruments.
5.2 Conclusion

It can be concluded that both methods of teaching have an impact on student performance in physics.

If the lecture method is used continuously, does not benefit learners and the interactive methodology yields better and quite competitive results as noted from the findings.

With the introduction of participatory methodologies in the teaching and learning field it has been found out that the interactive method of teaching is the one that is mostly beneficial to pupils in physics because of its positive impact on pupil performance.

5.3 Implications

Students taught through the interactive methodology approach attained higher marks than those taught through the lecture method.

Therefore education authorities in Zimbabwe should encourage physics teachers to use this approach and science teacher training colleges like Mutare, Hillside and Belvedere should make it part of their training curriculum content.
5.4 Recommendations of the study

The findings of this study suggest that the use of the interactive methodology can be an effective approach in enhancing student’s achievement in learning Newtonian Mechanics.

Based on these findings this study proposes the following recommendations

i. Teacher training should be designed to produce teachers capable of planning and implementing interactive methodology approach.

ii. Teachers in schools should be given training in planning and implementing interactive methodology approach through in service courses.

This may be an effective teaching approach in providing suitable learning styles and academic abilities that is common in most classroom settings

iii. Students taught through interactive methodology approach performed better and had higher mean scores than those taught through the lecture method.

Therefore the education authorities in Zimbabwe should encourage physics teachers to use this approach.
5.6 Suggestions for further research

The findings of the study indicate that interactive methodology approach is effective in enhancing students’ achievement and motivation in learning Newtonian Mechanics.

However there are areas that warrant further investigation

These include the following:

i. A comparative study involving single sex and co-educational school settings to establish whether the findings apply to the two categories of schools since they are the most prevalent in Zimbabwe

ii. Studies involving the impact of interactive methodology approach on the motivation of teachers since the interactive methodology approach is quite demanding on both the teacher and students may be an in depth study of the impact on teachers would be helpful.

iii. Studies involving larger sample sizes in terms of participating schools, students and teachers to confirm whether or not the present findings hold.

iv. Studies involving more topics in physics or involving other science subjects since the science subjects are similar in teaching context approach.
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APPENDICES

Appendix 1 Questionnaire for Physics Pupils

Dear Respondent

I am a Bindura University of Science Education student conducting a research on a comparative study on the impact of the lecture method and the interactive methodology on the performance in teaching of Newtonian Mechanics at ‘A’ level physics at C high school in Makoni District, Manicaland Province. Please assist by completing the following questionnaire. The questionnaire is primarily for academic purposes.

Your co-operation is greatly appreciated.

Yours sincerely

Mapfumo C.

Instructions

i. Do not write your name on the questionnaire.

ii. Put your answer in the provided space but if the space is not adequate use the back of the questionnaire.

iii. Kindly tick the appropriate answers.
1. Have you ever done an experiment when you were studying Newtonian Mechanics?

☐ Yes  ☐ No

If yes, how did they benefit you in such studies.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2. Have you ever embarked on group work when you were studying Newtonian Mechanics?

☐ Yes  ☐ No

If yes, how did they benefit you in such studies?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3. Have you ever adopted the question and answer approach when you were studying Newtonian Mechanics?

☐ Yes  ☐ No

If yes, how did they benefit you in such studies?

________________________________________________________________________

________________________________________________________________________
How did you benefited from the teacher’s presentations during the lesson time?

Rank all the above methods in such a way that you start with the way of learning that is most significant to your understanding of Newtonian Mechanics.

THANK YOU
Appendix 2 Interview Schedule for Physics Teachers

Dear Respondent

I am a Bindura University of Science Education student conducting a research on a comparative study on the impact of the lecture method and the interactive methodology on the performance in teaching of Newtonian Mechanics at ‘A’ level physics at C high school in Makoni District, Manicaland Province. Please assist by completing the following questionnaire. The questionnaire is primarily for academic purposes.

Your co-operation is greatly appreciated.

Yours sincerely

Mapfumo C.

Instructions

i. Do not write your name on the questionnaire.

ii. Put your answer in the provided space but if the space is not adequate use the back of the questionnaire.

iii. Kindly tick the appropriate answers.

1. How many Physics lessons do you have per week?

   Specifications: (specify the length of each lesson)

2. Which method(s) of teaching do you usually use in teaching Newtonian Mechanics?

   Specify reasons for using the identified methods.

   Specifications:
3. What challenges did you face in teaching Newtonian Mechanics using the methods stated above?

4. Which method(s) do you recommend to be used when teaching Newtonian Mechanics?

THANK YOU
Appendix 3 Students’ Performance Measurement Tool

Test (16-02-15)

Instructions

Write your name and school in full.

Answer all questions.

1. A projectile is fired with a velocity of $320\text{ms}^{-1}$ at an angle of $30^\circ$ to the horizontal. Find,
   i. The time to reach its greatest height.
   ii. Its horizontal range. [4]

2. A small ball A, suspended from a string OA, is set into oscillation (see diagram below). When the ball passes through the lowest point of the motion, the string is cut. If the ball is then moving with a velocity of $0.8\text{ms}^{-1}$ at a height 5m above the ground, find the horizontal distance travelled by the ball. (assume $g = 10\text{ms}^{-2}$)

3. A projectile is fired from the ground level with velocity $500\text{ms}^{-1}$ at $30^\circ$ to the horizontal. Find its horizontal range, greatest vertical height to which it rises, and the time to reach the greatest height. What is the least speed with which it could be projected in order to achieve the same horizontal range?
   (The resistance of the air to the motion of the projectile may be neglected) [2]
4. A car moving with a velocity of 10\,\text{ms}^{-1} accelerates uniformly at 1\,\text{ms}^{-2} until it reaches a velocity of 15\,\text{ms}^{-1}. Calculate;
   i. The time taken
   ii. The distance travelled during the acceleration
   iii. The velocity reached 100\,\text{m} from the place where the acceleration began. [6]

5. A ball is dropped from a height of 20\,\text{m} and rebounds with a velocity which is \(\frac{3}{4}\) of the velocity with which it hit the ground. What is the time interval between the first and second bounce? [2]

6. A ball is thrown vertically upwards with an initial speed of 20\,\text{ms}^{-1}. Calculate;
   i. The time taken to return to the thrower.
   ii. The maximum height reached. [4]

7. A small smooth object slides from rest down a smooth inclined plane at 30^\circ to the horizontal. What is;
   i. The acceleration down the plane?
   ii. The time taken to reach the bottom if the plane is 5\,\text{m} long?

   The object is now thrown up the plane with an initial velocity of 15\,\text{ms}^{-1}
   iii. How long does it take for the object to come to rest?
   iv. How far up the plane has the object then travelled? [6]

8. Two ships A and B are 4\,\text{km} apart. A is due west of B. If a moves with a constant speed of 10\,\text{ms}^{-1}. Calculate the difference in the velocity when the stone is;
   i. At opposite ends of the diameter
   ii. In 2 positions A and B where angle AOB is 90^\circ and O is the centre of the circle. [4]
Appendix 4 Observations of Non Participant

Interactions between Teacher (Tr) and Students (St), Teacher and student, students and students during a lesson.

Non- Participant Observation Schedule

| St to St | St to Sts | St to Tr | Sts to Tr | Tr to St | Tr to Sts | St to Self | Task in hand | Previous task | Future task | Non task |
|---------|-----------|---------|-----------|---------|-----------|-----------|-------------|--------------|-------------|----------|----------|