

**ASPECTS OF PHYSICS CURRICULUM INFLUENCING PERFORMANCE OF
STUDENTS WITH HEARING IMPAIRMENT IN SECONDARY SCHOOLS IN
WESTERN KENYA**

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JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

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DECLARATION AND APPROVAL

Declaration by candidate

This thesis is my original work and has not been presented for an award of a diploma or conferment of a degree in any other University or institution.

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DEDICATION

This work is dedicated to my family for their patience, encouragement and prayers that has propelled me this far in spite of life's huddles. May God bless you.

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ABSTRACT

Performance in physics subject in secondary schools, particularly in secondary schools for the Hearing Impaired (HI) has been a matter of great concern in Kenya. Attempts including in-service programmes for science teachers such as Strengthening Mathematics and Science in Secondary Education (SMASSE) have been made to improve the situation but not much tangible fruits have been realized. Surveys have always shown low performance in the subject in most secondary schools for the HI in most parts of the country. Some secondary schools for the HI have even stopped offering the subject at forms three and four while some do not offer the subject at all levels. The purpose of this study was to examine the aspects of physics curriculum that influence performance of students with HI in secondary schools in Western Kenya. Objectives were to establish the influence of time on task on performance of students with HI in physics, determine the influence of mathematical content on performance of students with HI in physics, examine the influence of teaching methods used by teachers on performance of students with HI in physics, and to find out the influence of curriculum support for teachers on performance of students with HI in physics. The study adopted concurrent triangulation design of mixed methods approach. The study used the constructivist theory of learning. The study population consisted of 4 principals, 59 teachers, 816 students and 4 curriculum support officers (CSO). Schools, teachers and students were selected purposively while saturated sampling technique was used to select the principals and CSOs. The study sample composed of 4 principals, 7 teachers of physics, 147 students and 4 CSOs. Questionnaires, in-depth interviews, observation schedules and document analysis guide were used for data collection. Reliability was addressed by use of Cronbach's Alpha Internal Consistency while validity was addressed through expert judgment by supervisors and lecturers from the School of Education. Quantitative data was analyzed using descriptive statistics through the use of charts, frequency tables and percentages. Qualitative data was organized and analyzed using thematic analysis. The research findings revealed that time on task influences performance of learners with HI in physics. Mathematical calculations in physics influences performance of learners with HI in the subject ($r = .930$; $k = .898$). This denotes that mathematical content in physics has a high positive correlation with performance of HI students in the subject. Methods used for teaching learners with HI influences their performance in physics. The main methods found out were ICT integration, discussions and practical work. Finally, curriculum support for teachers also influences performance of learners with HI in physics. The study concluded that time on task, mathematical content, teaching methods and curriculum support for teachers are critical aspects influencing the performance of students with HI in physics. It was recommended among others that physics syllabus be adapted to suit the unique needs of learners with HI. Teachers teaching learners with HI were encouraged to embrace remedial teaching to help the learners catch up with their hearing peers, and use more of visual learning and learner centered methods of teaching where learners are actively involved in the learning process rather than being passive recipients of knowledge. Increase in in-service programs for special education teachers was also recommended facilitated by specialists to help address teacher difficulties as well as learner challenges when teaching learners with HI. Based on the findings, a study on monitoring and evaluation and its impact on curriculum implementation in special schools would expound the current study.

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LIST OF ABBREVIATION AND ACRONYMS

ADHD	Attention Deficit and Hyperactivity Disorder
CSO	Curriculum Support Officer
DQAS	Director of Quality Assurance and Standards
ECDE	Early Childhood Development and Education
EFA	Education for All
GoK	Government of Kenya
HI	Hearing Impairment
HOH	Hard of Hearing
INSET	In-Service Education and Training
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KICD	Kenya Institute of Curriculum Development
KSDDC	Kenya Society for the Deaf and Dumb Children
KSL	Kenyan Sign Language
MOE	Ministry of Education
NACOSTI	National Commission of Science Technology and Innovation
SMASSE	Strengthening Mathematics and Science Secondary Education
SNE	Special Needs Education
SPSS	Statistical package for social sciences

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter discussed the background of the study, statement of the problem, purpose, and the objectives of the study. It also highlighted the research questions, significance of the study assumptions of the study, limitations of the study, scope of the study, theoretical framework of the study, conceptual framework of the study as well as the operational definitions of terms.

1.1 Background to the study

Every child, with or without disabilities has a right to education. This is significantly addressed in the World Declaration for Education For All (EFA, 1990), the Salamanca Statement and Framework for Action on Special Needs Education (UNESCO, 1994) among others. This has been a major concern worldwide. The United Nations Convention on the Rights of Persons with Disabilities (PWD, 2008) points out an extended right particularly to PWDs. The convention not only emphasizes their right to education but also the right to quality education for all, that all learners to be accommodated in schools regardless of their physical, intellectual, social, emotional or any other kind of disability. The concern of this study is about educational performance of students with HI; a cohort of children with special needs that such conferences address.

Globally, people with HI were traditionally viewed differently. For instance, the Greeks considered them as a burden and according to Wright (1969), whoever was identified as a burden to the society was supposed to be eliminated. This happened during war and conflict which occurred frequently and therefore, some abilities were necessary because everyone was meant to serve. Along the Kenyan coastal regions, disability was considered as a curse. Additionally, communities in the region did not allow individuals with disabilities to interact with other people without disabilities or even be seen in public as it was a taboo. People with disabilities were considered to bring bad luck to the society (Mwanyuma, 2016). Generally, in the larger part of the world, the society was so quick to judge the deviancy of people with hearing impairment and

medically, children with HI were often victims of attempts to cure impairment or forced speech. As a result of this, the status of people with HI was broadly ineducable. The most notable happening took place in the 17th Century when Juan Bonet of France created a one handed alphabet, although in the absence of formal schooling (Juan, 1620).

In the eighteenth century, the first formal schools for the HI were witnessed in France, Germany and England. A school for children with HI from all backgrounds in France, was opened by Abbé Charles de L'Épée where in the first place, speech with gestures and writing were introduced to children with HI, and later major on teaching. Similarly, Samuel Heinicke was also the first to establish a complete oral school in Germany (Shields & Lennox, 2017).

In Britain, Thomas Braidwood pioneered the first school for the HI between 1715-1806 and his approach instead of being the pure oralism used in Germany and most parts of Europe, was a combination of both oral and manual. This continued for nearly half the century. In the nineteenth century, Institutions or Asylums were already offering education for children with HI and these centers were majorly motivated by religious philanthropists than sound educational goals. According to Kisanji (1999) the asylums were not meant for educational purposes, but for custodial and treatment purposes for PWDs.

In Kenya, education for the hearing impaired can be traced back to the year 1958 when Aga Khan Units for the HI were established in Nairobi and Mombasa, and with the establishment of Kenya Society for the Deaf and Dumb Children (KSDDC) in the same year, Kenya has continued to offer education for learners with HI (Mbaluka, 2012). Later in 1960, Nyang'oma School for the HI was established and then Mumias Primary School for the HI in the year 1961. The continued support for education of people with hearing impairment by various organizations and policies led to rapid expansion of schools since then giving rise to schools such as Tumutumu, Ngala, Kapsabet, Kambui and other schools. As these schools continued to develop, their main approach in teaching remained the oral approach where they were taught speech and speech reading and the use of hearing aids in attempt to make people with HI to function like their hearing counterparts (Omutsani, 2012). The number of schools for the HI has continued to increase in the country since then. In 1970's, Kenya joined the global move towards implementing integrated education. In such program, students with HI were put together with

hearing students while taking care of their needs within the regular schools. This was supported by various education policies like the Persons with Disability Act 2003 (GoK, 2003), Special Needs Education policy 2018 (GoK, 2018), basic education act 2010 (GoK, 2010) among others. However, the effort encountered quite a lot of challenges such as scarce resources in the schools to meet the special needs of students with HI (Ndonyo, Matafwali & Chakulimba, 2017; Manchishi, 2015), inadequate training of staff (Kigotho, 2016), mode of instruction and knowledge of the area covered as well as the mastery of signs by the interpreters.

The assumptions that students with HI are the same as hearing students except that they do not hear has paused many challenges for the learners with HI over years. Marschark (1993), an ambassador for education for the hearing impaired in New York points out that students with HI are not supposed to be taught as hearing students who don't just hear. The difference is not only sign language and speech but also the way their memory works. That is, there is difference in their organization and learning strategies, the researcher adds. For instance, students with HI have better visual spatial memory while the hearing students have better sequential memory (Marschark, 1993). Hearing impairment is not only about hearing loss but it also opens up the individuals to such challenges as learning problems that result in reduced academic achievement due to language deficit, American Speech-Language-Hearing Association (ASHA, 2015) and difference in academic achievement between learners with HI and that of learners without HI usually widens as they progress through school (Roald & Mikalsen, 2000). Research studies have established that an individual's intellectual capacity to learn is not affected by Hearing Impairment (Chimedza and Peterson, 2003). However, Moores (1996) posit that it slows down their process of reaching full potential when early stimulation and training in communication is not done.

Based on this background, students with HI have been faced with difficulty in following the same curriculum used by their hearing peers and perhaps this could be the reason for their considerably lower performance than their hearing peers. This can be attributed to the fact that they have limited opportunities to fully interact with their environment as opposed to their hearing peers, Marschark (1993).

At secondary school level, learners are presumed to have developed the capacity for abstract scientific thinking and are therefore able to apply logical reasoning to all classes of problems

without any dependence on concrete manipulation. Based on this, the academic content beyond primary years increasingly utilizes abstract symbols and concepts which require higher-order thinking in order to examine relationships between principles and constructs. According to Luft (2016), the cognitive constructs necessary to comprehend, manipulate, and respond to curricular content depend upon linguistic abilities to describe comparisons, sequences, and causation. As a result, learners with HI may be greatly disadvantaged due to their inadequate language development. Consequently, this may deny them a favorable competition with their peers with hearing, possibly the disparity in their performances which projects to subjects like physics.

The study of physics contributes significantly to life in the society today. According to Ng'etich (2008), the learning of physics is critical and valuable as it expands the learner's knowledge and values. It is also important in the application of the required scientific knowledge in solving problems encountered in day-to-day experiences. This implies that it promotes scientific thinking and reasoning which includes the ability to solve problems through the analysis of quantitative empirical data. Echoing the same sentiments, (Musasia, Ochola & Memba, 2012) posit that physics infuses in learners the systematic thinking and supplies the theories necessary for understanding the mechanics of how the things mankind relies on work. Other researchers like Amunga, Musasia and Musera (2011) observe that physics generates fundamental knowledge needed for future technological advances that will continue to drive the economic engines of the world. For instance, the continuing research into the challenges posed by diseases such as cancer, HIV/AIDS which require the development of high precision equipment employs physics principles, the medical methods including the imaging techniques such as X-rays, ultrasound as well as screening techniques are based on physics (Freeman, 2012).

In Kenyan institutions and all over the world, physics is considered a basic requirement for admission into pure and applied science courses, medicine and engineering, without it, opportunities for placement into such employment fields become limited for students. Most worrying is the fact that despite the key fundamental roles played by physics in the society, still few students choose to study physics in their last two years in Secondary School (Wambugu & Chang'eiyiro, 2008). In secondary schools for the HI, the current trends further point out a repeated lower performance in physics as compared to other science subjects over years, hence the need to conduct the current study.

In this study, the aspects under study were time on task, mathematical content in physics, teaching methods as well as teacher curriculum support. Time on task as an aspect of curriculum is an essential component of instructional decision-making and subject area prioritization. It affects how much learners are introduced to a given content area and skills. Adoyo (2004) highlights time on task as one of the most important variables in the learning process of the hearing impaired students. As discussed earlier, learners with HI have limited access to their environment as compared to their hearing peers which leads to barriers of inadequate linguistic abilities and socio-cultural knowledge. This calls for substantially greater effort by teachers to help them attain outcomes similar to their hearing peers. Much time is therefore required in engaging their cognitive abilities in ways that reduce the barriers and enable them fully comprehend and participate in the activities of the same curriculum followed by their peers owing to the long physics syllabus. Other scholars have presented time as an indicator of opportunity to learn. For instance, Berliner (1990) points out that the greater the amount of instructional time teachers allocate toward a specific subject, the greater the content exposure and opportunity to engage learners. Confirming Berliner's sentiments, Farbman and Kaplan (2005) assert that with additional time, learning is less rushed and teachers have the flexibility that enables them to allow students to spend more time on task, which is one of the most basic predictors of student performance. It also enables teachers delve more deeply into the subject matter, because they are no longer pressed by the clock to squeeze as much content as possible into a single lesson, the researchers added.

Physics has been linked to mathematics and the link between them is very strong. They present two areas of intellectual activity deeply interwoven through the long history of science. This is evidenced by a number of topics which commonly appear in both the subjects, among them linear motion, decimal places and rounding off as well as standard form among others. Consequently, physical laws are expressed mathematically and all experimental results in physics expressed as numerical measurements. The relationship is supported by various researchers like Ataide and Greca, (2013) who assert that students bring required components from mathematics, including symbols, structures and algebraic equations, and embed them into the problem situations by combining the mathematics and physics concepts in order to explain the basic concepts in physics. Basson (2002) confirms this by observing that for students to perform well in Physics, they rely on their knowledge of mathematics to describe its physical

phenomena. This implies that student's performance in one area may influence the performance in the other.

Methods of instruction in any learning process determine whether or not learning has taken place depending on the level in which learners are engaged in the process. According to Yara (2009) the teacher's attitude and teaching method can both influence the attitude of the learners. This further influences their performance of the subject. Therefore the teachers' methods of teaching physics to learners with HI was a matter of general interest in order to realize better results. They should be such methods that attract and keep the attention of their learners. Sometimes, some language approaches teachers employ to teach students with HI may prove very challenging in teaching science subjects, particularly physics. This may be because of the abstract nature of the terms used in the discipline which makes the introduction of its basic concepts a difficult and complex process or the existence of few definite signs for scientific words, specifically to the subject of science, (Patalano, 2014). This may cause educators to use a 'home-made' sign to match the work. The best methods that could be employed to teach physics to the learners with HI comprise those that cognitively engage them. Such methods are student centered and highly emphasize their active involvement in the learning process.

Finally, the higher performance of learners is dependent on the effectiveness of both teaching and learning process. It's clear that better teacher produces better learning, though studies have shown that other than the teacher, other factors such as environmental, economic and socio-cultural factors similarly determine the students' performance in examinations (Jackson & Davis, 2000). Furthermore, Fenech (2006) observes poor work conditions, low salaries, heavy workloads, unrealistic expectations from managers, low professional status, organizational conflicts and reduced autonomy as the important factors that lead to teacher dissatisfaction and a dissatisfied teacher may be a poor performer (Rockoff, 2004, Hanushek, Kain & Rivkin, 2005). According to Stabback (2016), it is the teachers who decide and adopt the learning content, activities and pace that children need to move through the curriculum in ways that ensure that learning takes place effectively. As a result, teacher curriculum support was of great need and importance to the current study. This is in terms of their motivation, professional development through training as well as creativity and innovativeness in creation of learning activities and situations that lead to the most effective learning for high performance.

This study focused on in-service education and training (INSET) of teachers as one aspect of teacher curriculum support. Otunga, Odeo & Barasa (2011) describe INSET as a career long process where teachers are expected to be regularly updated on new curriculum materials, pedagogy and new policies in education and where supervision is routinely done. According to GoK (2010), there are two types of INSET programmes; a long term up-grading or professional courses for school teachers offered by the Quality Assurance and Standard Officers and short term INSET. These programmes include induction programmes, conferences, curriculum-based workshops led by curriculum support officers (CSO), refresher courses among others. Ndegwa and Khamah (2018) argue that INSET programmes provide opportunity for teachers to be on the track with the changing trends in teaching in order to remain pertinent and current in their work. During such programmes, teachers share on contemporary issues that are emerging and in the society and provide solutions them, the researchers add. Consequently this leads to improved academic performance by learners in the respective areas. King and Newman (2000) observed that the professional knowledge and skills of teachers can be developed through professional development and in-service programs to achieve successful student outcomes. Other related studies have also established that effective training of teachers leads to better content delivery, better use of teaching and learning resource, proper time management, good evaluation methods, among others (Gamoran, 2006; Dove, 1998; Guskey, 2000) which go along with improved academic performance.

Despite the many efforts to improve students' performance in physics, for instance by organizing various programs such as SMASSE for science teachers, not much improvement has been realized. In fact physics performance for learners with HI in the national examination has been very low over years. Moreover, a comparison of performance in physics in the national examinations for learners with HI and their peers from regular schools further reveals a loud difference that concerns various stakeholders. Tables 1.1 and 1.2 show physics mean scores for selected schools for the HI and regular schools respectively in Western Kenya between 2016 and 2021.

Table 1. 1 Physics mean score for selected schools for the HI in Western Kenya from 2016 to 2021

School	2016	2017	2018	2019	2020	2021
School A	1.08	1.22	1.07	1.00	1.00	1.06
School B	1.00	1.00	1.00	-	1.00	1.03
School C	1.20	4.00	4.67	1.54	1.33	1.51
School D	-	1.07	1.00	1.00	1.00	1.03

Source: Kenya National Examinations Council 2016 - 2021

Table 1. 2 Physics mean score for selected regular schools in Western Kenya from 2016 to 2021

School	2016	2017	2018	2019	2020	2021
School 1	4.647	4.131	3.462	3.561	3.502	4.214
School 2	4.600	7.000	6.833	6.911	6.713	6.709
School 3	4.409	4.351	4.426	4.020	4.374	5.111
School 4	3.204	4.957	3.672	4.123	3.821	3.916
School 5	3.231	5.571	3.571	4.263	4.304	5.322
School 6	2.824	3.110	4.030	3.986	3.997	4.163

Source: Kenya National Examinations Council 2016 – 2021

Table 1.1 shows extremely low performance in physics with the mean scores ranging between 1.00E and 1.75E in all the schools across the years, except for the few isolated cases of higher mean scores where the candidature was very low. In some schools, there were no candidates for examination for some years. This is not the case with regular schools whose performances were considerably higher with mean scores ranging between 2.70D and 7.00C+ as evidenced in table 1.2. This disparity can be attributed to the significant influence of hearing loss on language and

speech development of the students with HI which negatively influences their academic achievement, social and emotional interaction as well as cognitive milestones (Moore, 2001).

Although studies have shown that learners with HI in Kenya have constantly shown a generally low performance in the national examinations (Adoyo, 2004), their performance in physics has been repeatedly lower than the other science subjects over years. Table 1.3 shows the performance of learners with HI in biology, chemistry, physics and mathematics between 2016 and 2021.

Table 1. 3 Mean scores for science subjects for selected schools for the HI from 2016 to 2021

School	Subjects	2016	2017	2018	2019	2020	2021
School A	Biology	1.16	1.12	1.25	1.15	1.18	1.19
	Chemistry	1.16	1.12	1.25	1.19	1.21	1.17
	Physics	1.08	1.22	1.07	1.00	1.00	1.06
	Mathematics	1.00	1.00	1.02	1.00	1.00	1.02
School B	Biology	1.00	1.00	1.30	1.20	1.43	1.44
	Chemistry	1.00	1.70	1.30	1.00	1.31	1.50
	Physics	1.00	1.00	1.00	-	1.00	1.03
	Mathematics	1.00	1.00	1.00	1.02	1.00	1.00
School C	Biology	1.82	1.53	1.94	1.63	1.73	1.95
	Chemistry	1.41	1.59	1.30	2.00	2.11	2.09
	Physics	1.20	4.00	4.67	1.54	1.47	1.51
	Mathematics	1.00	1.00	1.26	1.41	1.00	1.00
School D	Biology	1.13	2.04	1.11	1.53	2.13	2.07
	Chemistry	1.21	1.17	1.05	1.12	1.18	1.32
	Physics	-	1.07	1.00	1.00	1.00	1.03
	Mathematics	1.00	1.31	1.33	1.12	1.00	1.00

Source: Kenya National Examinations Council 2016 - 2021

Although table 1.3 presented revealed a general low performance in the science subjects, it is evidenced that the learners' performance in physics is lower compared to biology and chemistry. The repeated lower performance in physics compared to other subjects could partly be as a result of negative attitude towards the subject as other researchers indicate, (Kuria, 2014), or high reliance on mathematical concepts and logics (Murithi 1996); a subject that is also poorly performed as shown in the table. Based on this background of lower performance in physics by learners with HI despite the overwhelming significance of physics in scientific, technological development and research, and the great need for quality education for ALL learners, the researcher was prompted to examine the aspects of physics curriculum influencing performance of learners with hearing impairment in secondary schools in Western Kenya.

1.2 Statement of the problem

In growing world of science and technology, it would look quite awkward and meaningless to educate a child without emphasis on the value of science as it enhances critical thinking thereby helping in the growth of minds of the children. Physics being one of the science subjects taught in the Kenyan secondary schools is significant in helping answer the day to day questions concerning the environment around us. It is also a key discipline that enables one to attain technological self-reliance. A nation without any background of physics fails a great deal in appreciating and understanding the world and may lead to lower levels of technology hence affecting its standards of living. In Kenya, learners with HI have recorded a repeated lower performance in physics over years than their hearing peers. This raises a question whether or not quality education is offered to ALL children, especially in such a subject like physics. In addition, physics performance among the learners with HI has also been considerably low as compared to the other science subjects as indicated in tables 1.3 above. Most researchers have linked lower physics performance in regular schools to such factors as attitude towards the subject, teachers' competency, among other factors. However, the cause for the low performance of physics among students with HI is not yet documented by any known research study in the Western Kenya. The current study attempted to establish and document why such a phenomenon among the students with HI. The study therefore sought to find out the aspects of physics

curriculum that influence performance of students with HI in secondary schools in Western Kenya.

1.3 Purpose of the study

The purpose of this study was to examine the aspects of physics curriculum that influence performance of students with HI in secondary schools in Western Kenya.

1.4 Objectives of the study

The following were the objectives of this study:

- i. To establish the influence of time on task on performance of students with HI in physics in secondary schools for the HI.
- ii. To determine the influence of mathematical content on performance of students with HI in physics in secondary schools for the HI.
- iii. To examine the influence of teaching methods used by teachers on performance of students with HI in physics in secondary schools for the HI.
- iv. To find out the influence of curriculum support of teachers on performance of students with HI in physics in secondary schools for the HI.

1.5 Research questions

The study sought to answer the following research questions:

- i. To what extent does time on task influence the performance of students with HI in physics?
- ii. To what extent does the mathematical content influence the performance of students with HI in physics?
- iii. How do the methods of teaching used by teachers influence the performance of students with HI in physics?
- iv. How does curriculum support of teachers influence the performance of students with HI in physics?

1.6 Significance of the study

The findings of this study would be of significance to various stakeholders. To teachers, the study would enable them evaluate themselves in terms of their teaching strategies and modes of

instruction which might lead to overall better performance of physics among the learners with HI while to the director of quality assurance and standards (DQAS), it would enable them formulate and organize relevant in-service programs to conduct training for teachers on methods of teaching physics to students with HI. The study would also help the Kenya Institute of Curriculum Development (KICD) to enable them review the physics curriculum and instructional materials and adapt it to suit the unique needs of the learners with hearing impairments so that the education provided is accessible to all. Finally the findings may be applied to other regions across the country to help improve the performance of all learners with hearing impairment.

1.7 Assumptions of the study

The study was based on the following assumptions:

- i. That time on task influences performance of students with HI in physics.
- ii. That mathematical calculations and expressions influences performance of students with HI in physics.
- iii. That the teaching methods used by teachers have influence on performance of students with HI in physics.
- iv. That curriculum support of teachers influences performance of students with HI in physics.
- v. By virtue of the students being admitted into secondary school, they have satisfactory abilities to tackle the secondary school curriculum subjects' content.

1.8 Limitations of the study

Not all sub-counties were assigned a CSO for SNE and those available were in charge of more than one sub-counties hence limited time due to many responsibilities. Data collection still proceeded as the researcher scheduled meetings at their convenience.

Due to the COVID-19 pandemic, most school administrations were reluctant about visitation by strangers to schools. This was overcome by the various safety measures put in place by the

researcher coupled with the letters of permission from relevant authorities. Due to effects of this pandemic, questionnaires were issued and collected immediately to minimize trips to schools and consequently much contact with the students.

1.9 Scope of the study

The study was confined only to secondary schools for the hearing impaired in Western Kenya. It only focused on aspects of physics curriculum influencing performance of learners with HI and the target population was CSOs, principals, teachers and the learners with HI in the sampled schools. The study adopted the constructivist theory of learning, and was confined to concurrent triangulation design while data was collected using questionnaires, observation checklists, interview schedules, and document analysis guide.

1.10 Theoretical framework

This study adopted the constructivist theory of learning (Vygotsky, 1978). Constructivism argues that humans construct knowledge and meaning from their experiences and this construction is through a subject's interactions with the world. This implies that the students' construction of knowledge and meaning in scientific concepts largely comes from themselves, and students with HI are not an exception. Acceptance of this theory requires that learners be given chance to interact with sensory data and construct their own world. While there is evidence that learners with HI have limited access to the environment as compared to their hearing peers (Marschark, 1993), this theory also emphasizes collaborative and consultative approach to learning, hence the learner (with HI) collaborates and consults with teachers, peers, parents and other experienced adults to actively learn; a better pathway to performance as in this study.

Constructivist teaching is based on the belief that learning is an active process of constructing rather than acquiring knowledge, and instruction is a process of supporting that construction rather than communicating knowledge (Duffy & Cunningham, 1996). This points to an approach in teaching and learning that is more students centered (Taber, 2010) which means that students are actively involved in the learning process through active engagement, inquiry, problem solving, and collaboration with others. Teachers therefore do not directly transfer the information to the students; rather they guide and help learners to reach the information and to construct it (Bryant, Kastrup, Udo, Hislop, Shefner & Mallow, 2013). This is due to the fact that the theory holds that an individual only learns what he or she has constructed but cannot learn in any

complete sense what someone else has constructed. Due to inadequate language development, learners with HI may be faced with a challenge of inadequate cognitive ability to comprehend abstract content in physics (Luft, 2016). This theory is relevant to the study as it guides the teacher in designing the body of knowledge in a manner that it activates relevant ideas already available to the learners to help them construct new knowledge.

The theory guides this study in relating approaches to learning which encourage knowledge construction and performance. That students' achievement in learning science concepts largely depends on the teaching learning methods used against time. It informs the teacher to prompt the learners to formulate their own questions based on the information given, give room for multiple interpretations from the learners and at the same time leading the learners through activities that engage both the mind as well as hands. This includes experimentation where learners individually perform an experiment and then come together as a class to discuss the results, research projects where they research a topic and present their findings to the class, as well as class discussions. Such methods let the learners be actively involved as opposed to the traditional lecture methods where learners remain passive recipients by taking notes hence less internalization of information. When a concept is too abstract that it cannot be directly demonstrated to learners, the teacher finds a way to help learners make connections with knowledge that could be relevant using models, analogies as well as metaphors (Ausabel, 2000). For learners with HI, the theory implies that such methods like multimedia integration could be employed where the learners are provided with visual images of physical ideas since they are visual learners.

Physics and mathematics are two related subjects. In guiding the learner to construct knowledge, understanding of this theory helps the teacher to design the body of knowledge in a manner that it activates the relevant mathematical knowledge already known to the learner to help in constructing the new concepts of physics.

Constructivism also aims at a holistic teacher professional development which focuses on the knowledge of the pedagogical content, the environment, and self, in order to realize quality education (Pitsoe & Maila, 2012). This school of thought is relevant to this study by pointing to the need for teacher curriculum support. Delannoy (2000) asserts that the initial education program is not enough to equip a teacher with all the necessary values, knowledge and skills

teaching career, owing to the speed with which the society changes and knowledge accumulation, hence the need for continuous teacher training which opens the teacher to the current information and new research on classroom management, new curriculum resources, emerging technology tools among others in order to be effective. Through such programs like INSET, teachers teaching learners with HI get to interact with colleagues, and exchange ideas in order to overcome their unique challenges faced when teaching learners with HI.

1.11 Conceptual framework

A conceptual framework refers to the system of concepts, assumptions, expectations beliefs and theories that supports and informs a research, (Robson, 2011). In this study a conceptual framework was used to explain and predict the relationships between various variables in the study. This study adopted a conceptual framework model in Figure 1.

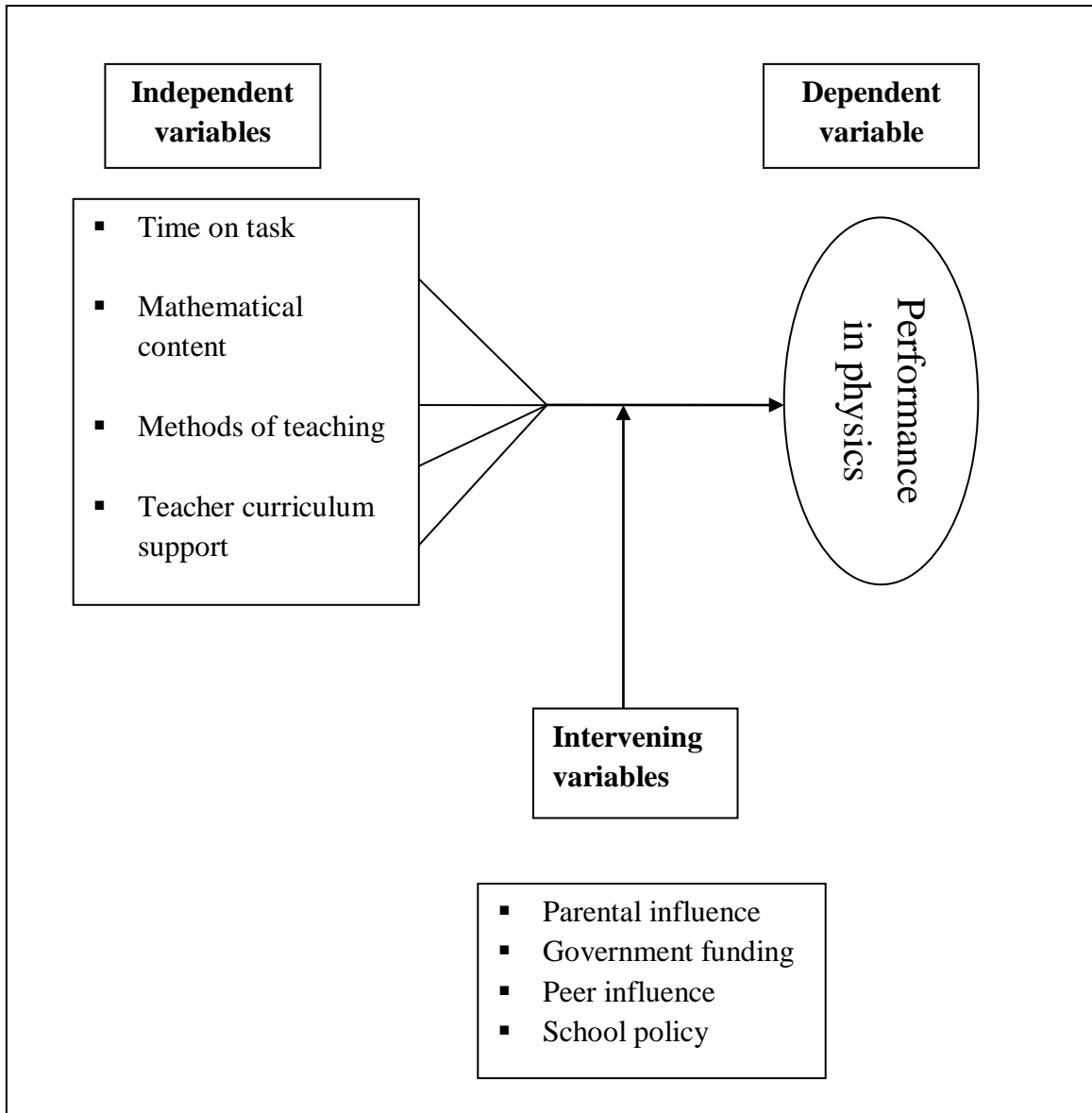


Figure 1: The concept model of the study

Source: Researcher 2022

The main goal of education in Kenya is to adequately prepare the individuals to fit into the society and to contribute to its well-being. The major yardstick that is used in Kenya to measure educational output is performance. Performance in physics depends on many variables some of which formed part of this study. This study focused on aspects of curriculum such as time on task, mathematical content in physics, methods of teaching as well as teacher curriculum support which could lead to either good or poor performance.

Syllabus coverage is directly proportional to the time needed to cover it therefore a wider content requires more time on task. Consequently, students with HI are greatly challenged when it comes to attending to multiple visual tasks at a time i.e. simultaneously writing what is said and at the same time comprehending it in sign language (Ingvild, 2002). This influences performance negatively particularly if the time on task is limited. The mode used to relay information greatly affects the learners' reception and consequently influencing performance. Teaching methods such as multimedia integration, discussions, experimentation and use of problem based learning influences the overall outcome of learners with HI. Interactive multimedia and web-based curriculum materials yields significantly greater knowledge gains for the students with HI as compared to traditional classroom experience (Lang and Steely, 2003). This leads to higher performance.

Finally, higher performance among learners depends on the effectiveness of the entire teaching and learning process and the teacher cannot be isolated from this. According to Stabback (2016), one of the key roles of a teacher is planning and writing the curriculum, as the teacher ensures that subject curriculum is adapted to the needs and expectations of different students. Teacher curriculum support in terms of professional development, relevant teacher guides, motivation which may lead to teacher satisfaction among others therefore determines the quality of performance realized by the learners at the end of their course work.

The intervening variables include: parental influence, government funding, and peer influence and school policy among other factors. Students whose friends work hard are likely to work hard too, that is, such students are likely to support, motivate and encourage each other to achieve their best. On the other hand, those whose friends don't work hard are also not likely to work hard and hence are not motivated towards higher academic achievements. Parents also play a key role in shaping their children up such that their educational level, family structures as well as motivational practices for instance involvement in their work may be causal influences on their academic achievements. Finally government funding for schools aids in ensuring availability of appropriate teaching and learning resources and the required facilities which may influence performance.

- xi. Sign language** A non-oral method of communication, purely visual, gestural language which has been developed and is used by people who are hearing impaired.
- xii. Special Need Education** The practice of educating students with disabilities and special needs in a way that addresses their individual differences and unique needs.
- xiii. Teaching methods** Teaching strategies, tactics and styles employed during the teaching and learning process.
- xiv. Time on task** Time teachers spend in teaching physics and the time students spend in revising their work in the subject.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviewed literature on four subsections. The first was review of literature on time on task and its results on performance of physics among the students with HI; the second review dwelt on influence of mathematical content on performance of students with HI in physics; the third was on methods of teaching physics and their influence on performance of learners with HI. The fourth one immersed itself on curriculum teacher support and its influence on performance of learners with HI in physics while the last subsection highlighted summary of the literature reviewed. The gaps that the study intended to fill were identified in form of integrated critique of each review.

2.1 Influence of time on task on performance of students with HI in physics

Generally, there is a significant relationship between the instructional time spent on a subject and the overall students' achievement on the same at all levels. A number of research studies have identified instructional time increment as the strategy to advance students' achievement at the local, state and international levels and to close the achievement gap between students (Farbman, Goldberg & Miller, 2014; Gromada & Shewbridge, 2016). Further, Farbman and Kaplan (2005) argue that by this extension, the students would have more time for learning and more time on task as the lessons would be less rushed. In addition, teachers can also cover the curriculum in more depth and breadth which can better correspond to students' interests and present materials with more contextual variety, which is believed by some cognitive scientists to increase students' deeper understanding (Farbman & Kaplan, 2005). More time can also allow greater interaction and more positive relationships between teachers and students, which can also benefit academic achievement (Farbman & Kaplan, 2005).

In Norway, five teachers with HI were interviewed by a researcher in a study to seek their observations and views based on the experiences they had as learners with HI in the learning of science; physics was their major subject (Ingvild, 2002). They observed that their curriculum was reduced and changed. One of the respondents also pointed out the struggle he experienced by his own students in his station of trying to cover similar curriculum like other schools and as

expected of them but limited time was his major challenge. Physics regular curriculum is long and some concepts are also very demanding. A lot of time is therefore required coupled with hard work for learners to understand. Many teachers, even in the regular schools are always under pressure because of shortage of time and sometimes may end up not carrying out the number of experiments required due to limited opportunities. HI learners cannot read signs and write/work simultaneously as their hearing peers can do. This clearly implies that with the longer regular curriculum content for physics, much time may be needed in order for it to be effectively covered. Although the above literature was done in physics, the researcher relied on data from interviews only while the current study applied multiple data collection instruments for verification hence improving the validity of the outcomes. Besides, the respondents in the reviewed study were only teachers while the current study comprised of learners with HI, principals and CSOs in addition to teachers. The current study therefore established how time on task influences performance in physics among HI learners.

In America, an analysis of the factors that impact academic achievement among the Asian America, African America, and Hispanic students was carried out by Nickerson and Kritsonis (2006). Various statistics indicated that Asian Americans achieved very high as compared to their counterparts (also referred to as the minority students). One outstanding factor leading to the vast inequality in academic achievement amongst the mentioned groups of students was time spent on task. It was reported that the Asian Americans spent the most time on school assignments and studying outside the school work than their counterparts. The study reviewed was conducted on mathematics and other sciences while the current study narrowed down to physics as a subject. Furthermore, the respondents in the above study were learners without HI while the current one involved HI learners in special secondary schools.

In America, another study was carried out on the effects of increased learning time on student academic and nonacademic outcomes (Kidron and Lindsay, 2014). In this study, meta-analysis was used to summarize the findings across 30 studies, where the effects of all the relevant studies were combined to arrive at a single estimate of the size of the effect. The outcome of the study indicated a positive relationship between time on task and academic achievement. The researchers affirm that some students lack the vital fundamental skills and because of this they may require several weeks of instruction to deliver a supplemental curriculum. Gersten, Chard,

Jayanthi, Baker, Morphy & Flojo (2009) in support to this add that an increase in learning time enhances an opportunity to offer supplemental instruction to enable the struggling students to catch up and to match instruction with students learning styles. The study further revealed that an increase in learning time enhanced literacy and math achievement when the instruction was led by certified teachers although the effects were small. It also improved literacy achievement of students performing below standards and the socio-emotional skills of learners with Attention Deficit and Hyperactivity Disorder (ADHD). The reports analyzed in the above study were based primarily on the outcomes of elementary and middle school colleges with only one study reporting on an effect on high school students hence the move by the researcher to conduct a study determining how time on task influences performance in physics among HI learners in special secondary schools. Furthermore, the researchers in the above study strongly recommended a research on effects of increased learning time on high school students' academic and non-academic outcomes including their career and college readiness. The current study arose to this call by dwelling on influence of time on task on physics performance among the learners with HI in secondary schools.

Kenyan curriculum may look far different from the American curricula than it actually is. Increased time spent on task beyond the traditional school day and year in America is made easier by such programs as summer schools; study programs held during the summer for supplementary and remedial study, expanded learning time schools; enrichment programs taking place after school, before school or during weekends, year round schools; schools that operate year round and replace the long summer recess with shorter breaks between school sessions, among other programs which are funded by various education departments, Kidron and Lindsay (2014). However, in Kenya similar programs could be the holiday tuitions, morning and evening and weekend remedial lessons to enable the students to catch up, which are currently illegalized by the ministry of education. Increased time on task for the learners with hearing impairment can be achieved by modifying the longer regular physics curriculum so that what needs to be covered can be done within the limited time available (Task Force on Appraisal of Special Needs Education - GoK, 2003), bearing in mind the unique and different needs of learners with disabilities. The studies discussed were carried out in America and were limited to the America hearing students. This study focused on influence of time on task on physics performance among high school students with HI in Kenya.

In Africa not much has been done relating to influence of time on task on students' performance. In fact, no known research study has been documented on how time on task influences performance of learners with HI in physics. This prompted the researcher to carry out the present study.

A study in Kenya was done on curriculum factors influencing performance of students with HI in mathematics in selected districts (Maina, Adoyo and Indoshi, 2011). 125 respondents from 4 secondary schools for the HI were sampled for the study. Descriptive survey design was employed in this study with data being collected through questionnaires, observations and interviews. The study revealed that 90% of teachers did not cover the syllabus on time as was expected and the reasons quoted include; mathematics syllabus too wide for learners with HI, the use of sign language for communication decelerating the process of teaching, among others. The findings in the above study are pointing to a major observation that instructional time set for studying mathematics was not enough for students with HI given the wide syllabus and the varied educational needs of the learners. It therefore attributed low performance of mathematics to insufficient time on task. Although the mentioned study focused on time on task in relation to mathematics, the researcher in this study aimed at finding out how time on task influences performance of students with HI in physics. The researcher also employed concurrent triangulation design as opposed to the descriptive survey design used in the reviewed literature, to give a more complete and comprehensive understanding of the research problem.

Adoyo (2007), reports that institutions in Kenya practice the regular curriculum which is extensive, demanding, centrally designed and rigid. The researcher further argues that this is not flexible and therefore gives very minimal room for teachers to adapt in trying to apply new approaches. The researcher adds that the time allocated by the ministry for the completion of the same curriculum is very unrealistic for HI students since the teaching/learning process is slowed down by the processes involved. The researcher's argument is supported by the SNE Task Force (GoK, 2003) which observed that the curriculum used was overloaded and does not take care of individual educational needs of learners with special needs like those with HI. As a matter of fact, one of the greatest challenges experienced by learners with HI is attending to multiple visual tasks. Students with hearing can listen to what is said by voice and at the same time write unlike their peers with HI. They cannot comprehend what is said in sign language and write

simultaneously since they fully rely on their sense of vision for both purposes, therefore the need to adjust their curriculum content with respect to time allocation.

Another study was carried out on factors affecting KCPE performance of learners with HI in special schools in selected counties in Kenya (Omutsani, 2012). One of the objectives in that study was to examine the extent of syllabus coverage. Respondents indicated that it was not possible to cover the curriculum content within the ministry's timelines. A number of reasons were floated to this effect by the respondents who were teachers and head teachers. 84% of the respondents agreed that the curriculum content was too wide, 68% of them said that the curriculum was unsuitable as far as the educational needs of learners with HI are concerned while 80% said that the stipulated time was too short to be able to cover the content at hand. This points out to the factor noted by the Task Force (GoK, 2003) that adaptation of curriculum content had not been done for many subjects. Besides, extra time given to learners with special needs during examinations doesn't work well in all subjects. The observations in the above study all support the factor of time on task as matter of concern.

Wider curriculum content implies that the time on task must be minimal as the teacher will be under pressure to complete the syllabus. The study discussed investigated how curriculum content in all subjects affect the overall outcome in KCPE while the current study being specific narrowed down to the influence of time on task on performance of physics subject. Furthermore primary school curriculum is different from that of secondary school hence this study was different in that it was carried out in secondary schools. Curriculum content should be adapted for example by simplifying language used to match these learners' abilities and their educational needs otherwise, a more struggle is experienced in trying to understand complex concepts which turns out to be time demanding. Although the ministry of education through the national examination council has made efforts to accommodate learners with HI in various areas like training invigilators and supervisors to enable them support HI candidates, examination of KSL in all national examinations instead of Kiswahili among others, barely nothing has been done in the area of science particularly in physics curriculum to ensure the wider syllabus content is covered within the available time and appropriate adaptations to suit learners with HI. The researcher in this study therefore aimed at finding out how time on task influences the performance of students with HI in physics.

2.2 Influence of mathematical content on performance of students with HI in physics

There is a stronger link between mathematics and physics. According to Knecht (1965), the teachings of physics and mathematics overlap since the two subjects are closely related. The fact that the two are interdependent and mathematical concepts form a key property of physics study may pose a bigger challenge to most students who would wish to study physics but are poor in their mathematical skills. This therefore means that those who finally choose physics at form three but do not perform well in mathematics may find it difficult to find their way through to good performance in physics in the final examination as their attitude is killed along the way. Wadsworth (1998) adds that underachievers who fail in mathematics remain passive and are blocked out of physics since the mathematical principles and applications lower their morale in pursuing it.

In Malaysia, a study was conducted on attitude towards physics and additional mathematics achievement towards physics achievement among secondary schools (Arsaythamby, Rahimah & Khalid, 2015). The respondents sampled for the study were grade 10 physics students and data was collected through questionnaires. It was established that there was a strong positive relationship between additional mathematics achievement and physics achievement. This is a clear indication that those students who show good performance in mathematics also do so when it comes to physics hence influencing their attitude and interest positively towards physics. In support of this observation, a study in Australia on the 8th grade students' attitude towards mathematics and mathematics contribution towards physics (Nilesh, 2011) also revealed a strong positive correlation between students' achievement in the two subjects. A study by Hudson and Rottmann (2006) confirms the observations of the above mentioned researchers by adding that performance in physics courses is mainly influenced by the prior mathematical skills. The study above used only students as respondents and questionnaires for data collection while the current study employed triangulation to ascertain the credibility as well as multiple data sources to ensure that the research findings are comprehensive and well developed.

In Nigeria, a study by Erinosh (2013) was carried out on how students perceive the difficulty of physics in secondary school. Questionnaires were administered 830 students and 52 teachers. From the data analyzed, the aspects of physics considered difficult were categorized into the nature of the subject, teaching and teacher factors, and curriculum/ assessment. The most cited

reasons for the difficulty were related to the nature of the subject which includes; too many mathematical calculations 47%, problems not easy to solve 45%, too much hard/difficult content to recall 46%, and difficulty constructing meanings of the content when taught 56%. The observations above pointed to a major conclusion that students generally consider the subject difficult and those studying it do so primarily because they find it useful for their future programs. The study reviewed focused on the students' perception of the difficulty of physics, with 47% of the respondents citing inclusion of too many mathematical calculations. However it did not explore the extent to which the mathematical content in physics influenced performance of students in the subject, a gap which the current study intended to fill. In addition, the study above employed only one instrument in data collection (questionnaires) while the current study employed the use multiple data collection instruments which was useful in improving the validity of the study.

However, a study on attitude of secondary school physics students towards mathematics; a case study of Nsukka Education Zone in Nigeria and Adamawa Region in Cameroon (Ngwoke, Atanga, Oyeoku, Ngwoke & Obikwelu, 2013) yielded contradicting findings to the studies discussed earlier. The findings of this study showed that students taking physics in both Nigeria and Cameroon have positive attitude towards mathematics leading to low enrollment and achievement in physics is not due to the students' mathematics phobia. While this study sought to establish the effects of students' attitude towards mathematics on physics enrolment and achievement, the current study focused on the mathematical content in physics syllabus and its influence on performance of learners with HI in the subject.

In Kenya, a study was carried out on factors influencing secondary school students' attitude towards the study of physics in Imenti South District (Mbaabu, Gatumu & Kinai, 2011). The study was carried out in 4 secondary schools in the district with 120 students as the respondents. Students' questionnaires and laboratory equipment observation checklists were used as instruments for data collection. One of the objectives of the study was to find out if mathematical calculations in physics influenced students attitude towards the subject. 30% of the respondents had a positive attitude towards the inclusion of mathematical principles, concepts and symbols in physics curriculum while 57% had a negative attitude. Taking into consideration that the respondents in this study were physics students, this outcome implied that the respondents do not

appreciate the mathematical work in physics curriculum. This also implied that the mathematical calculations make students to have a negative attitude towards physics. Kuria (2014) indicates that amount of time and effort a student dedicates to a given subject depends on his/her attitude towards the same which ultimately influences performance in the subject. The outcomes concurred with other researchers like Bassey (2003) who appreciated the contribution of mathematics to physics and their calculations as very important in expressing physics knowledge, while others the fact that it is a hindrance to good performance in the subject. The study above employed a single source of data (students) while the current study filled the gap by using multiple data source and instruments as a way of improving the validity of the research findings. Besides, the study reviewed was carried out in regular secondary schools while the current study was done in special secondary schools for the HI.

Another study was conducted on factors affecting enrolment and performance in physics among secondary schools in Gatundu District in Kenya (Kuria, 2014). The respondents in this study were physics teachers and students and questionnaires were used together with achievement test items to collect data. The objective of the study was to establish how mathematical ability of learners affects their enrolment and performance in physics. The study found out that majority of students who did well in physics achievement tests administered scored highly in questions involving mathematical calculations. In addition, all the teachers were in agreement with the notion that good performers in mathematics display the same in physics. The concluded that students' achievement in physics is dependent on their mathematical ability. The study above was limited to two data collection instruments while the current one expanded its scope by including physics lesson observation, interviews for teachers and head teachers other than questionnaires for students in order to improve on validity. Besides, a number of research studies (Mbaabu, et. al. 2011; Erinosh, 2013) have been done around attitude and performance of physics in regular schools however very little, barely nothing, has been done relating to the HI students hence the move by the researcher to investigate how mathematical content influences their performance in physics.

2.3 Influence of methods of teaching on performance of students with HI in physics

Physics subject as discussed earlier is an essential ingredient in education for all learners in the journey towards digitization. The subject is a key in role playing in the society in various forms

and therefore the teachers' methods of teaching should be a matter of general interest. Research findings have revealed various methods such as multimedia integration, experiential learning, and active learning/discussion among other methods as appropriate in teaching the HI students. This study therefore focused on the three methods of teaching so stated.

Akinoso (2018) describes multimedia integration as one concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (video), animation, audio and any other media to store and transmit information. The use of multimedia materials and creating multimedia environments during learning eases and objectifies learning. It also stimulates senses of learners making them active, (Giam, 2000 and Akinoso, 2018). This also appears more appealing particularly in the current digital society. Learners with HI being visual learners, this method helps provide numerous and more meaningful representations of concepts to the students with HI, for instance the computers which can provide learners with visual images of physical ideas. According to Alessi and Trolip (2001), multimedia and virtual simulations display three dimensional environment providing students with a more experienced learning and help them to apply theory in real life situations. The researchers add that images and photos in text books are presented in two dimensions which make it difficult for learners to imagine the real situation of an object. Echoing the same sentiments, Aris, Yahaya, Harun and Tasir (2000) propose that irrespective of how many colours displayed in text books/reference books, this still cannot outsmart the multimedia systems.

In order to make the instructional materials more accessible to students with HI, various supports such as video of sign language translation, graphics, images and display grids with combination of words and sign language graphics should be incorporated. This is due to the fact that students with HI primarily learn through the sense of vision and hence multimedia approaches enhance factual encoding and decoding of information. According to the American National Science Foundation (ANSEF,1999), mathematics and science subjects use specialized signs because of non common vocabularies and symbols involved, some of which majority of teachers and sign language interpreters may be unfamiliar with. This is probably one of the greatest challenges faced by instructors in delivering content to learners with HI leading to lower science performance particularly in physics among the HI learners as opposed to their hearing peers. The

researcher therefore found it worthy to establish the influence of using multimedia integration in teaching physics to learners with HI and their performance in physics.

In Malaysia, a study was carried out on web based multimedia approach to literature in Malaysian secondary schools: learners' preferences (Sivapalan & Ahmad, 2010). The respondents were upper secondary students. Data was collected using interviews. The main objective of the study was to investigate effectiveness of web based multimedia approach in teaching literature at upper secondary level. The findings of the study indicated that learning of literature through web based multimedia was more interesting than the traditional lecture session, 65.4%. 63% of the respondents were inclined towards learning literature through web based multimedia compared to teacher centered approach. The respondents also indicated that this method improved their language skills with 96.1% indicating improved reading skills while 82.7% for speaking skills. This study focused on literature while the current study focused on physics bearing in mind that the two subjects differ in their curriculum content with physics being more of a practical subject while literature is not. Besides, data was collected using one instrument, while the current study employed triangulation to improve the validity of the study.

A study was conducted in Pakistan by Shah and Khan (2015) on Impact of Multimedia-aided Teaching on Students' Academic Achievement and Attitude at Elementary Level. Pretest-posttest control group design was employed for the study. 60 students participated in the study. The study intended to find the effectiveness of Multimedia-aided teaching (MAT) on students' academic achievement, to find the effectiveness of Multimedia-aided teaching on students' attitude towards science at elementary level, among other objectives. The experimental control groups had similar achievement scores and attitude levels to that of control groups before treatment. However, there were significant differences in the mean scores of the groups in both academic achievement tests and ATSS after treatment. It means that treatment has positively impacted on the students' academic achievement and attitude. The study therefore concluded that MAT is an effective tool to develop positive attitude towards science hence improving achievement as it helps to develop higher order cognitive skills and appealing the students' psyche towards learning through the use of animations, sounds, and video and audio clips that makes lessons attractive and affective. The study reviewed was done on elementary level

students while the current one was done in secondary schools. Besides, the current study filled the gap by using multiple data collection instruments in order to validate the findings.

In north America, Lang and Steely (2003) in their study affirm that interactive multimedia and web-based curriculum materials yields significantly greater knowledge gains in science of students with HI when equaled to experiences from traditional classroom. Through the National Science Foundation, a science signing dictionary was invented which presents the signs for many science concepts. In America, a study evaluating this digital dictionary in the intermediate grade classrooms was carried out and the researcher found that it demonstrated improvement of students in science achievement and vocabulary scores (Vesel, 2006). However, the Kenyan schools for the HI seem not to have incorporated this new development during learning to better the performance of the students with HI by enriching their vocabulary as far as science is concerned. This current study therefore sought to find out the use of multimedia instruction as a method of teaching and its influence in performance of learners with HI in physics.

Another study was conducted in India on the effectiveness of the web based learning in secondary school education (Mriganka, 2015). The objectives of the study included: to find out the effectiveness of web based learning in secondary classroom, and to compare the effectiveness of the traditional teaching/learning with the web based learning. Pre-test and post-test experimental design was employed and data collected through achievement tests and questionnaires. The results analyzed showed that the mean score of the experimental group was significantly greater than that of the control group, implying that web-based learning improved performance. 76% of the respondents in the experimental group strongly agreed that they were able to acquire knowledge effectively through web based learning while 70% strongly considered that they would like to spend much time in web based learning. 48% strongly agreed while 40% agreed that the computerized web based learning helped them to learn at their own pace. 80% agreed that they were able better to visualize concepts. In conclusion, the study found web based learning more effective than the traditional methods. The study reviewed was general, covering all subjects in secondary school curriculum while the current study was more specific, focusing on physics. Moreover, the current study was done in special secondary schools for the HI as opposed to the reviewed study which was done in regular schools.

In Nigeria, a study was carried out on effects of the use of multimedia on students' performance in secondary school mathematics (Akinoso, 2018). In this study, quasi-experimental design was used and data collected from a sample of 60 senior secondary school students from two schools using mathematic achievement tests. Four selected topics in mathematics were studied. One of the objectives of the study was to investigate the effects of multimedia on students' performance in senior secondary school mathematics. Students in experimental group had a higher mean achievement than those in the control group. This implied that multimedia aides in teaching of mathematics than the traditional lecture method. Additionally, students' interest, motivation and participation increased since the materials used were more attention catching and enjoyable than the ones used in the control group while on the other hand, traditional method of instruction had less effects on the academic performance of students. It was concluded that students in the control group had difficulties in concretization of abstract topics which made their learning process not encouraging. This study focused on physics while the reviewed study covered mathematics. In addition, the reviewed study only used achievement tests for data collection while the current study employed multiple data collection tools. This improves the validity of the research.

In Kenya, Chepngetich (2015) studied the effect of video programmes utilization on standard two pupils' science achievement in Dagoretti District, Nairobi county. The study employed the descriptive survey design and data was collected using questionnaires and written achievement tests. The study revealed the following; majority of the teachers, (50%) agreed that the use of video programmes in their classes was very effective, 33.3% indicated that it was effective and only 16.7% of them indicated otherwise, no teacher indicated time allocation of less than 10mins for watching video programmes which showed that video utilization takes better part of a science lesson. Majority of the respondents 63.7% also indicated that to a great extent, the time allocated for utilization of video programmes in a lesson affects class two pupils science achievement. In conclusion, the study found that the academic achievement in science for pupils taught using only traditional methods and those taught with the integration of video programmes differed significantly. This implies that utilization of video programmes affects achievement in science. Primary school curriculum content is far different from that of secondary school. The study was carried out in regular primary schools while the current study filled the gap by finding out how multimedia instruction influences performance of learners with HI in special secondary schools.

Experiential learning involves learning through experimentation/practical work which refers to teaching/learning activity which involves at some points the students in observing or manipulating real objects and materials, (Millar, 2004). According to Lunetta, Hofstein and Clough (2007), teaching science through practical work provides simulative experiences which stimulate students' learning in states of enquiry which needs high mental and physical engagement. Practical work involves students following laid down procedures in order to arrive at predetermined outcomes. Millar adds that learning science at the school level is not the discovery or construction of ideas which are new and unknown, but entails making what others already know your own. The researcher likens it to that of solving a puzzle and having the solution explained to you by someone who already knows it. Odom, Stoddard and Lanasa (2007) observed that practical work provides hands-on activities which can improve students' achievement in science and daily usage and yields the greatest positive impact. In our society today, it is believed that there cannot be an equivalent substitute for hands-on activities where materials and equipment are used and students' experiences are guided.

Many researchers like Ottander and Grelsson (2006), and Tan (2008) among others have come up in full support of laboratory work while teaching science. Many teachers and educators as well have agreed that practical work is indispensable in the understanding of science since it gives learners an opportunity to experience science by using scientific research procedures. Ottander and Grelsson (2006) add that laboratory work encourages the development of analytical and critical thinking skills and boosts interests in science. Hirvonen and Viiri (2002) report that as a result of learning practical skills and scientific learning methods, students experience an increase in motivation hence high achievement in the subject. This study therefore sought to find out the influence of experiential learning on performance of learners with HI in physics.

Ingvild (2002) in a study on Norwegian HI Teachers' Reflections on their Science Education interviewed five teachers based on their own experience as students with HI. Among the methods of instruction highly appreciated by the respondents was experimentation as a positive part of the physics classes they had. The respondents added that with experiments, physics as a subject became interesting and this gave support to the text books hence it became much easier when they could see. In their study, the respondents however pointed out that they were limited to doing more experiments with their HI students, like they did, due to lack of much equipment

and laboratory rooms at their schools. In the above study, the respondents were teachers giving their reflections as students. The current researcher saw a gap in this as circumstances and experiences differed with time, that is, their experiences during childhood and that of their students due to environmental changes at different stages of the worlds' evolvement and owing to the fact that they were among the first students to have successfully completed the upper secondary school with a university entry certificate from a Norwegian school for the HI. The researcher therefore built a stronger case by involving both students and teachers as the respondents. Besides, the researcher collected data through interviews, lesson observations as well as questionnaires as opposed to the above study where only interviews were used.

A study in UK investigated the role of practical work in the teaching and learning of science, (Millar, 2004). The objective of the study was to explore and discuss the role of practical work in teaching and learning of science at school level. The outcomes of the study were summarized as follows; practical work is communicative rather than enquiry, it develops students tacit knowledge of scientific enquiry which is of great value to students who would wish to pursue more advanced science courses, and it is important in developing scientific literacy which is useful in developing understanding in particular ideas about data and their interpretation. The study above did not explore the role of practical work in relation to performance and also considered science in general while the current study looked at the influence of practical work on performance of learners with HI in physics.

In Botswana, Hinneh (2017) conducted a study on attitude towards practical work and students' achievement in Biology, a case of private senior secondary school in Gaborone. Sequential explanatory mixed method design was employed. Data collection instruments included interviews, observation and questionnaires. The objective of the study was to examine the extent to which students' attitudes towards practical work influenced their perceived achievement. The outcomes of the study pointed to the following; the students' attitude about the importance of practical work significantly influenced their achievement in biology while their attitude concerning interest and difficulty in practical work do not significantly influence their achievement in biology. The researcher therefore concluded that even though students demonstrate some level of positive attitude towards practical work in terms of its importance, the experience they gain from doing practical work in biology lessons do not motivate them to want

to pursue career in biology beyond secondary school. The study discussed was limited to how attitude towards practical work influences achievement in biology while the current study sought to explore the influence of practical work on performance of physics subject among the HI learners.

In Nigeria, Samuel (2016) did a study on Students' Academic Performance in Physics, Chemistry and Biology, a case study of some selected secondary schools in Fagge Local Government Area of Kano State. The study involved descriptive survey design and the questionnaires as a tool for data collection. A total of 395 respondents were sampled for the study. One of the objectives discussed was to investigate the role of science laboratory in the performance of students in Physics, Chemistry and Biology. 100% of the students indicated presence of laboratories in their schools, while majority of them, 66.7% viewed the laboratories as not equipped. 41.1% of the respondents indicated that they conducted practicals while 58.9 percent did not. Further, 66.7% of the respondents preferred practical classes, while 33.3% preferred theoretical classes. The study came to a conclusion that even though laboratories are present in the schools, majority of the students view their laboratories as not equipped, and most of the students do not conduct practicals. The reviewed study was general by looking at the three science subjects while the current study narrowed down to physics subject by finding out the influence of practical work on performance of physics as a subject. In addition, this study employed concurrent triangulation as opposed to the descriptive survey design used in the study reviewed above in order to provide a more comprehensive understanding of the topic and allow for cross-validation of the findings.

In Kenya, Maina (2015) studied the influence of competence in practical skills on students' performance in biology practicals in secondary schools in Kiambu County. Descriptive survey design was used. Questionnaires, observation schedules and practical test papers were used for data collection and respondents were biology teachers and students. On competence in observation skills, students reported that 80% don't make accurate observations during biology practical sessions and 90% faced challenges when drawing. On interpretation skills, teachers reported that 80% of students find it challenging to interpret results from biology practical, 30% observed that students are able to make meaning from the observed results, and 90% agreed that the level of competence determines students' ability to make interpretations from results from

practical. The researcher concluded that students who have high level of competence in biology practical skills perform highly in practical examinations. The study above was limited to influence of competence in practical skills on performance in biology practical examinations while the current study looked at the influence of practical work on performance of physics subject as a whole.

In Kenya, another study was done in Imenti South District on factors influencing secondary school students' attitude towards the study of physics (Mbaabu, et al., 2011). Availability of equipped physics laboratories and its influence on students' attitudes towards physics was discussed. The researcher established that the availability of physics equipment positively influence students' attitude towards the subject. However, the extent of usage of physics laboratories and how it influences performance was not explored. This current study therefore looked at extent to which experiments are done and how this influences physics performance among students with HI.

Active learning/discussion refers to a variety of forums for open ended collaborative exchange of ideas between a teacher and students and among students for furthering students' thinking, learning, problem solving, understanding or literacy appreciation (Wilkinson, 2009). During such forums, learners express, clarify and pool their knowledge, experiences, opinions, and feelings. The teacher explains a concept then the learners discuss amongst themselves. Discussion method provides an opportunity for learners not to be passive recipients of information from the teacher rather; learners are active participants Johnston (Andermann, Milne and Harris, 1994). This is supported by Zakaria, Chin and Daud (2010) who observed that teaching should not merely focus on dispensing rules, definitions and procedures for students to memorize, but should also actively engage students as primary participants. The engagement level of the learners with the subject being taught must be considered by the teacher to enhance the learners understanding. Larson, (2000) appreciates discussion method by observing that during classroom discussions, learners are actively involved in the process of learning. Consequently, they are able to associate the topics being learned with their life experiences. It also provides opportunity for students to use important science words and concepts in their discussions (Shemwell and Furtak, 2010). The current study sought to find out the influence of discussion method of teaching on performance of learners with HI in physics.

In Pakistan, a study was carried out on impact of discussion method on students' performance (Rahman, Khalid, Jumani, Malik and Sharif, 2011). The study employed Pre-test and post-test control group design. 62 grade 10 students participated in the study. The study found no significant difference in mean scores for both experimental and control groups in the pre-test while for the post-test, there existed a significant difference in the mean scores implying that students taught by discussion method scored higher than those taught by lecture method. The researchers concluded that discussion was the most effective method of teaching social studies. Based on the effectiveness observed, the researchers recommended a trial in other subjects and levels. The study was limited to social studies hence the current researcher saw it worthy to explore the influence of the method discussed on performance of physics among learners with HI since the two subjects differ in content with physics being a practical science. Besides, the researchers recommended further research on impact of the method discussed on performance of students in other subjects. This study therefore delved into influence of discussion methods on performance of learners with HI in physics.

In Norway, Ingvild (2002) carried out a study on Norwegian deaf teachers' reflections on their science education: implications for instruction. The study aimed at enhancing understanding of science learning by learners with HI. Five teachers with HI were interviewed on their experiences as students. They were the first group of students from a Norwegian school for the HI who successfully completed upper secondary school with university entry certificate. The respondents reported that class discussions were very significant and a major factor in good learning. They pointed out that comprehensive discussion of a topic using sign language prior to reading of the text book was very helpful in promoting their scientific concepts. Discussion enhances cooperative learning in class and in many cases the students find it easy to learn more comfortably from their peers as opposed to adults. This study differed with the current study as the researcher involved CSOs, principals, teachers and students which is not the case with the reviewed study. The researcher used multiple data collection instruments as a measure to improve the validity of the study. The current study found out how discussion method influences performance of HI learners in physics.

In Nigeria, a study was carried out on effects of discussion teaching method on senior secondary school students' performance in English language in Dutsinma, Katsina state, Nigeria, Olutola

(2017). 64 students; 35 male and 29 female were randomly selected from secondary schools in Dutsinma. Pre-test and post-test quasi-experimental design was employed where the experimental group was taught with discussion teaching method while the control group was taught with usual traditional (lecture) method. The study found out a significant effect of discussion teaching method on senior secondary school students' performance in English language. The study was concluded that discussion teaching method significantly affects secondary school students' performance in English. The study discussed was limited to English language while the current study investigated how discussion method influences performance of learners with HI in physics subject.

In South Africa, a study was carried out on Teaching Methods and Performance, Ganyaupfu (2013). The study intended to investigate the effectiveness of different teaching methods on academic performance. Three methods of teaching were studied namely: teacher-student interactive method, student-centered method and teacher-centered approach. The sample population was 109 (25male and 84 female) undergraduate students in a given university. Assessment test scores were used to obtain data. From the results analyzed, the study came to a conclusion that combining both teacher-centered and student-centered teaching methods in teaching learners is the most effective approach that produces best student results. The study above was carried out in the university with the respondents being undergraduate students, a gap which the current study filled by carrying out the study in secondary schools since the two curricula are different. Besides, the current study involved multiple methods of data collection as opposed to the single method in the reviewed study.

In Kenya, Kuria (2014) studied Factors Influencing Academic Performance of Students in Kenya Certificate of Secondary Education Examination: A Case of Roysambu Constituency in Nairobi. The research used a descriptive cross-sectional survey design and data was collected using structured questionnaires. The sample population consisted of 150 students, 29 teachers and 7 principals. One of the objectives of the study was to assess the influence of teaching approaches on students' performance in Roysambu Constituency. The teaching methods discussed in the study were lecture method, discussion method, field Involvement and recitation method. Principals and teachers were asked to describe the extent to which these methods influence KCSE performance. The analysis showed all these methods were to a great extent used in their

schools and they agreed that all the suggested teaching approaches influence KCSE performance. The students were also asked to indicate the teaching methods used in their schools and they confirmed that all the teaching approaches were used. When questioned how the use of the various approaches in teaching influenced KCSE performance, it was clear from the analysis of data that they thought that all the teaching methods influenced performance in school. This study differed with the present study in that the present study was done in special schools for the HI where some of the respondents were learners with HI. Moreover, the above study only used questionnaires for data collection while the present study employed multiple data collection methods. Further, the current study narrowed down to how discussion method influences the performance of physics subject and not all subjects as in the reviewed study.

2.4 Influence of curriculum support of teacher on performance of students with HI in physics

The higher performance of learners is dependent on the effectiveness on the entire teaching and learning process. As a result, teacher curriculum support is of great need and importance. This study will focus on INSET as one aspect of teacher curriculum support. According to Komba and Nkumbi (2008), professional development provides teachers with opportunities to explore new roles, develop instructional techniques, refine their practice and broaden themselves; both as educators and as individual, hence a key factor in determining improved student performance (Zakaria and Daud, 2009). The curriculum for teacher training colleges does not connect with the needs of learners in schools. This calls for a regular planning of INSETs as a major aspect of improving quality education for teachers and better learning outcomes in all schools (Ndegwa and Khamah, 2018).

In Malaysia, a study was carried out on The Professional Preparation of Malaysian Teachers in the Implementation of Teaching and Learning of Mathematics and Science in English (Idris, Cheong, Nor, Razak, & Saad, 2007). The study revealed that teachers perceived that they are professionally prepared to teach mathematics and science in English. Out of the 72 sampled teachers of mathematics and science, on analysis of the results, 44.3% stated that their pre-service training alone could not help develop confidence in their English speaking. Further analysis showed that about 84.7% of the teachers reported that there was need for further training on how to help students to learn the subjects in English. These outcomes showed that despite the

teachers' perceived professional preparedness, the need for continuous training was loud so as to overcome the students' difficulties in learning the subjects in English and to enhance their professional readiness to teach the subjects. The limitation of this study is that it focused on the teachers' professional preparedness to teach but never explored its influence on learners' academic performance in the subject which the current study sought to fill by finding the influence of teacher curriculum support through in service training on performance of students with HI in physics. Moreover, the respondents in the above study were only teachers while the current study included principals, teachers and students in order to improve its validity.

In Mexico, a study was carried out on the effect of in-service teacher training on student learning of English as a second language (Rosangela & Xia, 2014). The study revealed that teacher training led to improvement in teacher knowledge and in pedagogical techniques. On classroom practices, classes with trained teachers decreased the percentage of time spent by teacher on answering questions based on the reading from 17% to 9%, decrease in percentage of time spent leading activities based on students' composition or writing texts from 22% to 13% and increased percentage of time spent by teacher on listening and conversation and activities from 12% to 26%. On instructional practices, teachers decreased the amount of time students sat on their desks and increased time spent on dynamic activities by 8% of class time. They also increased the time spent by students on deductive materials from 8% to 19% and reduced use of text books from 16% to 8%. The study also revealed that trained teachers spent more class time speaking English which improved their students' English by around 0.16 standard deviation. The above study never explored the relationship between in-service teacher training and the students' academic achievement hence the current study filled the gap by investigating how teacher training influences the performance of students with HI in physics subject. Besides, the study in Mexico was carried out in English subject while the current study focused on physics subject.

In Nigeria, Asiyai (2016) did a study on Relational Study of In-Service Training, Teaching Effectiveness and Academic Performance of Students. The study used ex post facto design with a sample of 48 teachers. Interviews and questionnaires were used as tools for data collection and the study aimed at determining the usefulness of the in-service training programmes provided for the teachers, determining the benefits of teachers' participation in in-service training on their teaching effectiveness. It was also to establish the difference in mean scores of teachers' teaching

effectiveness before and after in-service training, among other objectives. The outcomes of the study revealed the following: teachers who participated in in-service training perceived the programme as useful and beneficial in many ways, the training which the teachers received positively affected their teaching effectiveness, and students' mean test scores in biology, physics, chemistry and mathematics increased after the teachers' participation in in-service training. Hypotheses were formulated and tested through Pearson Product Moment correlation which showed that there was a significant relationship between in-service training and teachers' teaching effectiveness. In addition, there was a significant relationship between in-service training of teachers and students' academic performance. The researcher found a gap in the reviewed study as the respondents were only teachers and the study was carried out in regular schools while the current study involved teachers, students and principals, and was done in special schools for the HI. Besides, the reviewed study related in-service training with the general performance of students while the current study dwelt on how in-service training influences performance of students with HI in physics subject.

In another study, *In-Service Education Programmes for Secondary School Teachers and Students' Academic Performance: A Case Study of Nyarugenge District in Rwanda* (Harerimana, Ntahobavukira, & Adegoke, 2017). Data was collected using document analysis and questionnaires. 10 heads of studies and 157 teachers were sampled purposively from a target population of 286. The study intended to examine the state of in-service programmes in secondary schools in Nyarugenge District between 2008 and 2012 and its impact on the academic performance and to investigate on the state of performance of the secondary school students in secondary schools in Nyarugenge District between 2008 and 2012, among others. The study found out that there was an effect of in-service education programmes for secondary school teachers on the students' academic performance in the last five years, the in-service education programmes had not been effectively implemented between 2008 and 2012, and were not regular in all secondary schools, the students' academic performance in Nyarugenge district has decreased during the last five years (2008-2012), the in-service education programmes for secondary school teachers organized by schools, district and the Ministry of Education had raised the levels and qualifications of teachers in secondary schools not the academic performance. This led to a conclusion that ineffective in-service education programmes for secondary school teachers lead to the lowest students' academic performance. The reviewed study did not include

students as the respondents while the current study did. Other than questionnaires used in the reviewed study, the researcher in the current study improved the validity of the study by incorporating other instruments like interviews and lesson observations.

In Kenya, Mahulo (2012) conducted a study to investigate the influence of teacher training on the performance of students in mixed secondary schools in Gem District. The study aimed at finding the influence of teacher training on content delivery, uses of teaching and learning resources time management as well as the relationship between teacher training and student achievement. From the analysis of the results, the study revealed that teacher training makes a big difference in their performance hence students' performance. The study discussed was general, exploring the influence of teacher training on overall performance while the current study was more specific by focusing on how teacher training influences the performance of students with HI in physics. In addition the current study differed from the above study as it was carried out in special secondary schools for the HI as opposed to the reviewed study which was conducted in regular schools.

In Kenya, another study on In-service Teacher Training Programmes: Implications on Teacher Effectiveness in Secondary Schools in Kenya was done in Sotik Sub-County, Manduku, Boiyon and Cheruiyot (2017). The objectives of the study were: to establish the effect of In-service Teacher Training Programmes on teachers' student evaluation, to determine the effect of In-service Teacher Training Programmes on teachers' development of Student-Teacher relationship, and to ascertain the effect of In-service Teacher Training Programmes on teachers' use of Teaching-Learning resources. The study utilized the mixed methods approach where both qualitative and quantitative data collection were used. The study came out with the following results: In-service Teacher Training Programmes has a positive relationship with teachers' student evaluation at a coefficient of 0.611($r=0.611$ $p<0.05$); it has a positive relationship with teachers' development of Student-Teacher relationship at a significant coefficient of 0.622($r=0.622$ $p<0.05$); it also has a positive relationship with teachers' use of Teaching-Learning resources at a significant coefficient of 0.692 ($r=0.692$ $p<0.05$).

Based on the results so summarized, the study concluded that increased In-service Teacher Training would lead to improvement on teachers' student evaluation, teachers' development of Student -Teacher relationship, and teachers' use of Teaching-Learning resources. This would in

turn lead to improved students' performance. The reviewed study did not relate the in-service training with students' performance, a gap that the current study came in to fill by investigating how in-service training of teachers influences performance of students with HI in physics subject. Further, the study reviewed was conducted in regular secondary schools while the current study was carried out in special secondary schools for the HI.

2.5 Summary of major literature review and gaps

This section summarizes the major literature reviewed which were related to the current study on aspects of curriculum influencing performance of learners with HI in physics. The literature reviewed revealed relationships between curriculum factors and performance in physics. The studies highlighted the following: There is strong relationship between time spent on task and students' performance, strong positive correlation between mathematics achievement and physics achievement, and that Mathematics content makes some students have negative attitude towards physics. Additionally, the literature also revealed a relationship between method used in teaching and learning and the performance of learners in the subject as well as a positive link between curriculum teacher support and students' performance, for instance in-service training lead to improvement in teacher knowledge and pedagogical techniques.

Several gaps were revealed in the studies reviewed in this section in relation to the current study. For example, many studies on curriculum factors and performance were carried out on regular students without disabilities leaving out students with disabilities yet they do the same secondary school curriculum. Only three studies were done on learners with HI; Maina et al, (2011) which was limited to mathematics, Omutsani (2012) which was done in primary schools, and Ingvild (2002) which was done in Norway and only interviewed teachers with HI based on their experiences as learners with HI. Secondly, not all the studies reviewed in this chapter used similar methods of data collection. Some used multiple methods while other employed single methods leading to variations in findings as some would lead to limited information.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter outlines the procedures and methods that the researcher employed in order to achieve the research objectives as set out in the first chapter of this study. It focuses on the research designs, description of the study area, the study population, sampling techniques and sample size, data collection instruments, data collection procedures, data analysis and finally the research ethics that the researcher considered.

3.1 Research approach

Research approach is a plan and procedure that consists of the steps of broad assumptions to detailed methods of data collection analysis, and interpretation (Creswell, 2014). The study adopted the mixed methods research approach. This is where the researcher incorporates methods of collecting or analyzing data from the quantitative and qualitative research approaches in a single research study (Johnson and Onwuegbuzie, 2004).

3.2 Research design

Research design is a plan, a roadmap and blueprint of strategy of investigation conceived so as to obtain answers to research questions (Kothari, 2004). The study adopted the concurrent triangulation design of mixed methods research approach. Creswell (2009) defines concurrent triangulation design as one in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. Mixed methods research has many advantages as has been pointed out by various scholars. Creswell (2014) points out its benefit of providing a more complete understanding of a research problem than either qualitative or quantitative approach alone, leading to well-validated and substantiated findings. Bamberger (2012) on the other hand underlines the good of promoting greater understanding of stakeholder perspectives on the nature of the interventions. Further, Plastow (2016) adds that in this method, the strength of one research method compensates the weaknesses of the other. Therefore concurrent triangulation design was suitable for this study as it helped the researcher develop a more complete understanding of the research problem, and to bring together the differing strengths and non-overlapping weaknesses of quantitative methods

with those of qualitative methods. In this design, the researcher collected both qualitative and quantitative data in the same phase of the research process, analyzed the two components independently, and interpreted the results together as shown.

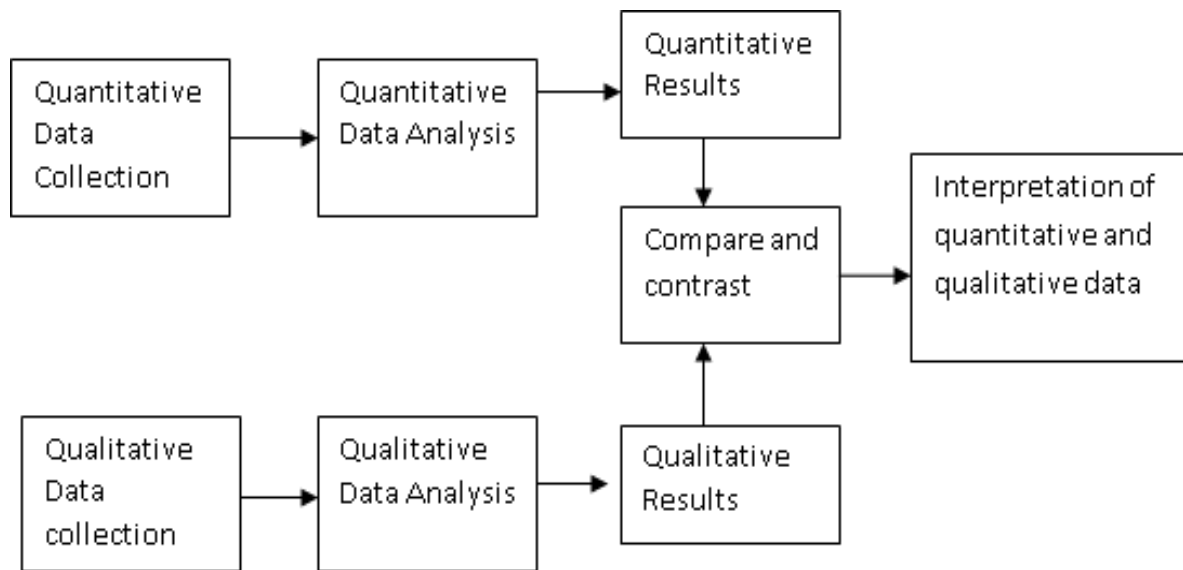


Figure 2: The research process of the study

Source: Adopted from Creswell 2014

3.3 Area of study

The study was carried out in four selected secondary schools for the HI from Kakamega, Vihiga and Migori counties in Western Kenya. Dornyei (2007) refers to convenience sampling as a type of nonprobability sampling technique where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study. The researcher used convenience sampling to select Western Kenya due to its geographical proximity as well as easy accessibility since Secondary schools for the HI are widely spread within the country. The region borders the west of Rift Valley Region and covers an area of about 19877.9 km² with a population of approximately 9776999 people (census, 2009). It has a total of 5 secondary schools for the HI offering pure science distributed within the region, 4 of which were sampled to participate in the study and one for pilot study. Numerous studies have been done in the region while some studies are ongoing. However, no known research study has been done related to the teaching and learning of physics within the schools for the HI in the region despite the

performance being low. This therefore prompted the researcher to carry out this research in the region.

3.4 Study population

Groove (2012) describes a study population as a group or category of human beings that have one or more characteristics in common and have been selected as a focus of the study. The study targeted four special secondary schools for the HI in Western Kenya which consists of a total of 816 students, 59 teachers, 4 principals and 4 CSO in charge of SNE from the four sub-counties in which the schools for the HI are located. Therefore, the target population in this study was 883 as indicated in table 3.1.

Table 3. 1 Target Population

School	Principals	Teachers	Students	CSO	TOTAL
School A	1	14	239	1	255
School B	1	10	75	1	87
School C	1	12	236	1	250
School D	1	23	266	1	291
TOTAL	4	59	816	4	883

3.5 Sampling technique and sample size

A sample is a small portion of a population selected for observation and analysis (Omari, 2011). Samples may be selected based on convenience or on the basis of strategic consideration as indicated by Cohen, Manion and Morrison (2011).

Sampling refers to the selection of a portion of a population which will be a representative of the whole population (Cresswell & Clark, 2011). Orodho (2005) defines purposive sampling technique as the handpicking of the cases to be included in the sample on the basis of one's judgment of their typicality. In this study, purposive sampling was used to select four secondary schools for the HI in the region. The choice of purposive sampling was informed by the researcher's assumption that the schools would be information rich since they do physics subject and therefore a great deal of issues of central information could be drawn from them. 4 head teachers and 4 CSOs were selected through saturated sampling technique. The choice of saturated sampling technique was because their number was too small to make a sample out of them.

Creswell and Clark (2011) further refer to purposive sampling as the identification and selection of individuals that are especially knowledgeable about or experienced with a phenomenon of interest. 7 physics teachers were purposively selected based on their experience of teaching physics to the learners with HI hence could be knowledgeable about the aspects of curriculum under study and how they influence performance in physics. All form two students (136) in the four schools were purposively sampled to participate in the study. The choice of form two students was informed by the fact that they have experience in the subject area and were about to make choices whether to proceed with subject to form three or otherwise. Finally purposive sampling was also used to select all the 11 form three students in the four schools based on the researcher's assumption that they would be information rich having made their informed choices to pursue the subject. This led to a sample of 162 respondents which was 18.35% of the target population. According to Mungenda and Mungenda (2003), a sample size of between 10% and 30% is a good representation of the target population. Table 3.2 shows a distribution of respondents sampled for the study.

Table 3. 2 Sample Size

School	Principals	Teachers	Students	CSO	Total
School A	1	2	53	1	57
School B	1	1	6	1	9
School C	1	2	54	1	58
School D	1	2	34	1	38
Sample size	4	7	147	4	162

3.6 Data collection instruments

The instruments used for data collection included observation checklist, questionnaires, interview schedules, and document analysis guide.

3.6.1 Observation checklist

An observation checklist entails a record of what the researcher anticipates to observe during the lesson. Maxwell (2005) asserts that observation always provides a direct and influential way of learning about people's behavior and contexts in which they occur. The researcher prepared a lesson observation checklist (Appendix J) to provide a structure and framework for observation. The researcher played the role of an observer by sitting at the back of the classroom during a lesson to observe the teacher's mastery of content, medium of delivery and his/her teaching approaches as well as the learners' responses.

3.6.2 Questionnaires for students (QFS)

Babbie (2009) defines questionnaire as an instrument that is specifically designed to elicit certain information useful for analysis in a study. According to Orodho (2005), a questionnaire has the ability to collect a large amount of information in a reasonably quick span of time. In this study, structured questionnaires were prepared for students (Appendices E and F). It consisted of closed ended questions related to aspects of school curriculum and their influence on performance in physics and the respondents provided with a list of possible alternative versions to select from

that best described their opinions. This type of questionnaire was preferred by the researcher due to such advantages as easier analysis, economical in terms of time and money, as well as easy administration.

3.6.3 Interview schedule for CSOs

An interview schedule is a set of questions that an interviewer asks when interviewing the respondents (Orodho, 2005). According to Mugenda and Mugenda (2008), interviews provide in depth data which are not possible with questionnaires. This study involved a standardized open-ended interview which involved the same set of questions being asked to each respondent in order to minimize the possibility of biasness. Interview was preferred since it provides in-depth information by allowing for more detailed questions to be asked and achieves high response rates as compared to other instruments such as questionnaires. Interview schedule was prepared for four CSOs for SNE (Appendix I) from the four sub counties within the region where the four schools under study fell. CSOs are officers at every sub county charged with the responsibility of assessing teachers' needs, training them, providing professional guidance and assessing learning outcomes. In this study, the CSOs helped the researcher gather information relating to how the aspects of curriculum under study influenced performance of learners with HI. The interview took approximately 45minutes with every CSO.

3.6.4 Interview schedule for principals

The school principal is directly in charge of the implementation of the curriculum policy at the school. They therefore have the full knowledge of the implementation process. Interview schedule was prepared for four principals for the four schools for the HI under study (Appendix H) seeking to find out how the aspects of curriculum influenced performance. The interview lasted for about an hour with every principal.

3.6.5 Interview schedule for teachers

Interview schedule was prepared for seven physics teachers from the four schools for the HI (Appendix G). Teachers help students develop an engaged relationship with the specific curriculum contents. Physics teachers have the experience of teaching the subject and are therefore knowledgeable of the aspects under study and their influence on performance of physics. The duration for interview with each teacher was about an hour.

3.6.6 Document analysis guide (DAG)

Bowen (2009) defines document analysis as a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic. According to Babbie (2010), document analysis is the study of recorded human communications, such as books, websites, paintings and laws in order to make certain deductions based on the study parameters. Document analysis was used in this study (appendix K). It involved examining various documents such as syllabus, schemes of work, lesson plans, time tables, student progress reports and records of work covered. One importance of use of documents as outlined by Yin (2009) is to corroborate and augment evidence from other sources. It helps facilitate collection of reliable information without necessarily questioning many people hence preferred by the researcher.

3.7 Validity and reliability of instruments

3.7.1 Validity

Validity is the degree to which a research instrument measures what it is designed to measure (Robson, 2011). It entails accuracy of measurement. Validity of instruments in this study therefore referred to the ability of an instrument to provide adequate coverage of the objectives of the study. To ensure validity, the researcher's supervisors reviewed the instrument to assure content validity and ensured that all the components of the research were covered. This was followed by a thorough scrutiny of the instruments by other experts in the department of Special Needs and ECDE and judgments for further adjustments before they were finally used. The questionnaire was also given to a physics and mathematics specialist in one of the schools to help with the content review.

3.7.2 Reliability

Mugenda and Mugenda (2003) defines reliability as the measure of consistency. It entails ability to get the same responses each time a test is completed and the aim is to ensure consistency of responses across all variables. According to Orodho (2008), pilot study is the most important stage in the design of questionnaires and must be completed before the actual study. It helps in identification of weaknesses, inconsistencies, and to check for ambiguity of the questions which may result into modification thereby increasing the efficiency of the study. This was achieved in this study through a pilot study with students in a school that was not sampled as part of the study but

within the same region. According to Connelly (2008), 10% of the students were selected for pilot study which translated to 15 respondents. Cronbach's alpha was used to check the reliability of the questionnaire. The coefficient alpha value was .976 which indicates a high level of internal consistency (Davidshofer and Murphy, 2005).

Table 3. 3 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.976	.979	15

In qualitative research, reliability (consistency of the instruments) is ensured by trustworthiness of the instruments in terms of credibility, transferability, dependability and conformability.

i. Credibility (internal validity)

Credibility is defined as the confidence that can be placed in the truth of the research findings, (McCabe, 2008). In this study, credibility was ensured through the following: first is triangulation where the researcher used different data collection methods so as to check the consistency of the findings as well as different data collection sources, that is, CSOs, teachers, students and principals to ensure that the research findings are comprehensive and well developed. Secondly, the researcher also used member checks as a measure of establishing credibility. In this the researcher shared data interpretations and conclusions with the respondents for them to clarify their intensions. This also gave room to correct errors and also provided additional information that was necessary for the study.

ii. Transferability (external validity)

Transferability refers to the degree to which the results of the study can be generalized to other context with other respondents (Bitsch, 2005). The researcher adds that a researcher can facilitate transferability judgment through purposeful sampling where a detailed description of enquiry is provided. The researcher ensured transferability through purposive sampling, since it provides in-depth findings than other probability sampling methods (Cohenet al., 2011). Schutt (2006) also points out that purposive sampling helps the

researcher to focus on key informants, who are particularly knowledgeable of the issues being investigated.

iii. Dependability (external reliability)

Dependability refers to the stability of findings over time, (Bitsch, 2005). This implies that the study can be repeated and still yields a consistent result. Cohen et al. (2011) assert that dependability as a measure of trustworthiness involves participants in the study evaluating the findings, interpretations and recommendations of the study. This in turn ensures that they are supported by the data that were received from the respondents. The researcher ensured dependability through peer examination by discussing the research findings with colleagues doing qualitative research to enhance honesty and for peers to contribute their deeper reflexive analysis (Bitsch, 2005). In addition, the instruments were reviewed by the researcher's supervisors to ensure that all the components of the research were covered by the instruments.

Confirmability (internal reliability)

Baxter and Eyles (1997) define confirmability as the degree to which result findings could be corroborated by other researchers. This implies how well the research findings can be supported by the actual data collected when other researchers examine it. The researcher discussed and shared meanings and any other category emerging from the study with peers to determine if they also perceive the same meanings. Confirmability was also ensured by producing a draft thesis to be scrutinized by supervisors and other experts from the school of education.

3.8 Data collection procedures

The researcher first sought the consent to carry out this study from the Board of Postgraduate studies of Jaramogi Oginga Odinga University of Science and Technology followed by an authorization from the National Commission of Science, Technology and Innovation (NACOSTI). The two documents were taken to the offices of the directors of education for the selected counties for approval before proceeding to the schools to carry out the study. For effective administration of the questionnaires, the researcher made visits to the selected schools and made arrangements with the administrations of the various schools on the most appropriate dates to collect data. During the second visit the researcher explained the expectations and

clarified any issues that arose in the questionnaires after which they were administered to the students with help of the physics teachers. Lesson observation was carried out in various classes as well as interviews at appropriate time agreed upon by the researcher and the respective teachers. The process took a period of approximately two months.

3.9 Data analysis

3.9.1 Quantitative data analysis

Quantitative data was analyzed through the statistical package for social sciences (SPSS version 22). The analyzed data was presented using descriptive statistics such as charts and tables showing frequencies and percentages. This method was preferred by the researcher as it enabled the researcher to use one or more numbers to show the average score and the variability of scores of a sample (Orodho, 2008). The relationship between study variables was measured using inferential statistics.

3.9.2 Qualitative data analysis

Qualitative data analysis is a method which involves identifying, analyzing and reporting themes within data and interpreting various aspects of the research topic (Braun and Clarke, 2006). The researcher adopted the six-phase thematic analysis approach in analyzing the qualitative data as recommended by Braun and Clark. This involved reading and re-reading the transcripts to familiarize with data then generating initial codes where the researcher organized the data into a systematic and meaningful way. This was followed by sorting themes by examining the codes and combining those that were clearly fitting together to form a theme, reviewing the themes, naming them, and finally reporting.

Table 3.4 shows a sample of interview data extracts, codes and themes generated from some of the respondents.

Table 3. 4 Sample of interview data extracts, codes and themes

INTERVIEW DATA EXTRACT	CODE	RESPONDENT'S IDENTIFICATION	THEME
<i>Doing three things at ago copying on the board, signing and speaking as well. Remember there is no dictation as is the case in regular. The 40minutes allocated is not enough to cover much work.</i>	PA	Principal	Unique challenges encountered
<i>I think it is bulky. If you don't have extra time to be with the students, most of the times we're unable to complete the syllabus and it overlaps. You can't combine subtopics for our students_ just one at a time. If you combine they either get confused or switch off from it. In fact, a subtopic can even be repeated.</i>	TB	Teacher	Length of content
<i>It is quite an impossibility to complete the syllabus unless you want to complete it alone as a teacher, but with the students it is impossible! In fact syllabus for the HI is one year behind the regular, that is, when the regular students are doing form four work, the HI learners are doing form three work. Syllabus is never completed!!</i>	PD	Principal	Extent of coverage
<i>Yes... So many topics are shared between the two like mass, weight. Also formulas and calculations so if they get the mathematics concepts faster then they are able to get the calculations in physics as well.</i>	TB	Teacher	Relationship between maths and physics
<i>Students fear mathematics a lot a lot! A partially deaf</i>	TA1	Teacher	Attitude

student confessed that in physics there is a lot of mathematics hence she'll select history and leave physics.

Aaahh... what I know is that physics is one of the subjects with several unfamiliar terms, and very abstract of course, and we have language barrier. When a word is fingerspelt (due to lack of signs), it is difficult to recall it as opposed to when it is signed; the learners are bound to miss spelling. Some terminologies must be used in the definition of some terms such that when it is missing the meaning may not come out. If a student for instance forgets since it was finger spelt, then he/she misses the meaning. Mmhh..that's a big challenge.!

PA Principal

Abstract nature of terms

Such programmes need facilitation. Due to limited resources, we usually have them once a term for language and science teachers.

CSO4 Curriculum support officer

Relevance of INSET

It is not! Let us be realistic! Some aspects of it are not realistic to the HI learner, except for those with mild problems. What we do is to advice the school management and the teacher handling them to improve on resources.

CSO1 Curriculum support officer

Relevance of INSET

Yes... sometimes you have to speed up in order to cover much although at the back of your mind you just know they are getting nothing...but you have to cover it anyway to take the blame off your shoulder! This negatively affects their academic performance since they don't understand.

TC Teacher

Length of content

3.10 Logical considerations and Ethical issues

3.10.1 Logical considerations

Secondary schools for the HI are very few in number and widely spread across the country. The choice of Western Kenya was necessitated by the need for convenience by the researcher in accessibility in terms of reduced travelling costs and to save time needed to collect data. Permit to legally carry out the study was sought from the various offices concerned. The researcher also came up with a work plan that guided the entire research process.

3.10.2 Ethical issues

Ethics refers to an “ethos” or “way of life”, “social norms for conduct that distinguishes between acceptable and unacceptable behavior” (Shah, 2011; Akaranga & Ongong’ a, 2013). The study was guided by universally accepted ethical considerations. It was reviewed and approved by the Board of Post Graduate Studies, Jaramogi Oginga Odinga University of Science and Technology. According to Kombo and Tromp (2006), participants were given full information about the nature and purpose of research study and the implications of their participation.

Informed consent of various respondents was sought (Appendices A,B & D) and in cases of child participation, written consent forms were provided to be filled by parents/ guardians on their behalf (Appendix C). The researcher ensured the principle of justice by ensuring voluntary participation in the study and no one was coerced to give any information.

Further, in order to uphold confidentiality, the researcher ensured that information offered was not unduly disclosed. In addition, the respondents did not indicate their names on the questionnaires. The identities of respondents in the interviews were concealed by using pseudonyms.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0. Introduction

This chapter presents the findings of the study on aspects of physics curriculum influencing performance of students with hearing impairment in physics in secondary schools in Western Kenya. It consists of three subsections. The first subsection involves background information of the respondents, the second, the return rate of the instruments used, while the third subsection includes the results and discussions of the study guided by the following research questions that were directly generated from the objectives.

- a) To what extent does time on task influence the performance of students with HI in physics?
- b) To what extent does the mathematical content influence the performance of students with HI in physics?
- c) How do the teaching methods used by teachers influence the performance of students with HI in physics?
- d) How does the curriculum support of teachers influence the performance of students with HI in physics?

4.1. Return rate of the instruments

One of the instruments used in this study was document analysis (Appendix K). This was conducted in the staffroom in collaboration with the teachers who teach physics in the respective schools visited. Data was recorded in form of a tick for availability and an x for unavailability of the document. According to the document analysis guide, six documents were to be analyzed in the four schools under study. Timetable and subject syllabus were available in all the schools, two schools lacked learners' progress reports, one school lacked schemes of work while another school lacked record of work covered. Analysis of the subject syllabus was necessary in this study as it would reveal some of the mathematical content in physics and the relationship between the two subjects. Schemes of work show time within which a given content/topic was to be covered in terms of the number of lessons required, the methods of teaching to be employed as well as the teacher's comment on the learners' level of acquisition of content within the time

stipulated. Lesson plan would reveal mathematical content in physics as well as methods of teaching employed by the teacher. Time table would show the numbers of lessons allocated for the subject per week and the duration of each lesson. Students' progress report would show the students performance in the subject. Finally, records of work covered would show whether the learners acquired the intended content. It would also show the week, date and the work covered which when compared to the schemes of work would reveal whether or not the syllabus was being covered within the required time.

The other instruments used for data collection included questionnaire for students, interviews for CSOs, principals and teachers as well as observation checklist. The details of the return rate are summarized in table 4.1.

Table 4. 1 Instruments return rate

INSTRUMENT	ISSUED	RETURNED	PERCENTAGE
Questionnaires			
QFS	147	140	98.6
Interviews			
Principals	4	4	100
Teachers	7	5	71.4
CSOs	4	3	75

The research targeted 147 students to respond to the questionnaires. Of the 147 questionnaires administered, 140 were returned, which translated to a return rate of 95.2%.

The study also targeted 4 interviews for principals which were effectively conducted, making a response rate of 100%. 7 interviews were anticipated for teachers of physics. Out of the 7, 5 were effectively carried out as two teachers had transferred to other schools by the time of data collection. This amounted to 71.4% response rate. Finally, the study targeted 4 CSOs for SNE in the four sub counties. One CSO transferred and had not been replaced by the time of data

collection. Three CSOs therefore participated in the study translating to a response rate of 75%. The overall return rate of the instruments used in this study stood at 85.4%. According to Morton, Bandara, Robinson and Carr (2012), a return rate of approximately 50% is suitable for analysis, 60% is considered good, 70-85% very good while above 85% is excellent. Based on this scale, the response rate for this study was excellent.

4.2. Background information of the respondents

This section investigated the gender distribution of the respondents, class, and motivation for choice of the subject.

4.2.1. Distribution by Gender

The research analyzed the gender distribution of the respondents in order to ensure fair involvement of the respondents in the study. Table 4.2 shows that out of 152 respondents, 103(67.8%) were male while 49(32.2%) were female respondents.

Table 4. 2 Gender Distribution

	Male		Female		Total
	Frequency	Percentage	Frequency	Percentage	
CSOs	3	100	0	0	3
Principals	3	75	1	25	4
Teachers	3	60	2	40	5
Students	94	67	46	33	140
Total	103	68	49	32	152

This finding shows that there was a fair involvement of both female and male respondents in the study, hence no biasness.

4.2.2. Distribution by Class

The students were requested to indicate their classes. The results were analyzed in figure 3 as shown.

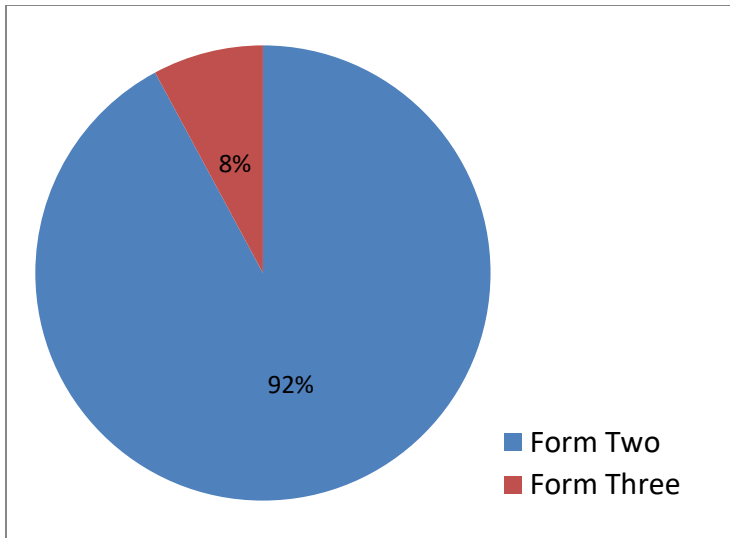


Figure 3: Students' distribution by class

The chart on classes of the students indicates that 129(92%) of them were in form two while 11(8%) indicated they were in form three. This shows that majority of the respondents were in form two.

4.2.3. Interest in the Subject.

The respondents were requested to indicate whether they liked physics as a subject or not. Figure 4 shows the results.

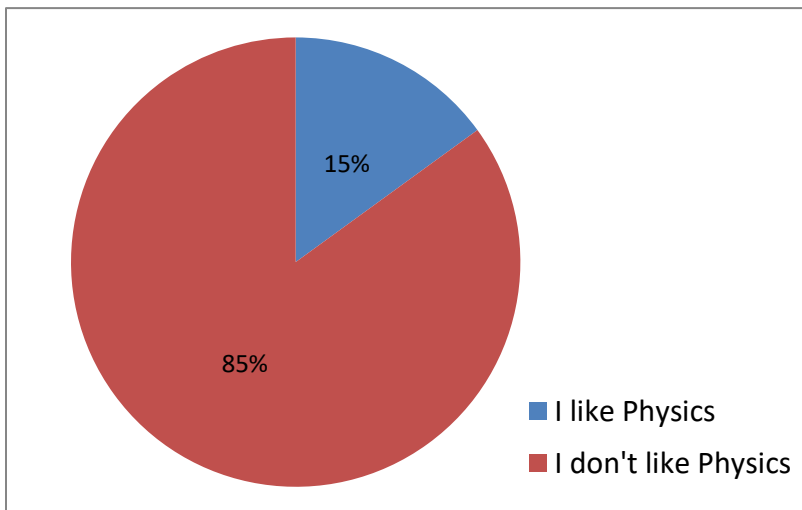


Figure 4: Interest in the Subject

119(85%) of the respondents indicated that they did not like physics, while 21(15%) indicated that they liked physics. It can be derived that majority of the students did not like physics as a subject.

The study further determined the reasons as to why the students in form two were likely to select physics and why the form three students did choose the subject amongst the other subject options that they had. Their responses were as follows: 27% of the students indicated that they were encouraged by their previous marks to select physics while 44% stated otherwise, majority (71%) agreed that the subject was taught well in their schools while 16% disagreed. 20% indicated that they understood physics while the majority (61%) disagreed with the statement. 62% of the students admitted that they selected physics because the remaining optional subjects were their worst while 57% indicated that they did select the subject because they needed it in their future career. From the findings, it can be seen that even though the subject is well taught as indicated by majority of the students, most of the students didn't understand and this informs the dislike. It can also be deduced that those who were likely to select the subject and those who selected it did so because they had no better alternative while others just because they needed it in their future career.

4.3. Results and Discussions.

4.3.1. Influence of time on task on performance of students with HI in physics?

The study examined the extent to which time on task influences the performance of learners with HI in physics. This was responded to by students, teachers, principals and CSOs. The students were asked to indicate if the physics syllabus was fully covered. Their responses were as shown in table 4.3.

Table 4. 3 Syllabus coverage (N=140)

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	50	35.7	35.7	35.7
Valid	No	90	64.3	64.3	100.0
	Total	140	100.0	100.0	

50 (35.7%) of the students indicated that physics syllabus had been covered while 90 (64.3%) of them indicated that physics syllabus was not fully covered. This shows that majority of the students had a feeling that physics syllabus was not well adequately covered within the schools studied.

When asked to quantify the number of topics that were uncovered, table 4.4 summarizes 4 the responses.

Table 4. 4 No of topics uncovered (N=90)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One topic	36	40	40	40
	Two and above	54	60	60	100
	Total	90	100	100	

36 (40%) of the students questioned indicated that one topic was uncovered by the time they were moving to the next class while 54 (60%) showed that two and above topics were uncovered. It can be concluded that there were a number topics that were uncovered in physics within the schools studied at the time the learners were transiting to the next class as evidenced from the table.

Additionally, interviews done with principals, teachers and CSOs came up with themes that seemed to suggest a number of factors relating to time on task that influenced performance of learners with HI in physics. The themes were, but not limited to unique challenges encountered in teaching learners with HI as opposed to their hearing peers, length of physics syllabus in relation to time of study and extent to which the syllabus was covered.

4.3.1.1 Unique challenges in teaching learners with HI as opposed to their hearing peers

Participants highlighted a number of challenges in relation to time that they encounter in teaching learners with hearing impairment. For instance, a statement captured from one principal stated that:

Doing three things at ago copying on the board, signing and speaking as well. Remember there is no dictation as is the case in regular. The 40minutes allocated is not enough to cover much work. (PA)

Another principal said:

Aahhh most of these HI learners learn best under visual learning/ visual teaching and you find that when you go teaching lecture method they may not be able to understand and the other thing is that their memory lifespan is sooo short, then also the issue of language. Most of them use KSL and you get that most of subjects are English so that poses a challenge for them to be able to interpret and internalize what is taught. (PD)

Further, one principal who had an experience of teaching both hearing and learners with HI in the same context noted:

The school is inclusive hence we can compare... the class of hearing impaired is a little been behind compared to the hearing class. The teacher finds it easy to explain a concept and move with the hearing learners than HI. The same teacher teaches the same thing at a slower pace to the HI and the reason is simple: you don't have to move to the next thing if you think they haven't conceptualized so the time you think they have now conceptualized, the regular have moved ahead.(PC)

One teacher stated:

Another big challenge is common terms in different subjects. For instance the word 'mean' in both mathematics and English. Two words with different meanings and signs. It takes time to get a learner distinguish the two. Explaining the term in its context is quite a big deal. (TA2)

Another teacher added:

If a learner cannot recall what he/she learnt in F1, it becomes very hard for him/her to apply the same knowledge in answering questions. For instance when solving a problem in class involving topic learnt in the previous class, it becomes very hard coz he/she can't recall. (TC)

One of the CSOs on the other hand pointed out inadequate human resource as a recipe for poor performance. He said:

To me inadequate human resource is a challenge! Physics is a practical subject and some of our learners have multiple disabilities that will require more than one person in a class to attend to them in a manner that can yield better results. (CSO1)

Another CSO had this comment:

Challenges in teaching these learners are immense, if our teachers go for passion when selecting SNE then curriculum delivery can be very smooth. So you find very many special schools doing poorly because most teachers are going in for grade and not value addition for the students. (CSO4)

These findings seem to concur with ASHA (2015) whose study revealed that hearing impairment is not only about hearing loss but it also opens up the individuals to such challenges as learning problems that result in reduced academic achievement due to language deficit. Some of the challenges that emerged from this study include: doing three things at ago copying on the board, signing and speaking as well which affects the pace of syllabus coverage, short memory lifespan hence the learners have difficulty recalling what is learnt in the previous class or lesson. The participants also pointed out that learners take longer time to comprehend what is taught, limited or lack of definite signs for some terms in physics leading to much interference when locally made signs are to be used, and the fact that most subjects are presented in English while the learners are KSL users which poses a great challenge to learners when it comes to internalization and interpretation of what is taught, among other challenges. Chimedza and Peterson (2003) found that these challenges do not affect the learners' intellectual capacity to learn. However, they slow down their process of reaching full potential (Moores, 1996). Thus, poor performance in physics among learners with HI was attributed to limited time on task awing to their unique challenges as opposed to the hearing peers.

4.3.1.2 Length of physics syllabus in relation to time of study

Most of the participants felt that physics syllabus is generally bulky and covering it within the stipulated time was difficult awing to the unique challenges encountered in teaching learners

with HI. These have a great bearing on the pace of coverage of the syllabus. The response from one teacher was as follows:

I think it is bulky. If you don't have extra time to be with the students, most of the times we're unable to complete the syllabus and it overlaps. You can't combine subtopics for our students_ just one at a time. If you combine they either get confused or switch off from it. In fact, a subtopic can even be repeated. (TB)

Another teacher added:

Yes... sometimes you have to speed up in order to cover much although at the back of your mind you just know they are getting nothing...but you have to cover it anyway to take the blame off your shoulder! This negatively affects their academic performance since they don't understand. (TC)

When asked the same question, another teacher had this to say:

Form one and three syllabus is very bulky and definitely that means I'll have to carry forward some work to the next class and if I have to do revision then I'll have to move very fast to spare some time for revision, which is not the case most of the times. (TA2)

One teacher on the other hand had this to add:

Form 1 syllabus is very long, form 2 is light but form 3 is very long with calculations in every topic and so you have to take a long time. These learners do graphs in mathematics, when they come to physics it appears like they have never done it before. What can you do?? (TA1)

From the interviews, it was evidenced that physics syllabus was wide hence covering the content within the stipulated time is a challenge to teachers in both regular and special schools. The problem is even worsened when teaching learners with HI due to the unique challenges as has been discussed earlier. Wider curriculum content implies that the time on task must be minimal as the teacher will be under pressure to complete the syllabus. This finding is in agreement with the conclusion by Ingvild (2002) and GoK (2003) that the longer regular physics curriculum needs to be modified and reduced so that what needs to be covered can be done within the limited time available.

4.3.1.3 Extent of syllabus coverage.

All participants from the sampled schools indicated that physics syllabus is never fully covered in their schools. This emerged in statements such as:

If you were to go literally to cover syllabus within the stipulated time, I can emphatically say that the deaf cannot cover the syllabus within that time..! you cannot...! It needs almost a year. If there is four years, they need 5years to cover what the regular cover in 4years. (PC)

One principal in response to the question said that:

It is quite an impossibility to complete the syllabus unless you want to complete it alone as a teacher, but with the students it is impossible! In fact syllabus for the HI is one year behind the regular, that is, when the regular students are doing form four work, the HI learners are doing form three work. Syllabus is never completed!! (PD)

Another principal had this to say when approached with same question:

No! No! No..! We have never completed the syllabus in time...(PB)

The teachers interviewed were in total agreement with the principals' take on syllabus coverage. Their responses were as follows:

Doing three things at a time....talk, write and sign. You cannot move at the same pace with somebody teaching in regular school. In regular they write the key points where the students may have spelling problems, but mostly dictate so they move faster. In HI, I have to sign, talk and write on the chalkboard as a result a smaller content is covered per time. While those in regular schools clear everything, those in HI cover just a portion if handling the same sub topic meaning I have to go back to the same thing in the next lesson. Hence the method of teaching interferes with the speed of syllabus coverage. Syllabus coverage is therefore a serious challenge! (TA1)

Another teacher added:

In most cases, a class work is carried to the next class. This means that by the time the students are in form four, probably they're still doing form three work. When you

struggle to move fast and it cannot work owing to the nature of our learners, you think of other strategies like topical revision. (TD)

In response to the question, one teacher narrated her experience with the previous candidate class:

I remember the last topic I did with them was mains electricity (topic 6 out of 10) and again the remaining were taxing and demanding na hata kusoma the vernier scale which is basic physics hajui....so tutaendelea kusoma what you can't manage within a short time...!!? Then I opted for much of practical work. (TA2)

The CSOs on the other hand confirmed the sentiments by the other respondents when questioned whether syllabus was fully covered. One of them said:

No no! It is quite a big challenge...but achievable depending on the teachers' creativity. If they embrace remedial times then it is achievable. (CSO1)

It emerged that physics syllabus was never fully covered within the sampled schools. The respondents expressed the fact that the timing for its completion was a target unachievable especially for learners with HI. This is because teaching and learning process is slowed down by the use of sign language (Maina, Indoshi and Adoyo, 2011). This implies that learners are tested on content that is not covered. Lower performance in physics among learners with HI could therefore be attributed to limited time on task.

4.3.1.4 Conclusion

The results from questionnaires and interviews indicate that syllabus was not adequately covered in most of the schools. During lesson observations in the various schools, it was further evidenced that syllabus coverage was a major issue. For instance, a form three class was still in the second topic out of ten topics in the last quarter of third term. Elsewhere, a form two class was still covering form one work. This could imply that the time allocated for studying physics is inadequate for learners with HI owing to their unique challenges as enlisted by most of the participants. This finding is in agreement with Adoyo (2007) who observed that the timing for completion of the curriculum is unrealistic for students with HI as the teaching and learning process is slowed down due to the process involved. Teachers are therefore forced to either rush

with the coverage irrespective of whether or not the students understand, or opt for alternative methods like topical revision instead of deeper content teaching as one teacher earlier pointed out during an interview. As Farbman, Goldberg, & Miller (2014), Gromada & Shewbridge (2016) indicated, if time is adequate, students would have more time for learning, more time on tasks and less rushed lessons, on the contrary learners with HI suffer a great deal. The findings of the current study reveal that they are denied the opportunity for deeper interaction with the content and consequently the understanding of the same due to rushy syllabus coverage and the worst of all, failure to fully cover the syllabus leading to learners being tested on what they have not learnt. This negatively affects their performance in the subject hence the repeated lower performance observed in the schools. It can therefore be concluded that time on task influences the performance of students in the subject.

4.3.2 Influence of mathematical content on performance of students with HI in physics.

The study examined the extent to which mathematical content in physics influences the performance of learners with HI in the subject. This was responded to by students, teachers, principals and CSOs.

The students were asked to indicate if they have a fear for mathematical calculations in physics and if the mathematical calculations lower their physics scores. They were also to give their opinion on the idea of physics being difficult to understand. Their responses were as follows: majority (62%) of the students indicated that they had a fear for mathematical calculations in physics while 22% indicated otherwise. However 62% of the students disagree with the notion that mathematical calculations lower physics scores. Most (55%) of the respondents did agree that physics is interesting but challenging while a majority of 69% confessed that physics is indeed quit difficult to understand.

Karl Pearsons Correlation analysis was carried out using the students' questionnaires. Table 4.5 shows the output.

Table 4. 5 Karl Pearsons Correlation Coefficients

		Physics and Mathematics are related and they don't like Mathematics	Fear of Mathematics calculations in Physics	Mathematics calculations lower Physics scores
Physics and Mathematics are related and they don't like Mathematics	Pearson Correlation	1	.930**	.852**
	Sig. (2-tailed)		.000	.000
	N	140	140	140
Fear of Mathematics calculations in Physics	Pearson Correlation	.930**	1	.900**
	Sig. (2-tailed)	.000		.000
	N	140	140	140
Mathematics calculations lower Physics scores	Pearson Correlation	.852**	.900**	1
	Sig. (2-tailed)	.000	.000	
	N	140	140	140

****.** Correlation is significant at the 0.01 level (2-tailed).

***.** Correlation is significant at the 0.05 level (2-tailed).

The analysis above revealed a strong positive correlation between mathematical content and physics performance which was statistically significant, with r values of 1, .930 and .852 respectively for the sub-variables under the specific objective. Further, Kendall's correlation analysis was also carried out to confirm the relationship between the two variables. Table 4.6 shows the results.

Table 4. 6 Kendall's Correlation

		Physics and Mathematics are related and they don't like Mathematics	Fear of Mathematics calculations in Physics	Mathematics calculations lower Physics scores
Physics and Mathematics are related and they don't like Mathematics	Correlation Coefficient	1.000	.898**	.813**
	Sig. (2-tailed)	.	.000	.000
	N	140	140	140
Fear of Mathematics calculations in Physics	Correlation Coefficient	.898**	1.000	.882**
	Sig. (2-tailed)	.000	.	.000
	N	140	140	140
Mathematical calculations lower physics scores	Correlation Coefficient	.813**	.882**	1.000
	Sig. (2-tailed)	.000	.000	.
	N	140	140	140

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Kandall's correlation analysis likewise showed a very strong positive correlation between mathematical content and students' performance in physics with r values of 1, .898 and .813 respectively.

During an interview with principals, teachers and CSOs, the following themes emerged: relationship between mathematics and physics subjects, mathematical calculations and their influence on attitude towards physics, as well as the influence of mathematics performance on physics performance.

4.3.2.1 Relationship between mathematics and physics subjects

When asked to give their opinion on the relationship between physics and mathematics, some of the statements captured from teachers were as follows:

Mathematics and physics are very close... for instance, graphs taught in mathematics... you expect them to come with the knowledge they acquired in mathematics to answer physics on graph. (TA1)

One teacher added:

Yes... So many topics are shared between the two like mass, weight. Also formulas and calculations so if they get the mathematics concepts faster then they are able to get the calculations in physics as well. (TB)

Another teacher had this to say in response to the same question:

There are so many mathematical calculations in physics and if a student has a problem in mathematics, it definitely affects the choice of physics. For example, if a learner lacks the knowledge of mathematics in finding volume, applying it in physics becomes even harder. (TC)

It emerged that physics and mathematics are two subjects that are related. This confirms the outcomes of the two correlation analyses of the students' questionnaires (tables 4.5 and 4.6) which revealed a strong positive relationship between mathematics and physics. This relationship is evidenced by the number of topics taught in both the subjects as well as various components such as symbols, structures and algebraic equations which are combined to explain basic concepts in physics. These findings conformed to the outcomes of various research studies done elsewhere. For instance, Bassey (2003) revealed that mathematics and physics are related and mathematical calculations as very important in expressing physics knowledge.

4.3.2.2 Mathematical calculations and attitude towards physics

The study found out the views of teachers on whether mathematical calculations in physics had a bearing of their attitude towards the subject. One principal said:

Majority believe that mathematics is difficult hence they (students) bear an attitude that physics is difficult as well. This affects choice. In fact, this is one of the reasons why we don't have students taking physics in forms 3 and 4 in our school. (PB)

Another principal added that:

Attitude towards mathematics definitely affects attitude toward physics. There are some symbols (signs) which are same in physics. If I have a problem with them in mathematics why should I go there!?! (PD)

Teachers were also asked to respond to the same question. One of them said:

Students fear mathematics a lot a lot! A partially deaf student confessed that in physics there is a lot of mathematics hence she'll select history and leave physics. (TA1)

In response to the same, another teacher observed that:

Mostly students who hate mathematics don't prefer selecting physics since they are almost the same. They'd rather do mathematics alone which is compulsory. (TB)

Another teacher had this to say:

Those who fear mathematics never come but those who come know nothing. They just come there to go through the system. (TA1)

These findings pointed to the fact that mathematical calculations in physics had a bearing on the students' attitude towards physics. Additionally, it also affected the choice of physics as a subject of study in forms three and four as evidenced in some of the sampled schools where there were no students studying physics in forms three and four. Mbaabu, et. al. (2011), in support of these findings revealed that mathematical calculations in physics make students to have a negative attitude towards the subject.

4.3.2.3 Mathematics performance and physics performance

Document analysis was done and students' test scores for both mathematics and physics were obtained from the students' progress reports. A Pearson product moment correlation was then

run to determine the relationship between students' performance in mathematics and their performance in physics. The data showed no violation of normality or linearity. Table 4.7 shows correlations.

Table 4. 7 Correlations using students' marks

		Maths_marks	Physics_marks
Maths	Pearson correlation	1	.732**
	Sig. (2-tailed)		.005
	N	140	140
Physics	Pearson correlation	.732**	1
	Sig. (2-tailed)	.005	
	N	140	140

There was a strong positive correlation between students' performance in mathematics and their performance in physics which was statistically significant ($r = .732$, $n=140$, $p= .005$).

Further, the study through interviews, sought the opinion of participants as to whether performance of students in mathematics in any way had an influence in their performance in physics. The following were their responses:

There exists a very big correlation between mathematics performance and physics performance. A student who does very poorly in mathematics, there is a high likelihood of very poor performance in physics. (PB)

One teacher added:

It is automatic that good performers in mathematics also perform well in physics. Even in regular schools, students who perform well in mathematics are the ones taking physics... because they know what they want (career). They want to do pharmacy, medicine etc, but here they just do it without knowing where the subject will take them to. (TA)

The second teacher was in agreement with the other colleagues when asked the same question. This was the response:

Exactly! It affects. Physics calculations are being expressed mathematically and some of the deaf students are afraid of mathematics. So the mathematics in physics makes others fail. They just say calculation is 'hard hard' and they keep off. (TB)

However the third teacher when asked his view on the same had a contrary opinion. This was his response:

Not really! When it comes to mathematical calculations they do well but when it comes to explanation of some events, some of them don't do well. For instance, I have a student who does well in mathematics and mathematical part of physics but when it comes to explanations, he is very poor. (TC)

These results indicated that indeed the performance of students in mathematics had an influence on their performance in physics. A number of studies have supported the findings generated from this study. A study by Nilesh (2011) revealed a strong correlation between achievements mathematics and physics. Further, Arsaythamby, et. al., (2015) in their study also that those students who show good performance in mathematics also do so when it comes to physics.

4.3.2.4 Conclusion

The findings of this study indicated that while most students disagreed with the notion that mathematical calculations lower physics scores, majority of the respondents interviewed confirmed the existence of a strong correlation between mathematics and physics as observed by Bassey (2003), Hudson and Rottmann (2006), and Ataide and Greca, (2013) that some components from mathematics, including symbols, structures and algebraic equations, are embed into some problem situations in order to explain the basic concepts in physics. The study further revealed that due to the relationship between the two subjects, performance of a student in mathematics do have a bearing on his/her attitude towards physics which is in agreement with (Mbaabu, Gatumu & Kinai, 2011) that mathematical content in physics makes students have negative attitude towards physics. The study also revealed that a student's performance in mathematical skills influences his/her performance in physics. This confirms the findings by Nilesh (2011), Arsaythamby, Rahimah & Khalid (2015) and Kuria (2014) which indicated that

mathematical ability contributed towards achievement in physics hence a those who perform well in mathematics also did so in physics. From the findings above it can therefore be deduced that mathematical content in physics influences the performance of students in physics.

4.3.3 Influence of teaching methods used by teachers on performance of students with HI in physics.

The study sought to find out how teaching methods used by teachers influenced the performance of students with HI in physics. The respondents included teachers, students, principals and CSOs. Students were asked to indicate how many times they had physics practical lessons. Their responses were summarized in figure 5 below.

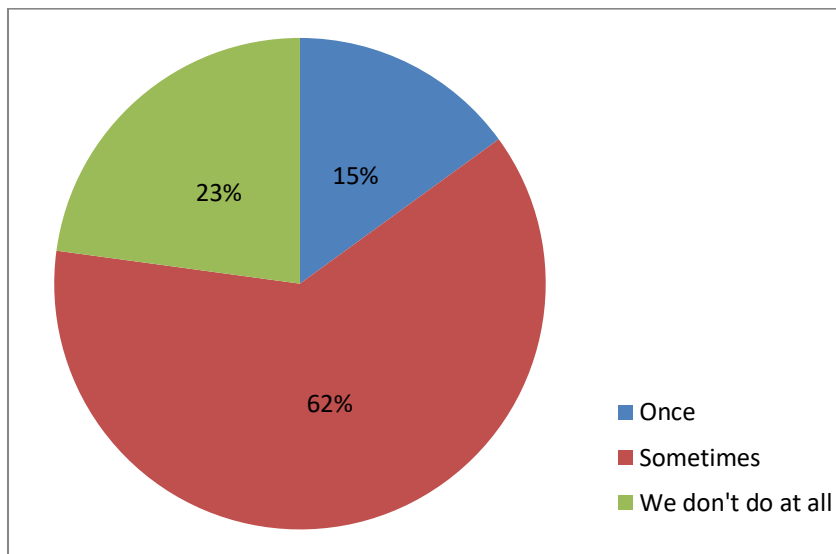


Figure 5: Practical lesson per week

21(15%) of the respondents indicated that they had practical physics lessons once a week, 87(62%) showed that they sometimes had practical lessons per week, while 32 (23%) indicated that they did not have practical lessons at all. With a mean of 2.78, it was deduced that most of the schools sometimes had physics practical lessons in a week.

The students were also asked to indicate whether there was need for more practical lessons in order to pass physics. Table 4.8 summarizes their responses.

Table 4. 8 Need more practicals to pass (N=140)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	55	39.3	39.3	39.3
	Agree	33	23.6	23.6	62.9
	Disagree	24	17.1	17.1	80.0
	Strongly Disagree	28	20.0	20.0	100.0
	Total	140	100.0	100.0	

55 (39.3%) of them indicated that they strongly agreed with the idea of having more practical lessons in order to pass their exams, 33 (23.6%) agreed, 24 (17.1%) disagreed, while 28(20%) strongly disagreed with the idea of having more practical lessons in order to pass their exams. Based on the findings, it was concluded that most of the respondents strongly agreed with the notion of having more practical physics lessons to aid in the passing of physics exams (mean = 2.18, standard deviation = 1.16).

When asked whether or not ICT was being used in teaching physics, their responses were as shown.

Table 4. 9 ICT integration (N=140)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always	20	14.3	14.3	14.3
	Sometimes	35	25.0	25.0	39.3
	Not used at all	85	60.7	60.7	100.0
	Total	140	100.0	100.0	

20(14.3%) of the respondents indicated that there was always the integration of ICT in the physics lessons, 35(25.0%) indicated sometimes, while 85(60.7%) indicated that there was no integration of ICT in the physics lessons in their schools. With a mean of 2.46 and standard

deviation = 0.73, it was concluded that most schools never integrated ICT in their physics lessons.

Those that indicated that they did have ICT lessons were asked to show if the lessons were enjoyable. Their responses were as shown in table 4.10 below.

Table 4. 10 ICT lessons enjoyable (N=55)

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly Agree	14	25.5	25.5	25.5
	Agree	25	45.5	45.5	71.0
Valid	Disagree	10	18.1	18.1	89.1
	Strongly Disagree	6	10.9	10.9	100.0
	Total	55	100.0	100.0	

14 (25%) of the respondents indicated that they strongly agreed that ICT lessons were enjoyable, 25 (45%) agreed, 10 (18%) disagreed, while 6 (11%) strongly disagreed that the ICT lessons were enjoyable. It was deduced, based on this information, that most students agreed that ICT lessons were enjoyable (mean = 2.58).

The students were required to indicate if they held discussions in their lessons. The table 4.11 gives a summary of what they indicated.

Table 4. 11 Often have discussions (N=140)

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	78	55.7	55.7	55.7
Valid	No	62	44.3	44.3	100.0
	Total	140	100.0	100.0	

78 (55.7%) indicated that they often had discussions during their lessons while 62 (44.3%) indicated that they did not often have discussions in their lessons. This implies that majority of the lessons often had discussions.

The respondents were further questioned on whether they understood more during discussions in the lesson. Table 4.12 shows their response.

Table 4. 12 Understand more during discussions (N=140)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	61	43.6	43.6	43.6
Agree	44	31.4	31.4	75.0
Valid Disagree	15	10.7	10.7	85.7
Strongly Disagree	20	14.3	14.3	100.0
Total	140	100.0	100.0	

61 (43.6%) indicated that they strongly agreed that there is more understanding during discussions in a lesson, 44 (31.4%) agreed, 15 (10.7%) disagreed, while 20 (14.3%) strongly disagreed with the idea that discussions made students understand more during a lesson. It can be deduced therefore, that most of the students strongly agreed that discussions in a lesson made them understand more content.

Similarly, during interviews with principals, teachers and CSOs, it commonly emerged that the methods preferred for teaching learners with HI included discussions, demonstrations, practical work and ICT integration. One principal responded:

We prefer to use more of practicals, demonstration and discussion. For the deaf it is almost impossible to do practicals without demonstration and discussion. It helps sink the concept easier and faster (PC).

One teacher had this to say:

When engaged in practical work, they see and able to retain since they are visual learners (TC).

When questioned about ICT integration, one principal observed that:

We have Digital content purchased from KICD which are yielding better results. They are intergrated by simulation. Learners grasp concepts better however abstract they may look (PB).

The findings above support a number research studies. For instance, Giam (2000) and Akinoso (2018) observed that the use of multimedia materials during teaching/learning makes learning easy as well as stimulating the learners' senses making them active. This in turn makes learning more effective than the traditional methods.

On the other hand, Ingvild (2002) revealed that discussions enhance cooperative learning in class and in many cases the students find it easy to learn more comfortably from their peers as opposed to adults. Through this method, learners are also able to associate the topics being learned with experiences they have already had in their lives making learning more real. This further enhances their understanding.

Despite the mentioned methods being suitable and preferable for teaching the learners with HI, discussions were more oftenly used as opposed to the other methods. The respondents expressed challenges in employing the other methods during their lessons. The statement by one of the teachers concerning practicals was as follows:

No resource like lab to conduct practicals. You have to organize the apparatus and do the practicals in class which in most cases is challenging due to limited preparation time and even time to do clearance for the next lesson to also begin in time. In most cases you either do away with the practical or do simple demonstration. (TB)

Another teacher lamented:

Our learners have always shown a capability of performing better in practicals exams than in theory exams. However, their poor performance in theory still have a negative implication on the overall performance since if you don't have theory content, you can't manipulate data during practicals. That's the tragedy! (TC)

Another teacher added:

Theory is quite challenging especially if the question is wordy and requires explanation. They can struggle to collect data but drawing graphs may be a challenge, and even interpreting the data collected. (TA2)

One principal had this comment on ICT integration:

Most of the ICT materials are not deaf friendly_ they are tailored towards the hearing. The materials have to be deaf friendly for them to be applicable in our context. Materials for the HI are not so much in the market. The resources are not there. What we have got so far is in English, that is sounds and signs. (PD)

A teacher had this to say on the same:

Use of ICT would be the best, but we rarely employ it in teaching since it consumes a lot of time considering the fact that physics syllabus is very bulky. (TC)

These results seemed to suggest that inadequate resources was a major factor that hindered the application of effective teaching and learning methods in order to improve performance of learners in the subject. This conforms to a study by Samuel (2016) which came to a conclusion that even though laboratories are present in the schools, majority of the students viewed their laboratories as not equipped, and most of the students did not conduct practicals.

The outcome also pointed to the need to adapt the physics curriculum to be applicable in the context of the HI. This is in view of the fact that these learners still struggle to perform well in the theory part of physics which consequently affect overall performance in the subject.

4.3.3.1 Conclusion

The results of this study revealed the methods teachers preferred to employ when teaching learners with HI. They included demonstrations, practical work, discussions and ICT integration. Their reasons for the preferred methods were because such methods would encourage visual learning and also actively involve the learners in the learning process through hands-on activities leading to better understanding of concepts, Andermann, Milne and Harris (1994), Odom, Stoddard and Lanasa (2007), and Zakaria, Chin and Daud (2010). From the interviews, respondents indicated that of the preferred methods, only discussions and demonstrations were more oftenly used in the sampled schools. They cited the challenge of limited time for covering the bulky physics syllabus as a hindrance to exposing learners to more Practical work and ICT integration since they believed the two methods are time consuming. However there was no evidence of discussions and demonstrations during lesson observations as all the lessons observed were dominated by monologue with few instances of question and answer. It was also evidenced that some of the sampled schools had one laboratory for all the science subjects, some without laboratory technicians while others had some apparatus with neither a laboratory nor a laboratory technician. This therefore implies that the teachers would double up as laboratory technicians and practical lessons would be organized in classrooms where there were no laboratories leading to limited preparation time as pointed out by the respondents. The lower performance in physics in the sampled schools can therefore be attributed to failure to employ effective methods of teaching.

4.3.4 Influence of curriculum support of teachers on performance of students with HI in physics.

The study sought to establish the extent to which curriculum support of teachers influences the performance of students with HI in physics. This was responded to by principals, teachers and CSOs. During interviews with the participants, the following themes emerged; teacher difficulties in teaching physics in sign language, relevance of INSET in teaching the subject and INSET and students' academic achievement.

4.3.4.1 Teacher difficulties in teaching physics in sign language.

The study requested for the views of the participants on some of the teacher difficulties experienced when teaching physics in sign language. One teacher pointed out this:

You go to modern physics in form 4: the CRO, electronics, Xrays... quite difficult to teach the deaf! Limited signs.. you draw the CRT on the board but soon after they ask "is this a bulb?". We can't bring them physically to class to be seen, even some of us have never seen them, and these students are in their own world! When you lack mother tongue, you lack everything!! Somebody who never learnt mother tongue is very difficult to teach for your information! (TD)

Another teacher added:

The big issue here is the challenge of sign language. Physics as a subject is very abstract in nature having many terms without signs!! There are no books with signs. Learners would easily conceptualize words signed as opposed to those fingerspelt hence it would be easy if physics terms would have sign equivalence. (TB)

One principal had this observation to make in response to the same question:

Aaahh... what I know is that physics is one of the subjects with several unfamiliar terms, and very abstract of course, and we have language barrier. When a word is fingerspelt (due to lack of signs), it is difficult to recall it as opposed to when it is signed; the learners are bound to miss spelling. Some terminologies must be used in the definition of some terms such that when it is missing the meaning may not come out. If a student for instance forgets since it was finger spelt, then he/she misses the meaning. Mmhh..that's a big challenge.! (PA)

The CSOs were asked to indicate whether the physics curriculum was realistic for learners with HI. One of them had this to say:

Currently with 8-4-4, nothing has been done in terms of curriculum adaptation to enable learners with HI to do well in physics. My plea is that CBC takes root and all will be sorted out since the focal point is the learner.(CSO3)

Another CSO added:

It is not! Let us be realistic! Some aspects of it are not realistic to the HI learner, except for those with mild problems. What we do is to advise the school management and the teacher handling them to improve on resources. (CSO1)

The study found out that some aspects of the physics curriculum were unrealistic and not easily applicable to the HI and no adaptation had been done to the regular curriculum to suit the unique needs of learners with HI as was the case in some subject areas. GoK (2003) observed that the curriculum used was overloaded and one which does not care for the individual needs of learners with special needs in education. The major challenge that emerged was language barrier as most respondents decried the fact that physics had a lot of very abstract terms without signs. It is therefore very difficult for the teacher to bring learners to the understanding of some concepts hence affecting performance of learners in the subject.

4.3.4.2 Relevance of INSET

This study found out the views of the participants on the relevance of the trainings, one teacher had this to say:

Through training and interaction with others, you learn and adjust. Help you learn how to handle several topics which somehow may be challenging since you are able to share experiences and areas of difficulties. (TB)

Another teacher added:

These trainings helps boost confidence of the teacher and also improves content delivery. They should be done at least once a year. They also keep the teacher at par with the kinds of learners' needs. (TA2)

One teacher who had attended KICD training narrated her experience as a newly employed teacher in a special school for the HI. She said:

I can tell for a fact! It's quite a difficult task teaching learners with HI. Believe me..two years after employment, I had lost hope in teaching, I even felt like quitting, but from the

trainings, I got encouraged and have moved on.. .. I even learnt that it is possible to use video to learn practicals when it can't be actually done due to challenges at school level.
(TB)

However, one of the teachers had a contrary opinion to put across. This is what he had to say:

The trainings I received are general which is a challenge.!They don't add much value due to unique challenges of learners with special needs. After the workshop, it is upon us to pick what is applicable to our set up, which in most cases is a very small percentage.
(TD)

When asked how often INSET programmes were organized, one CSO responded by saying:

Such programmes need facilitation. Due to limited resources, we usually have them once a term for language and science teachers. (CSO4)

When asked whether the trainings were general or specific for SNE teachers, another CSO said:

In many occasions they are attended by both categories of teachers. For SNE teachers, they may not be so educative... It is a point, going forward we need to look for specialists to facilitate. (CSO1)

All the teachers interviewed said that they had attended workshops after employment. All of them indicated that the only one attended was the SMASSE, with only one teacher having attended other trainings by the county and KICD. The participants also pointed out that all the training and workshops attended were general for all teachers from both special and regular schools except for KICD which was for teachers from special schools. When asked how often they attended the trainings, majority said once in a while since SMASSE was organized yearly and teachers attended rotationally according to year of stay in the service. It can be concluded that although INSETs were organized within the sampled schools, they did not help the teacher to a reasonable extent in overcoming challenges experienced in the context of HI as far as physics is concerned hence not effective in improving performance of learners with HI in the subject.

4.3.4.3 INSET and performance in the subject

The study investigated the influence of INSET on students' performance in physics. One principal said this in response:

Yes... Through the trainings, a teacher's curriculum content delivery is improved and definitely this brings a positive impact on performance. (PD)

One teacher responded by saying:

There are so many things learnt in the university which are not applied here, through training, the teacher learns a lot and is able to remain relevant even amidst changing trends. This definitely brings positive influence on students' performance. (TC)

Another teacher added:

The trainings have positive effect on students' academic performance. (TB)

The study revealed that INSET brings a difference in terms of teaching effectiveness. It positively influences content delivery and the use of teaching/ learning resources. Consequently, this positively influences performance of learners in the subject. This finding supports Mahulo (2012) and Asiyai, (2016) who concluded that there exists a significant relationship between INSET and students academic performance.

4.3.4.4 Conclusion

The outcome of this study showed that language barrier was a major challenge when it comes to teaching physics. Physics is abstract with most of its terms lacking definite signs. Some terminologies must be present in some definitions and laws of physics such that when alternative signs are used, the meaning misses out. Likewise, when fingerspelt, the students easily forgets since they would easily conceptualize a signed word as opposed to the one fingerspelt, just like a hearing student would easily conceptualize a verbalized word than a word that is spelt. Idris, Cheong, Nor, Razak, & Saad, (2007) suggest that in-service education trainings should be continuous to be able to overcome student difficulties in learning, however this study revealed that the trainings were very scarce and the ones attended were general without the learner with

special needs in mind. This implies that despite their confidence boosted after interaction with other teachers as some respondents pointed out, the trainings were not adequate enough to help them address the unique needs of the students with HI as one participant decried. Furthermore even the trainers themselves were noted by the respondents to have very little or simply no knowledge of special needs education. This could be the reason for lower performance in the subject as is currently the case in the sampled schools. This finding agrees with a conclusion by Harerimana, Ntahobavukira, & Adegoke, (2017) that ineffective in-service education programmes for secondary school teachers lead to the lowest students' academic performance.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0. Introduction

This chapter outlines summary of the study and conclusions made having collected and analyzed data. It further presents recommendations and suggestions for further research.

5.1. Summary of the findings

This study investigated the aspects of physics curriculum influencing performance of students with hearing impairment in physics in secondary schools in western Kenya. The study was guided by the following research questions directly generated from the objectives set to guide the study:

- a) To what extent does time on task influence the performance of students with HI in physics?
- b) To what extent does the mathematical content influence the performance of students with HI in physics?
- c) How do the methods of teaching used by teachers influence the performance of students with HI in physics?
- d) How does the curriculum support of teachers influence the performance of students with HI in physics?

5.1.1. Summary of findings related to influence of time on task on performance of students with HI in physics

Physics syllabus was not adequately covered in all the sampled schools due to limited time. In some schools teachers resorted to alternative means like topical revision in form four when they could not complete the syllabus, others brushed over the syllabus without considering whether or not the students understood to avoid the blame of not covering everything, while others taught only what they could manage leaving out the remaining topics. This implied that physics students did not even have time to revise what was learnt in the previous years and for adequate preparation prior to the final examination. This easily led to panic and lack of confidence, hence low performance in the subject by learners with HI.

5.1.2. Summary of findings related to influence of mathematical content on the performance of students with HI in physics.

This study revealed the existence of a strong correlation between mathematics and physics subject ($r = .930$; $k = .898$). The mathematical ability of a student had a bearing on his/her performance in physics. Consequently, the mathematical content in physics affected their performance in physics.

5.1.3. Summary of findings related to influence of teaching methods used by teachers on performance of students with HI in physics.

Methods of instruction determine whether or not learning has taken place depending on the level in which learners are engaged in the process. Learners with HI have been cited over time to have very short attention and memory span. The methods chosen should therefore be able to attract and keep the attention and highly emphasize on their active involvement in the learning process while engaging in more of visual learning. In spite the fact that teachers have this background, they did not embrace it in their style of teaching, citing challenges of limited time.

5.1.4. Summary of findings related to influence of curriculum support of teachers on performance of students with HI in physics.

INSET programmes were scarcely attended by teachers. Most of them were general in nature and therefore did not help in addressing the unique needs of learners with HI in relation to the teaching and learning of physics.

5.2. Conclusion of the study

In light of the findings of the study, the following conclusions were drawn:

5.2.1. Conclusion of the study related to influence of time on task on performance of students with HI in physics

The aspect discussed was found to influence the performance of learners in physics. The greater the time allocated to a specific content, the greater the exposure and opportunity to engage

learners in the same. This leads to better understanding and higher retention, and consequently better performance. Due to the unique challenges faced by learners with HI as discussed earlier, they require more time to fully comprehend what is taught hence shortening the bulky regular physics syllabus would help teachers not to be under pressure to squeeze much content per lesson at the expense of students' understanding of the same. The lower performance in physics among the HI learners was attributed to limited time on task. The study therefore found out that time on task influence performance.

5.2.2. Conclusion of the study related to influence of mathematical content on the performance of students with HI in physics.

Learners are required to apply the knowledge acquired in mathematics to answer some questions in physics. This study revealed that students who have difficulties acquiring mathematical skills bear an attitude that physics is difficult as well hence performing poorly in the subject. It also found out those students who perform well in mathematics do so even in physics since physics calculations are expressed mathematically. It can therefore be concluded that mathematical calculations in physics influence performance of learners in the subject.

5.2.3. Conclusion of the study related to influence of teaching methods used by teachers on performance of students with HI in physics.

Despite the teachers exhibiting a very outstanding mastery of content, they did not present the content to learners in the best way to ensure better knowledge acquisition and higher retention. This study concluded that the lower performance in the subject could partly be due to failure to employ appropriate methods of teaching that best suits learners with HI hence teaching methods employed in teaching physics influence performance of learners in the subject.

5.2.4. Conclusion of the study related to influence of curriculum support of teachers on performance of students with HI in physics.

Teachers require continuous INSET programs in order to keep up with the changing trends in teaching for relevance and effective delivery of lessons to learners hence better performance. This study attributed the lower performance in physics to failure to engage teachers in effective

programs that help them address the unique needs of their learners as well as overcoming teacher difficulties in delivering the abstract physics content to learners with HI. This study therefore revealed that curriculum support of teachers influence performance.

5.3. Recommendations of the study

Based on the findings of this study, the following recommendations for action were made:

5.3.1. Influence of time on task on performance of students with HI in physics

- a) Physics syllabus be adapted to suit the unique needs of students with HI. Teachers be encouraged to embrace remedial teaching to help students with HI to catch up with their hearing peers.
- b) Harmonize signs for physics especially the abstract terms to minimize interference by locally made signs in case of student transfers to other schools or teacher change over.
- c) Instructional materials and examinations be presented in KSL just like Braille for the visually impaired.

5.3.2. Influence of mathematical content on the performance of students with HI in physics.

- a) The study found strong positive correlation between Physics and Mathematics. Teachers are therefore encouraged to work at sharpening the learners' mathematical skills and cultivate a positive attitude towards mathematics in order to improve physics performance.

5.3.3. Influence of teaching methods used by teachers on performance of students with HI in physics.

- a) Teachers be encouraged to embrace visual learning and learner centered methods of teaching where learners are actively involved in the learning process rather than being passive recipients of knowledge.
- b) School administration to prioritize construction of laboratories in schools without one, adequately equip them and employ laboratory technicians to help teachers effectively engage learners in practical work.

5.3.4. Influence of curriculum support of teachers on performance of students with HI in physics.

- a) Increase in-service programs for special education teachers. Facilitation by specialists be encouraged to help address teacher difficulties as well as learner challenges when teaching learners with HI.
- b) Government to employ enough human resource at the education offices. Improve facilitation for CSOs for SNE to ease their mobility. This will enhance monitoring and evaluation for schools.

5.4. Suggestions for further research

- a) This study focused on aspects of curriculum. It was recommended that a study be done on factors other than aspects of curriculum affecting performance of learners with HI in physics.
- b) Explore the effectiveness of INSET offered to teachers in special schools.
- c) Explore the extent of monitoring and evaluation in special schools and its impact on curriculum implementation.

REFERENCES

- Adoyo P.O. (2004). Kenyan Sign Language and Simultaneous Communication: Differential effects on memory and comprehension in deaf children in Kenya Kisumu: Lake Publishers & Enterprise Ltd.
- Adoyo P.O. (2007). Educating deaf children in inclusive setting: Challenges and Considerations. Retrieved May 21, 2009 from http://www.ed.wright.edu/~prenick/Winter-Spring_08/Inclusive_education-2-D.htm
- Akaranga, S.I. & Ongong'a, J. (2013). "Work Ethics for University Lecturers: An Example of Nairobi and Kenyatta International Journal of Arts and Commerce, 2 (8) 8-22.
- Akinoso O. (2018). Effect of the Use of Multimedia on Students' Performance in Secondary School Mathematics. *Global Media Journal*, 16:30, ISSN 1550-7521.
- Alessi, M.S. & Trollip, R.S. (2001). *3rd Edition Multimedia for Learning-Methods and Development*. Needham Heights, Massachusetts.
- American National Science Foundation, (1999). Preparing our children: Math and science education in the national interest. Washington, D.C: National Science Task Force on Mathematics and Science Achievement.
- Amunga, J.K., Musasia, M.A. & Musera, G. (2011). Disparities in the Physics Achievement and Enrolment in Secondary Schools in Western Province: Implications for Strategy and Renewal, *Problems of Education in the 21st Century*, 31(31), 18-32, ISSN: 1822-7864
- Aris, B., Yahaya, N., Harun, J., & Tasir, Z. (2000). *Education Technology*. Skudai: University of Teknologi Malaysia.
- Arsaythamby, V., Rahimah, N. & Khalid, N. (2015). Attitude towards Physics and Additional Mathematics Achievement towards Physics Achievement. *International education studies; vol 8, no 3; 2015. ISSN 1913-9020 E-ISSN 1913- 9039. Published by Canadian center of science and education*.
- ASHA (2015). Effects of Hearing Loss on Development. American Speech-Language Association, 2200 Research Boulevard, MD 20850*800-638-8255.
- Asiyai, R.I. (2016). Relational Study of In-Service Training, Teaching Effectiveness And Academic Performance of Students. *Journal of Teaching and Education*, 05(02):205216, ISSN: 2165-6266.
- Ataide, A., & Greca, I. (2013). Epistemic views of the relationship between physics and

- mathematics: Its influence on the approach of undergraduate students to problem solving. *Science & Education*, 22(6), 1405-1421.
- Ausabel, D.P. (2000). *The acquisition and retention of knowledge: a cognitive view*. Dordrecht: Kluwer Academic Publishers.
- Babbie, E.R. (2009). *The practice of social research* (12th Edition).
- Babbie, E.R. (2010). *The Practice of Social Research* (12th Edition).
- Bamberger, M. (2012). Introduction to mixed methods in impact evaluation. *Impact Evaluation Notes*, 3. The Rockefeller Foundation. Retrieved from <http://www.interaction.org/impact-evaluation-notes>.
- Bassey, M. (2003). *School Science for Tomorrow's Citizen*. New York: Pergamon Press.
- Basson, I. (2002). Physics and mathematics as interrelated fields of thought development using acceleration as an example. *International Journal of Mathematical Education in Science and Technology*, 33(5), 679-690.
- Baxter, J. & Eyles, J. (1997). Evaluating qualitative research in social geography. Establishing 'rigour' in interview analysis. *Transactions of the Institute of British Geographers*, 22(4), 505-525. doi: 10. 1111/j.0020-2754.1997.00505.x
- Berliner, D.C. (1990). What's all this fuss about instructional time? In M. Ben-Peretz & R. Bromme (Eds.), *The nature of time in schools: Theoretical concepts, practitioner Perceptions* (pp. 3-35). New York, NY: Teachers College Press.
- Bitsch, V. (2005). Quality research. A grounded theory example and evaluation criteria. *Journal of Agribusiness*, 23(1), 75-91
- Bowen, G.A. (2009). Document analysis as a qualitative research method. *Qualitative research journal*, 9(2), 27-40. Doi:10.3316/QRJs0902027
- Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2). pp. 77-101. ISSN 1478-0887 Available from: <http://eprints.uwe.ac.uk/11735>
- Bryant, F.B., Kastrop, H., Udo, M., Hislop, N., Shefner, R., & Mallow, J. (2013). Science anxiety, science attitudes, and constructivism: A binational study. *Journal of Science Education and Technology*, 22(4), 432-448.
- Chepngetich, I. (2015). Effect of Video Programmes Utilization on Standard Two Pupils' Science Achievement in Dagoretti District, Nairobi County, Kenya.

- Chimedza, R. & Peterson, S. (2003). *Disability and Special Needs Education in an African Setting*. Harare: College Press.
- Cohen, Manion & Morrison (2011). *Research Methods in Education*. (5th Ed.) London: Croom Helm.
- Connelly, L. M. (2008). Pilot studies. *Medsurg Nursing*, 17(6), 411-1.
- Creswell, J. W. (2009). *Research design* (3rd ed.). Los Angeles: Sage Publications, Inc.
- Creswell, J.W. & Clark, P.V.L. (2011). *Designing and Conducting Mixed Methods Research*. 2ndedn. Thousand Oaks, CA: Sage.
- Creswell, J.W. (2014). *Research Design: Qualitative, quantitative, and mixed approaches* (4thed.). London: Sage Publications, Inc.
- Davidshofer, K. R. and Murphy, C. O. (2005). *Psychological Testing Principles and Applications*. Upper Street River, N. J Pearson Prentice. Hall.
- Delannoy, F. (2000). *Tacher Training or Lifelong Professional Development? World-wide Trends and Challenges*. Knowledge Enterprise, Inc.
- Dörnyei, Z. (2007). *Research methods in applied linguistics*. New York: Oxford University Press.
- Dove, L. (1998). *How Professional Development For Teachers Works*. Columbia: How stuff works, Inc.
- Duffy, T.M. & Cunningham, D.J. (1996). *Constructivism: new implications for instructional technology*. New York: Macmillan.
- Erinosho S.Y., (2013). How students perceive difficulty of physics in secondary school; An exploratory study in Nigeria. *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE)*, 3(3).
- Farbman, D.A., Goldberg, D.J., & Miller, T.D. (2014). *Redesigning and Expanding School Time to Support Common Core Implementation*. Washington, DC: Center for American Progress. National Center on Time & Learning.
- Farbman, D. & Kaplan, C. (2005), *Time for a Change: The Promise of Extended-Time Schools for Promoting Student Achievement*, Massachusetts 2020, Boston.
- Fenech, M. (2006). The impact of regulatory environments on early childhood professional practice and job satisfaction: A review of conflicting discourses. *Aust. J. early childhood* 31(2), 49-57.
- Freeman T., (2012), The Lancet highlights role of physics in medicine, *medicalphysicsweb*,

April 20, <http://www.iop.org/mt4/mt-tb.cgi/4415>

- Gamoran, A. (2006). *Strong Professional Community Benefits Teachers and Students*. Madison: University Of Wisconsin Press.
- Ganyaupfu, E.M. (2013). *Teaching Methods and Students' Academic Performance*
- Gersten, R., Chard, D., Jayanthi, M., Baker, S., Morphy, P., & Flojo, J. (2009). *A Meta analysis of mathematics instructional interventions for students with learning disabilities: Technical report*. Los Alamitos, CA: Instructional Research Group. Available from <http://www.inresg.org>
- Giam K.H. (2000). *Appreciation, Learning Styles and Use of Multimedia in Teaching and Learning*. Department of Science and Mathematics, MPSK. *Journal PendidikanTiga ENF* 1999/2000. 2 (3).
- GoK (2003). *Persons with Disabilities Act*. Government Printer: Nairobi.
- GoK (2018). *Special Needs Education Policy*. Government Printer: Nairobi.
- GoK (2010). *The Constitution of Kenya*. Government Printer: Nairobi.
- Gromada, A., & Shewbridge, C. (2016). *Student Learning Time: A Literature Review*. Paris: OECD Publishing. OECD Education Working Papers No. 127. <https://doi.org/10.1787/5jm409kqqkjh-en>.
- Groove, H. (2012). *Mozambique: Using education for empowerment of rural women*. Retrieved on 24th may 2016 at 2.00am from <http://www.educationforalln/devt.com>.
- Guskey, T. & Clifford, R. (2000). *Evaluating professional development*. ThousandOaks CA: Corwin Press.
- Hammer, D. (1996). Misconceptions or p-prims: How many alternative perspectives of Cognitive structure influence instructional perceptions and intentions? *Journal of the Learning Sciences*, 5, 97-128.
- Hanushek, E.A., Kain, J.F. & Rivkin, S.G. (2005). Teachers, schools, and academic achievement", *Econometrical* 73(2), 417–458.
- Harerimana, J.P., Ntahobavukira, B. & Adegoke, O.T. (2017). In-Service Education Programmes for Secondary School Teachers and Students' Academic Performance: A Case Study of Nyarugenge District in Rwanda. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, Volume 22(Issue 2), PP 100-115 e-ISSN: 2279-0837,p-ISSN: 2279-0845.
- Hinne, J.T. (2017). *Attitude towards Practical Work and Students' Achievement in Biology*:

- A Case of a Private Senior Secondary School in Gaborone, Botswana. *IOSR Journal of Mathematics (IOSR-JM)* 13.4: 06-11.
- Hirvonen P.E. & Viiri J. (2002). Physics teacher idea of the objectives of practical work. *Science & education*, 11, 305-316.
- Hudson, H.T. & Rottmann, R.M. (2006). Correlation between performance in physics and prior mathematics knowledge. *Journal of research in science teaching*, 18(4), 291-294. doi:10.1002/tea.3660180403
- Idris, N., Cheong, L.S., Nor, M.N., Razak, A.Z.A., & Saad, R. (2007). The Professional Preparation of Malaysian Teachers in the Implementation of Teaching and Learning of Mathematics and Science in English. *Eurasia Journal of Mathematics, Science & Technology Education*, 3(2), 101-110
- Ingvild, R. (2002). Norwegian deaf teachers' reflections on their science education: *Journal of Deaf Studies and Deaf Education, Implications for instruction*.7, 57-73.
- Jackson, A. & Davis, G. (2000). *Turning Points 2000: Educating Adolescents in the 21st Century*. New York: Teachers College Press.
- Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.
- Johnstone, J., Andermann, L., Milne, L. & Harris, D. (1994). *Improving civic discourse in the classroom: taking the measure of channel one (research report 4)*. Ann Arbor, MI: Institute for Social Research, University of Michigan.
- Juan, P. B. (1620). *The Adaptation of Letters and Art of Teaching Mutes to Speak*. Published by Francisco Abarca de Angulo, Madrid.
- “Kenya census 2009 - census Kenya”. Archived from the original on 3rd March, 2011. Retrieved 23 April 2018.
- Kidron, Y., & Lindsay, J. (2014). The effects of increased learning time on student academic and nonacademic outcomes: Findings from a meta-analytic review (R EL 2014 – 015). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Appalachia. Retrieved from <http://ies.ed.gov/ncee/edlabs>.
- Kigotho L.W. (2016). Barriers faced by learners with hearing impairment in inclusive learning environment, a case of university of Nairobi.

- King, M.B., & Newmann, F.M. (2000). Will teacher learning advance school goals? *Phi Delta Kappan*, 81(8), 576-580.
- Kisanji, J. (1999). *Key note address for the Workshop on "Inclusive Education in Namibia: The Challenge for Teacher Education"*, 24-25 March 1999, Rossing Foundation, Khomasdal, Windhoek, Namibia
- Knecht, W. (1965). *Teaching Physics Today*. Paris: OECD What research says to the teacher. *Instructional Science*, 31, 277-298
- Komba, W.L., & Nkumbi, E. (2008). Teacher professional development in Tanzania: Perceptions and Practices. *J. Int. Cooperat. Educ.*, 11: 67-83.
- Kombo, D.S., and Tromp, D.L. (2006). *Proposal And Thecae Writing. An Introduction*. Nairobi: Paulines Publications Africa.
- Kothari, C.R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.). New Delhi: New Age International Limited.
- Kuria, C.N. (2014). Factors Influencing Academic Performance of Students in Kenya Certificate of Secondary Education Examination: A Case of Roysambu Constituency, Nairobi, Kenya.
- Kuria S.M. (2014). Factors Affecting Enrolment and Performance in Physics Among Secondary School Students in Gatundu District, Kenya.
- Lang, H.G., & Steely, D. (2003). Web-based science instruction for deaf students: What research says to the teacher. *Instructional Science*, 31, 277-298
- Larson, B.C. (2000). Classroom Discussion: a method of instruction and a curriculum outcome. *Teaching and Teacher Education*, 16(2000), 661-677.
- Luckner, J.L. & Bowen, S. (2006). Assessment practices of professionals serving students who are deaf or hard of hearing: an initial investigation. *American Annals of the Deaf*, 151(4):410–417.
- Luft, P. (2016). What Is Different About Deaf Education? The Effects of Child and Family Factors on Educational Services. *The Journal of Special Education*, 1–11, DOI: 10.1177/0022466916660546.
- Lunetta, V.N., Hofstein, A., & Clough, M.P. (2007). Teaching and learning in the school science laboratory. An analysis of research, theory, and practice. In, S. K. Abell and N. G. Lederman (Eds), *Handbook of Research on Science Education*. Mahwah, NJ: Lawrence Erlbaum Associates, pp. 393–431.

- Mahulo, P. (2012). Influence of Teacher Training on the Performance of Students in Mixed Secondary Schools in Gem District, Kenya
- Maina, A.W. (2015). Influence of Competence in Practical Skills on Students' Performance in Biology Practicals in Secondary Schools in Kiambu County, Kenya.
- Maina, E.N., Adoyo, P.O. & Indoshi, F.C. (2011). Curriculum factors influencing performance of deaf students in mathematics. *Educational Research* (ISSN: 2141-5161), 2(3) pp.956-964.
- Manchishi, S. (2015). Factors Contributing To Low Achievement Levels in Mathematics Among Hearing Impaired Learners: A Case of Selected Schools of Lusaka, Zambia. Dissertation, Master of Education in Special Education. University of Zambia.
- Manduku, J., Boiyon, E., & Cheruiyot, A. (2017). In-service Teacher Training Programmes: Implications on Teacher Effectiveness in Secondary Schools in Kenya. *European Journal of Education Studies, Volume 3 (Issue 7)*, ISSN: 2501 – 1111.
- Marschark, M. (1993). *Psychological development of deaf children*. NY: Oxford University Press.
- Maxwell, J.A. (2005). *Qualitative Research Design. An Interactive Approach*. London: Sage Publications, Inc.
- Mbaabu, F.N., Gatumu, H.N. & Kinai, T. (2011). Factors Influencing Secondary School Students' Attitude Towards the Study of Physics in Imenti South District, Kenya. *Journal Of Research in Education and Society; Volume 2, Number 2*.
- Mbaluka, L.P. (2012). Analysis of strategies used in teaching speech and language: A case study Of Machakos School for the Deaf, Kenya.
- McCabe, S., & Macnee, L.C. (2008). *Understanding nursing research: using research evidence-based practice*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Millar, R., (2004). *The role of practical work in teaching and learning of science*. University of New York.
- Morton, S.M.B., Bandara, D.K., Robinson E.M., and Carr, P.E.A. (2012). In the 21st Century, what is an acceptable response rate? *Australian and New Zealand journal of public health*, 36(2). doi:10.1111/j.1753-6405.2012.00854.
- Moore, D.F. (1996). *Educating the Deaf: Psychology, Principles and Practices* (4th Edition). Boston: Houghton Mifflin Company.

- Moore, D.F. (2000): *Educating the Deaf. Psychology, principles and practices*. Boston: Houghton Mifflin
- Moore, D. (2001). *Educating the deaf*. Boston: Houghton Mifflin.
- Mriganka, N.A., (2015). Effectiveness of Web-Based Learning in Secondary School Education. *International journal of informative & futuristic research (IJIFR)*, 2(8), 2456-2461
- Mugenda, M., & Mugenda, G. (2003). *Research Methods: Quantitative and Qualitative Approaches*. Nairobi ACTS Press.
- Mugenda, A.G., (2008). *Social Science Reserach, Theories and Principles: applied Research and Training Services*; Kijabe Printing Press; Kenya.
- Murithi, E.M. (1996). *Expectation of Handicapped Students and their Teachers in Learning and Teaching of Science Subjects in Kenya Special Secondary School for the Physically Handicapped*. Unpublished Masters Thesis, Kenyatta University.
- Musasia, A.M., Ocholla, A.A., & Memba, E.B. (2012). Effect of Practical Work in Physics on Girls' Performance, Attitude change and Skills acquisition in the form two-form three Secondary Schools' transition in Kenya, *International Journal of Humanities and Social Science*, 2(23), 151-166
- Mwanyuma R. (2016). *Factor influencing the Academic Achievement of Deaf Learners in Kilifi County, Kenya: a cases of sahajana school for the deaf*.
- Ndegwa S.M. & Khamah, A.H. (2018). Influence of Curriculum Support Officers' Strategies on Sustainability of Early Childhood Development Education in Mvita Sub County, Mombasa, Kenya. *European Journal of Education Studies*, 5(1).
- Ndonyo, T.M., Matafwali, B. & Chakulimba, O.C. (2017). Structural Quality Factors In the Provision of Education to Pupils with Hearing Impairments: A Case of Selected Special Schools/Units in North Western Province of Zambia. *International Journal of Development Research*, Vol.07(9) pp.15556-15562
- Ng'etich J.K. (2008). *Factors Influencing Girls' Low Enrollment and Poor Performance in Physics: The case of Secondary Schools in Nandi South, Kenya*.
- Ngwoke, D.U., Atanga, N.J., Oyeoku, E.K., Ngwoke, A.N. & Obikwelu, C.L. (2013). Attitude of Secondary School Physics Students towards Mathematics; a case Study of Nsukka Education Zone in Nigeria and Adamawa Region in Cameroon. *Indian journal of applied research* vol. ISSN- 2249-555X.

- Nickerson, T.G & Kritsonis, A. W. (2006). Analysis of the Factors that Impact Academic Achievement Among Asian American, African American and Hispanic Students. Doctoral forum, National journal for publishing and mentoring student research volume 3 no. 1. Houston, Texas.
- Nilesh, A.N. (2011). 8th Grade Students' Attitude towards Mathematics and Mathematics Contribution Towards Physics in TIMSS. *International Journal of Teacher Education Research (IJTR) Vol. 4 No. 3 March 2015*.
- Odom, A., Stoddard, E.R., & LaNasa, S.M. (2007). Teachers' practices and middle school science achievements. *International Journal of Science Education*, 29(11), 1329-1346.
- Olutola, A.T., Iliyas, R.A. & Abdulsalam, N.A. (2017). Effects of Discussion Teaching Method on Senior Secondary School Students' Performance in English Language in Dutsima, Katsina State, Nigeria.
- Omutsani J.A. (2012). Factors affecting KCPE Performance of learners with hearing impairments in special schools in selected counties, Kenya.
- Omari, I. M. (2011). *Concepts and Methods in Educational Research*, Oxford: Oxford University Press.
- Orodho, A.J. (2005). *Essential of Education and Social Science Research Methods*. Masola Publisher.
- Orodho, J. (2008). *Techniques of writing research proposal and reports in educating and social sciences*. Nairobi : Reata Printers.
- Ottander C. & Grelsson G. (2006). Laboratory work: the teachers' perspective. *Journal of biological education*, 40(3), 113-11
- Otunga, N., Odeo, I. & Barasa, L. (Eds) (2011). *A handbook for curriculum and instruction*. Eldoret; Moi University Press.
- Patalano, F.L. (2014). Science Based Education for Students Who Are Deaf and/or Hard of Hearing.
- Pitsoe V.J. & Maila W.M. (2012). Towards Constructivists Teacher Professional Development. *Journal of Social Sciences* 8 (3): 318-324, 2012
- Plastow, N. (2016). Mixing-up Research methods: A recipe for success or disaster? *South African Journal of Occupational Therapy*, 46(1), 89-90.
- Rahman, F., Khalil, J.K., Jumani, N.B., Ajmal, M., Malik, S. & Sharif, M. (2011). Impact of

- discussion method on student performance. *International journal of business and social science*. 2(7).
- Roald, I., & Mikalsen, O. (2000). What are the Earth and the heavenly bodies like? A study of objectual conceptions among Norwegian deaf and hearing pupils. *International Journal of Science Education*, 22(4), 337–355.
- Robson, C. (2011). *Real world research* (3rded.). Oxford, UK: Blackwell.
- Rockoff, J.E. (2004). The impact of individual teachers on student achievement: Evidence from panel data, *American Economic Review* 94(2), 247–252.
- Rosangela, B.,& Xia, L. (2014). The Effect of In-Service Teacher Training on Student Learning of English as a Second Language. *Inter-American Development Bank*.
- Samuel, G.S. (2016). Students’ Academic Performance in Physics, Chemistry and Biology, a case study of some selected secondary schools in Fagge Local Government Area of Kano State.
- Schutt, R.K. (2006). *Investigating the Social World. The process and practice of research.* (5 ed.). thousand Oaks, CA: Pine Forge.
- Shah, I. & Khan, M. (2015). Impact of Multimedia-aided Teaching on Students’ Academic Achievement and Attitude at Elementary Level. Allama Iqbal Open University, Islamabad, Pakistan. *US-China Education, Volume 5 (Issue 5), pp 349-360*
- Shah, N. (2011). “Ethical Issues in biomedical Research publication”. *Journal of Conservative Dentistry*,14(3), 205-207.
- Shemwell, J.T.,& Furtak, E.M. (2010). Science classroom discussion as scientific argumentation: a study of conceptually rich (and poor) student talk. *Educational assessment*, 15(3), 222-250
- Shields,M. & Lennox, M. (2017). Strategies to Address Educational Need of Students Who are Deaf and Hard of Hearing. *TEACH journal of Christian education: vol, 11: Iss. 2, Article 2. <https://research.avondale.edu.au/teach/vol11/iss2/2>.*
- Sivapalan, S. & Ahmad, W.F.W. (2010). A Web-Based Multimedia Approach to Literature in Malaysia Secondary Schools: Learners Preferences. *European Journal of Social Sciences*,<https://www.researchgate.net/publication/228633423>.
- Stabback, P. (2016). What Makes a Quality Curriculum?. UNESCO International Bureau of Education,(2).

- Taber, K.S. (2010). Exploring student learning from a constructivist perspective in diverse educational contexts. *Journal of Turkish science education*. 5(1) p2-21
- UNESCO (1990). World conference on Education for All. Jomtien: UNESCO.
- UNESCO (1994). The Salamanca Statement and Framework for Action on Special Needs Education: World Conference on Special Needs Education: Access and Quality. Salamanca: UNESCO.
- UNESCO (2005).EFA global monitoring report 2005: Education for All, the quality imperative, (Paris, UNESCO).
- United Nations (2008). ‘Convention on the Rights of Persons with Disabilities’. Convention International.
- Vesel, J. (2006). *The Signing Science Dictionary research study report of findings*. Washington, D.C.:National Center for Technology Innovation.
- Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wadsworth, B. J. (1998). Piaget for the Classroom Teachers. New York: Longman.
- Waititu, M. (2004). Exploring and Students Perception of Difficulty in Topics Areas of the Kenya Secondary School Physics Syllabus. Unpublished Masters Thesis, Kenyatta University.
- Wambugu, P.W.,& Chang’eiwo, J.M. (2008). Effects of Mastery Learning Approach on Secondary School Students’ Physics Achievement, *Eurasia Journal of Mathematics, Science & Technology Education*, 4(3), 293-302
- Wilkinson, L. (2009). *Discussion methods*. Retrieved on September 5, 2016 from education. Com/reference/article/discussion-methods.
- Wright, D. (1969). Deafness, a Personal Account. London: Allen Lane the Penguin Press. p. 156.
- Yara, P.O. (2009). Students’ attitude towards Mathematics and academic Achievement in some selected secondary schools in southwester Nigeria. *European Journal of Scientific Research*36(3) PP.336-341 <http://www.eurojournals.com/ejsr.htm>.
- Yin, R.K. (2009). *Case study Research: Design and Methods*. Thousand Oaks: Sage Publications.
- Zakaria, E., Chin, L.C., &Daud, Y. (2010). The Effects of Cooperative Learning on Students’ Mathematics Achievement and Attitude toward Mathematics. *Journal of Social*

Sciences, 6(2), 272-275. <http://dx.doi.org/10.3844/jssp.2010.272.275>

Zakaria, E. & Daud, Y.M. (2009). Assessing Mathematics Teachers' Professional Development Needs. *European Journal of Social Sciences*, 8, 225-231.

APPENDIX A

CONSENT FOR THE PRINCIPAL AND SCHOOL MANAGEMENT

RESEARCH TITLE: *Aspects of Physics Curriculum Influencing Performance of Students with Hearing Impairment in Secondary Schools in Western Kenya*

I have understood the research study and have had the opportunity to ask questions where necessary.

I understand that forms two and three students will be invited to participate in the study by filling in questionnaires while the physics teachers will be interviewed by the researcher. Physics lesson observation will also be done as well as document analysis. Consent forms will be issued to parents for the students to participate in the study. The teachers will be explained for what the study involves and each be given a consent form which they may choose to sign.

I understand that our participation as a school is completely voluntary and there will be no penalty for any teacher or student who withdraws from the study or chooses not to participate.

I understand that the information offered will be treated with absolute confidentiality and will not be unduly disclosed. Neither our names nor that of the school will be recorded and any identifying information from the interviews will be removed. All the information will only be used as pertains to this study and not otherwise. Thank you.

Principal’s signature..... Date.....

Researcher’s signature..... Date.....

Please tear off and return to Hellen A. Kombija before or on the interview day

Contact: 0713665711

APPENDIX B

CONSENT FOR CURRICULUM SUPPORT OFFICERS FOR SNE

RESEARCH TITLE: *Aspects of Physics Curriculum Influencing Performance of Students with Hearing Impairment in Secondary Schools in Western Kenya*

I have understood the research study and have had the opportunity to ask questions where necessary.

I understand that I have been invited to participate in the research study through an interview with the researcher, and my participation is completely voluntary.

I understand that the information offered will be treated with absolute confidentiality and will not be unduly disclosed.

I understand that my name will not be recorded and any identifying information from the interviews will be removed. All the information will only be used as pertains to this study and not otherwise.

I understand that the summary of this report will be availed to me if I wish to have it.

I agree / do not agree to participate in the research study.

I wish/ do not wish to be given a summary of the report when it is complete.

Participant's signature..... Date.....

Researcher's signature..... Date.....

Please tear off and return to Hellen A. Kombija before or on the interview day

Contact: 0713665711

APPENDIX C

PARENT’S/GUARDIAN’S CONSENT FOR STUDENTS TO PARTICIPATE IN THE RESEARCH

RESEARCH TITLE: *Aspects of physics curriculum influencing performance of students with hearing impairment in secondary schools in Western Kenya*

I have understood the research study as explained by the researcher and do understand that my/our child will be required to participate in this study while at school.

I understand that my/our child’s name will not be disclosed and the information offered will be treated with absolute confidentiality and will not be unduly disclosed.

I understand that all the information will only be used as pertains to this study and not otherwise, and that my/our child’s participation is completely voluntary and he/she may withdraw from this research at any time without having to give reasons and without any penalty.

I understand that the summary of this report will be availed to us if we wish to have it.

I agree / do not agree to my/our child participation in the research

I wish/ do not wish to be given a summary of the report when it is complete.

Parent/Guardian signature.....Date.....

Researcher’s signature..... Date.....

Please tear off and return to Hellen A. Kombija before or on the interview day

Contact: 07136657

APPENDIX D

INTERVIEW CONSENT FORM

Research title: *Aspects of physics curriculum influencing performance of learners with HI secondary schools in Western Kenya*

Thank you for agreeing to be interviewed as part of the above research project. The interview will last for 45-60minutes. I don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time. This consent form helps the researcher to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

Would you therefore read the accompanying **information sheet** and then sign this form to certify that you approve the following:

- I have read and understood the project information sheet
- I have been given the opportunity to ask questions about the project.
- I understand that my taking part is voluntary; I can withdraw from the study at any time and I do not have to give any reasons why I no longer want to take part.
- I agree to take part in the project. Taking part in the project will include being interviewed and recorded (audio or video)
- the interview will be recorded and a transcript will be produced
- I will be sent for the transcript and given the opportunity to correct any factual errors
- I also understand that my words may be quoted directly. With regards to being quoted:

Please tick the appropriate	Yes	No
I wish to review the notes, transcripts, or other data collected during the research pertaining to my participation.		
I agree to be quoted directly.		
I agree to be quoted directly if my name is not published and a made-up name (pseudonym) is used.		
I agree that the researchers may publish documents that contain quotations by me.		

.....
Participant's Signature

.....
Date

.....
Researcher's Signature

.....
Date

Please tear off and return to Hellen A. Kombija before or on the interview day

Contact: 0713665711

APPENDIX E
QUESTIONNAIRE FOR FORM THREE STUDENTS

I am a postgraduate student at Jaramogi Oginga Odinga University undertaking a research study and I request you to participate in it. This questionnaire is aimed at collecting information on *aspects of physics curriculum influencing performance of students with hearing impairment in secondary schools in Western Kenya*. The information offered will be treated with absolute confidentiality and will not be unduly disclosed. All the information will only be used as pertains to this study and not otherwise. Your participation is completely voluntary. Kindly respond to the items with honesty.

INTRUCTIONS

- Do not write your name on this paper
- Please answer all the questions
- Where choices are given, choose the most appropriate in your own view by ticking

General information

1. Gender: Male Female
2. I like physics. Yes No
3. What made you choose physics? ***Choose the most appropriate by ticking***

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Encouraged by my previous marks					
I need it in my future career or job					
Easily understands the subject and interested					
Encouraged by my physics teacher					
The remaining optional subjects are my worst					
The teacher teaches well					

Influence of time on task on performance

4. Did you finish form two syllabus? Yes No
 If no, how many topics remained.....
5. Failure to finish form 2 syllabus negatively affects my performance in form 3.
 a) Strongly agree b) Agree c) Disagree d) Strongly disagree
6. When some topics are not covered in time, our teacher teaches faster in order to complete them.
 a) Strongly agree b) Agree c) Disagree d) Strongly disagree
7. We need more time for learning physics in class. Yes No

Influence of mathematical content on performance

8. Suggest possible reasons why some students drop physics in form two. ***Choose the most appropriate by ticking***

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Physics and mathematics are related and they don't like mathematics					
Fear of mathematical calculations in physics					
Mathematical calculations in physics are difficult					
Mathematical calculations lower physics scores					

9. Any other reason why some of your friends dropped physics.

.....

How do you find physics subject?

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Easy to understand					
Interesting but challenging					
Quite difficult to understand					

Influence of teaching methods on performance

10. Is there a physics laboratory in your school? Yes No

11. In one week, how many times do you have lessons in that laboratory?

- a) Once a week
- b) Sometimes
- c) We don't do at all

12. In order to pass physics very well, we need to use laboratory practicals more.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

13. Information communication technology (ICT) involves the use of all means of communication like prints, pictures, animations, audios, video clips, televisions (TV), internets, smart phones and any other media in storing and transmitting information. How many times is this used in the teaching and learning of physics?

- a) Always
- b) Sometimes
- c) Not used at all

14. I find physics lessons more captivating and enjoyable when ICT is used.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

15. Do you often have discussion times during physics lessons? Yes No

16. Discussions make me understand the some topics more.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

Thank you.

APPENDIX F
QUESTIONNAIRE FOR FORM TWO STUDENTS

I am a postgraduate student at Jaramogi Oginga Odinga University undertaking a research study and I request you to participate in it. This questionnaire is aimed at collecting information on *aspects of physics curriculum influencing performance of students with hearing impairment in secondary schools in Western Kenya*. The information offered will be treated with absolute confidentiality and will not be unduly disclosed. All the information will only be used as pertains to this study and not otherwise. Your participation is completely voluntary. Kindly respond to the items with honesty.

INTRUCTIONS

- Do not write your name on this paper
- Please answer all the questions
- Where choices are given, choose the most appropriate in your own view by ticking

General information

1. Gender: Male Female
2. I like physics. Yes No
3. Would you like to select physics in form 3? Yes No
4. What can make you choose physics? ***Choose the most appropriate by ticking***

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Encouraged by my previous marks					
I need it in my future career or job					
Easily understands the subject and interested					
Encouraged by my physics teacher					
The remaining optional subjects					

are my worst					
The teacher teaches well					

Influence of time on task on performance

5. Did you finish form one syllabus? Yes No

If no, how many topics remained.....

6. Failure to finish form 1 syllabus negatively affects my performance in form 2.

a) Strongly agree b) Agree c) Disagree d) Strongly disagree

7. When some topics are not covered in time, our teacher teaches faster in order to complete them.

a) Strongly agree b) Agree c) Disagree d) Strongly disagree

8. We need more time for learning physics in class. Yes No

Influence of mathematical content on performance

9. Suggest possible reasons why some students drop physics in form two. ***Choose the most appropriate by ticking***

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Physics and mathematics are related and they don't like mathematics					
Fear of mathematics calculations in physics					
Mathematical calculations in physics are difficult					
Mathematical calculations lower physics scores					

10. Any other reason why some of your friends dropped physics.

.....

 How do you find physics subject?

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Easy to understand					
Interesting but challenging					
Quite difficult to understand					

Influence of teaching methods on performance

11. Is there a physics laboratory in your school? Yes No

12. In one week, how many times do you have lessons in that laboratory?

- a) Once a week
- b) Sometimes
- c) We don't do at all

13. In order to pass physics very well, we need to use laboratory practicals more.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

14. Information communication technology (ICT) involves the use of all means of communication like prints, pictures, animations, audios, video clips, televisions (TV), internets, smart phones and any other media in storing and transmitting information.

How many times is this used in the teaching and learning of physics?

- a) Always
- b) Not always
- c) Not used at all

15. I find physics lessons more captivating and enjoyable when ICT is used.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

16. Do you often have discussion times during physics lessons? Yes No

17. Discussions make me understand the some topics more.

- a) Strongly agree
- b) Agree
- c) Disagree
- d) Strongly disagree

Thank you.

APPENDIX G

TEACHERS' INTERVIEW SCHEDULE

Hallo.

I am aware you are a teacher of physics in this school. This interview with you is conducted in order to get your opinion on aspects of physics curriculum that influence the performance of learners with HI in physics. I am looking for different perspectives and therefore there is no any right or wrong answer. If you don't mind, I will tape record this conversation in order to capture all the details and I'm assuring you that all your comments will remain confidential and no reference to any individual will be attached to the comments given in my report. If that's ok, I'll request that you be audible when you talk and if you have any question or comment you feel free to do so at any time.

General information

1. Which classes do you teach currently?
2. Have the mean scores in physics been high or low? *Probe*
3. To what extent has the school administration supported the teaching and learning of physics? *Probe*
4. Physics performance in regular schools has been relatively higher than that in schools for the HI. What's the difference all about in your opinion? *Probe*

Influence of time on task on performance

5. Comment on the length of physics syllabus in relation to time allocated for its study.
6. To what extent do you cover physics syllabus for all your classes yearly? *Probe*
7. What are some of the challenges experienced when teaching learners with HI? *Probe*
8. As a curriculum developer, given a chance, what changes would you propose on the physics syllabus for learners with HI in relation to time? *Probe*

Influence of mathematical content on performance

9. Students who are good in mathematics are also good in physics. Comment. *Probe*

10. Physics has terms that are very abstract in nature, sometimes lacking definite signs. Does this affect content delivery? *Probe*

Influence of teaching methods on performance

11. Which teaching methods do you often use in teaching physics? *Probe*

12. Explain the performance of your students on theory and practical exams. *Probe*

13. How often is ICT used? *Probe*

Influence of INSET on performance

14. Have you gone for any in-service education and training (INSET) program since employment in this school? *Probe*

15. Comment on the relevance of the INSET attended to you as a teacher of students with HI. *Probe*

16. How have the trainings attended changed your classroom behavior? *Probe*

17. Has the training been helpful in overcoming different student challenges and difficulties in the teaching and learning process? *Probe*

18. Comment on your professional preparedness and level of confidence to teach the subject in sign language after the trainings attended. *Probe*

19. In your opinion, what is the relationship between the teacher trainings and academic achievement of students with HI? *Probe*

Thank You..

APPENDIX H

PRINCIPALS' INTERVIEW SCHEDULE

Hallo,

I am aware you are the principal of this school. This interview with you is conducted in order to get your opinion on aspects of curriculum that influence the performance of learners with HI in physics. I am looking for different perspectives and therefore there is no any right or wrong answer. If you don't mind, I will tape record this conversation in order to capture all the details and I'm assuring you that all your comments will remain confidential and no reference to any individual will be attached to the comments given in my report. If that's ok, I'll request that you be audible when you talk and if you have any question or comment you feel free to do so at any time.

General information

1. Comment on your teachers' knowledge of sign language as mode of communication to learners with HI and ability to effectively communicate with the learners.

Influence of time on task on performance

2. In your opinion what are some of the unique challenges in relation to time that you think are encountered by teachers in teaching learners with HI as opposed to those in regular schools?

Probe

3. What is the influence of these challenges on pace of syllabus coverage and performance of students? *Probe*
4. Do you think your teachers complete all the syllabi in time? *Probe*
5. Learners with HI need much time in order to engage their cognitive abilities due to barriers of inadequate linguistic abilities and socio-cultural knowledge. How do your teachers make up for this time with the long physics syllabus that also requires even longer time for practicals?

Influence of content on performance

6. Comment on your teachers' professional preparedness and level of confidence to teach physics in sign language. *Probe*
7. Mathematics and physics are two related subjects. What do you think is the influence of students' attitude towards mathematics on attitude towards physics? *Probe*

Influence of teaching methods on performance

8. List some of the methods of teaching employed by your teachers. *Probe*
9. How can you comment on the ICT integration in teaching and learning? *Probe*

Influence of INSET on performance

10. Trends in teaching keep changing how do you ensure that your teachers remain relevant and effective in their work? *Probe*
11. In what ways do you ensure that your teachers are motivated to do their work despite the challenges encountered in teaching learners with HI? *Probe*
12. Any teacher professional development programs that your teachers attend? *Probe*
13. How often is internal quality assurance carried out to ensure teachers prepare adequately for lessons and content effectively delivered to learners? *Probe*

Thank You..

APPENDIX I
INTERVIEW SCHEDULE FOR CSO

Hallo,

I am aware you are the CSO for SNE in this sub county. This interview with you is conducted in order to get your opinion on aspects of physics curriculum that influence the performance of learners with HI in physics. I am looking for different perspectives and therefore there is no any right or wrong answer. If you don't mind, I will tape record this conversation in order to capture all the details and I'm assuring you that all your comments will remain confidential and no reference to any individual will be attached to the comments given in my report. If that's ok, I'll request that you be audible when you talk and if you have any question or comment you feel free to do so at any time.

General information

1. How have learners with HI constantly performed in physics as compared to their hearing peers? *Probe*
2. Are the instructional materials available in schools adapted for HI learners? Cite a few and their adaptations
3. Comment on the flexibility of the physics curriculum provided. *Probe*

Influence of time on task on performance

4. As one of the key persons behind curriculum implementation, comment on whether physics syllabus that is offered to learners with HI suit them. *Probe*
5. Explain how the length of time affects how much students are exposed to the content and skills and consequently performance in the subject.
6. Physics syllabus is long and also requires much time for practicals. Do you think teachers complete the syllabus? *Probe*

Influence of content on performance

7. Are the instructional materials for physics all in sign language? What is the impact on performance of learners with HI? *Probe*

8. Physics is related to mathematics. How does performance in one affect the performance of the other? *Probe*
9. Physics is challenging to teach the HI learners due to the existence of terms that are very abstract in nature, some lacking definite signs. How do you think this influences the effectiveness of content delivery by teachers? *Probe*

Influence of teaching methods on performance

10. List some of the teaching methods you recommend for teaching learners with HI and their advantages. *Probe*

Influence of INSET on performance

11. How often do you organize INSET programmes for teachers? *Probe*

Thank you..

APPENDIX J

OBSERVATION CHECKLIST FOR PHYSICS LESSON

Date..... Time started Time ended.....

Topic

Subtopic

Indicators	Researcher comments
Lesson notes and lesson plan present and used	
Content well mastered in line with the syllabus	
Simplifies the content and highlights key points. Signs used	
Appropriate and familiar examples used to illustrate concepts	
Varied teaching methods employed to enhance understanding-list	
Appropriate teaching and learning aids used	
Lesson teacher centered or learner centered	
Learners stimulated during the lesson	
Teacher innovation and creativity evidenced in the lesson	
Communicates using appropriate language	
Provide visual aids	

APPENDIX K

DOCUMENT ANALYSIS GUIDE


I am a postgraduate student at Jaramogi Oginga Odinga University undertaking a research study. This document is aimed at collecting information on *aspects of physics curriculum influencing performance of students with hearing impairment in secondary schools..*


This guide will be filled in collaboration with the teachers of physics. The information offered will be treated with absolute confidentiality and will not be unduly disclosed. All the information will only be used as pertains to this study and not otherwise.

No	Item	Availability				Remarks
		School A	School B	School C	School D	
1	Subject syllabus					
2	Schemes of work					
3	Lesson plan					
4	Students' progress Report					
5	Records of work covered					
6	Time table					

APPENDIX L


RESEARCH AUTHORISATION PERMIT


REPUBLIC OF KENYA


NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: **523400** Date of Issue: **20/January/2022**


RESEARCH LICENSE




This is to Certify that Ms.. Hellen AWUOR Kombija of Jaramogi Oginga Odinga University of Science and Technology, has been licensed to conduct research in Busia, Kakamega, Migori on the topic: **ASPECTS OF SCHOOL CURRICULUM INFLUENCING PERFORMANCE OF STUDENTS WITH HEARING IMPAIRMENT IN PHYSICS IN SECONDARY SCHOOLS IN WESTERN KENYA REGION** for the period ending : 20/January/2023.

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APPENDIX M

CLEARANCE BY ETHICS AND REVIEW OFFICE - JOOUST



**JARAMOGI OGINGA ODINGA
UNIVERSITY OF SCIENCE AND TECHNOLOGY
DIVISION OF RESEARCH, INNOVATION AND OUTREACH
JOOUST-ETHICS REVIEW OFFICE**

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Email: erc@jooust.ac.ke
Website: www.jooust.ac.ke

P.O. BOX 210 - 40601
BONDO

OUR REF: JOOUST/DVC-RIO/ERC/E4

20th November, 2021

Kombija Hellen Awuor
E452/4516/2014
JOOUST

Dear Ms. Kombija,

RE: APPROVAL TO CONDUCT RESEARCH TITLED “ASPECTS OF SCHOOL CURRICULUM INFLUENCING PERFORMANCE OF STUDENTS WITH HEARING IMPAIRMENT IN PHYSICS IN SECONDARY SCHOOLS IN WESTERN KENYA REGION”

This is to inform you that JOOUST ERC has reviewed and approved your above research proposal. Your application approval number is **ERC 20/12/21-4**. The approval period is from 20th December, 2021 – 19th December, 2022.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations and violations) are submitted for review and approval by JOOUST IERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to NACOSTI IERC within 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks of affected safety or welfare of study participants and others or affect the integrity of the research must be reported to NACOSTI IERC within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to JOOUST IERC.

Prior to commencing your study, you will be expected to obtain a research permit from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,

for
Prof. Francis Anga'wa
Chairman, JOOUST ERC

Copy to: Deputy Vice-Chancellor, RIO Director, BPS SEHSS