INFLUENCE OF TEACHING METHODS ON DEAF STUDENTS' ACADEMIC PERFORMANCE IN SCIENCES AT NGALA SCHOOL FOR THE DEAF, NAKURU COUNTY, KENYA

[1,2]Geoffrey Mienda Okeng'o, Dr. Lazarus Momanyi Okioma
[1]geoffreymienda@yahoo.com
Department of Education, Moi University

Abstract

The study sought to analyze teaching methods being used in class on deaf students' performance in sciences at Ngala Secondary Schools for the Deaf in Nakuru County, Kenya. The study used a descriptive case study design. The target population is 1 principal, 21 teachers, and 450 students of Ngala secondary school of the deaf. The sample size of the study comprised of; 1 principal, 5 science teachers and 153 students producing a sample of 159 participants. Data was collected using questionnaires, interview and lesson observation. It was analyzed by both quantitative and qualitative data collection strategies. The quantitative data was presented using percentages, frequency tables and charts while data from principal, teachers, students and lesson observation will be reported in narrative form based on major themes. The study found that majority of the teacher use learner centered teaching method as the best method in sciences. The study concluded that the most commonly used method of instruction is learner centered teaching method. The study recommended that the Ministry of Education Science and Technology (MoEST) in conjunction with Quality Assurance and Standard Officers (QUASO) should intensify inspection of schools for the deaf to ensure that teachers were using correct teaching methods that allowed learners to occupy an active role in the learning environment.

Key Words: *Teaching Methods, Students' Academic Performance, Deaf, Kenya*

1.0 Introduction

Over the last 40 years, results from numerous studies have indicated that deaf children have significantly poorer reading comprehension, literacy skills, and overall depressed academic achievement in general when compared to their hearing peers (Qi & Mitchell, 2012), decreasing the likelihood of enrollment in postsecondary education institutions (Garberoglio, Cawthon, & Bond, 2014). Historical analysis of the patterns and trends in education reveal that, people live and work in a highly changing society whose existence and sustainability is dependent on science. The increasing technological and industrial revolution in education, agricultural, health, and industrial growth marks one of the important milestones in history. While this has been used as a benchmark of development, it has gone a long way to define the economic power of many countries. Science subjects are increasingly viewed as subjects of life-long utility among students,

society and the country at large. This has been reiterated by McIntosh (1994) who states that scientific literacy has become a necessity for everyone as the need to use scientific information to make choices that a rise in everyday life increases.

Early educators such as Dewey and McLellan (1964)) believed that, effectiveness of teaching and learning are determined by the type of teaching strategies applied in classroom. National Research Council (2005) echoes the same sentiments when it asserts that, pedagogical practices that address students initial understandings and preconceptions about topics, provides a foundation of factual knowledge and conceptual understanding. While reviewing good teaching strategies in sciences, Roth and Gainier (2007) explored science learning in high achieving countries. This was based on "Trends in International Mathematics and Science Assessment of 1999. In their study, they used video tape to examine a random sample of 100, 8th grade science lessons in five countries; Czech Republic, Australia, Netherland, United States and Japan which were later analyzed for major themes.

According to Roth and Gainier (2007) education in Czech Republic had gone a notch higher producing well rounded individuals capable of driving the country's innovation. Strategies employed in classroom placed high premium on students' accurate understanding of science concepts. Students were usually exposed on challenging, often theoretical science knowledge and ideas and held accountable for understanding materials through scientifically, technical and challenging public discussion (Roth & Garnier, 2007). Lessons began with discussion which were then followed by calling students in front of the class to be quizzed by others orally and then graded on their multiple understanding of content idea as the lesson progressed. Practical and hands-on-activity were less emphasized and when used were specifically connected on the development of scientific ideas (Roth & Garnier 2007).

In Japan, teaching strategies emphasized scientific education as a gateway to industrial, technological advancement (Roth & Garnier 2007), this had enabled Japan to remain competitive on the global market where industrialization and technology are key. Lessons were developed conceptually and coherently with little emphasize on theoretical ideas (Roth & Gainier 2007), consequently learning was inductive oriented with strong focus on one or two main ideas that were developed in-depth and supported with data, phenomena and visual presentations. Teachers

encouraged brainstorming of ideas to reach at coherent conclusion which were then followed by a summary of main ideas of discussion enabling learners to reach at a more sophisticated understanding (Roth & Garnier, 2007). In Netherlands, Roth and Gainier (2007) observed that, learning science subjects were quite unique. In class, students assumed responsibility for their own learning and were expected to monitor their own work as well as progress. Text book and homework defined science lessons, content and organization, they observed. Class discussions were emphasized as a way of supplementing text book with teacher role being secondary, mainly responding on areas of difficulty in assignment as students continuously engaged in scientific discourse (Roth & Gainier, 2007).

In Kenya, a study conducted by KIE (1989) revealed, commonly used teaching strategies in class were, lecture, problem solving, examples and experimentation. However, Maina (2012) established that on average lecture, examples and problem solving were commonly used. Despite many teachers preferring these teaching strategies Baxter, Bass and Glaser (2000), Maree and Frasers (2004) caution that, a method as lecture contributes little to the development of skills, nurturing of inquiry attitudes and conceptual understandings of science. Ingosi (2011) noted that pedagogical practices that involved effective strategies were what distinguished good teaching from poor teaching. It's highly important to note that, learning in deaf schools is mainly done through Sign language, Bilingual Communication, Code Switching or Total Communication and hence it was important to carry out research on teaching methods teachers use on deaf learners in a science class at Ngala Secondary School for the Deaf. The remaining sections of this article are as follows: Section two covers literature review, section three covers materials and methods, section four results and discussion while section five conclusion and recommendations.

2.0 Literature Review

2.1 Teaching Methods Used on Deaf Learners in Science Class

In history of education, a great deal of research has focused on the practice of teaching as opposed to learning on the methods used and the problem that hinders teacher effectiveness (Njeri, 2010). Patton, Palloway and Cronin (1990) noted that, 38% of special education students hardly receive any instruction in science and that 90% of teachers who teach science to students with special needs often employ textbook centered teaching approach. This reveals many educators are

not usually aware of essential practices in science classroom which even becomes more difficult for them to design and execute instructional in classroom.

According to Maina (2012) the two methods documented by KIE used in curriculum coverage are the heuristic and didactic approaches. Heuristic methods which include; question and answer, demonstrations, investigations, probing, group work and discussions encourage active participation and involvement of students in the learning process compared to didactic approaches which tend to be teacher centered. Nwagbo (2001) while quoting research report on teaching approaches in many schools argues that, teachers usually shy away from more effective activity oriented teaching methods in preference for methods that are easy and mostly inappropriate such as lecture which is purely teacher centered, leaving students as passive recipient of knowledge supplied in classroom.

Fosnote (1996) cautions that in any learning environment, students should no longer be passive recipient of knowledge supplied by teachers and teachers should no longer be purveyors of knowledge and classroom managers. Dewey a strong proponent of child centered learning approach views a teacher as a helper whose key role is to challenge the learner to discover things for himself (Njeri, 2010). Ossai (2004) noted that, even in a good curriculum with a well-stocked laboratory; there will still be poor results in the hands of an incompetent teacher. A study conducted by Akubue (2008) on some strategies for effective teaching in social studies did establish that, the use of appropriate teaching strategy in class tends to bring about achievement of lesson objectives.

In Kenya, the issue of poor teaching strategies according to Njeri (2010) was raised by Ominde report of 1964. In this report, the Kenya Education Commission blamed the drill method of teaching for neglecting activity and pupil participation resulting in low achievement in education. The report encouraged teachers to adjust their teaching strategies to suit the needs of particular learners and to use activity methods so as to make education a child centered approach. It is highly important to note that these recommendations from different educators and teachers have not yet changed even after undergoing the relevant training (Njeri, 2010). This study sought to find out if teachers of science at Ngala Secondary School for the Deaf in Nakuru County are using relevant teaching methods at their disposal for teaching science subjects and whether they are following the learner centered approach advocated by Dewey and Ominde Commission of 1964.

3.0 Materials and Methods

The study used a descriptive case study design. This design was chosen because it gives a detailed investigation into the phenomenon under the study. The study used both qualitative and quantitative data collection strategies even though most of the Case studies emphasize qualitative approach. This was meant to minimize limitations of each method. The target population comprised of 1 principal, 21 teachers, and 250 students of Ngala secondary school of the deaf. The principal provided data on how students who are deaf had performed in sciences over the years, while teachers and students gave their views on array of teaching methods they are using in classroom. The sample size for this research was obtained using Slovins (2012) sample size determination formula. Slovins formula was proposed by Magigi (2015) to calculate appropriate sample of the study which is optimal and hence its adoption in this study. The formula is $n = \frac{N}{1 + Ne^2}$. Where n = required sample size, N = Population and e^2 = error limit (0.01 for samples between 100 and 1000). n = $\frac{250}{1+250*0.05^2} = \frac{250}{1.625} = \mathbf{153.85} \approx \mathbf{153}$ students at Ngala secondary school for the deaf.

The researcher used purposive sampling technique when sampling Teachers and Principals to take part in research. According to Orodho (2005), Purposive sampling techniques is handpicking the cases to be included in the sample on the basis of one's judgment of their typicality. The goal is to select cases that are likely to be "information rich" with respect to purposes of the study he contends. The main reason for using purposive sampling technique to sample principals and teachers was that; the sample size for study was small based on the research design adopted. On the other hand stratified random sampling techniques was used to select a sample size of 153 students. The school has four streams with a population of 450 students and 21 teaching staff.

Out of this sample size of 153 students, 117 are deaf students while 36 are hearing students. The classes of deaf students are three streams with hearing students occupying the fourth stream. Only Form Two to Four science students took part in the study. Form one students did not participate in the study owing to the fact that, they were yet to settle and did not have had reliable information touching on this study. On the other hand, out of 21 teachers, there are 6 science subjects teachers, Chemistry, Biology and Physics who took part in this study. The school principal also took part in the study by informing the researcher on how science subjects had been performed for years. The

study used questionnaires, interview and lesson observation schedules as instruments for data collection. There are two sets of questionnaires meant for science teachers and students respectively, then interview schedule for principal. Before the actual study, the researcher was carried out pilot study at Murang'a Secondary School for the Deaf. The school was picked because it is among schools that is perpetually performing poor in sciences. Only Chemistry subject was used in the study. Three chemistry teachers and six students were picked to fill the questionnaire while the principal was interviewed using interview schedule. The researcher also pre-tested observation schedules. This is quite essential as it helps the researcher in estimating reliability and validity of the researcher instruments.

In this study, validity of research instruments was determined through professional judgment by the supervisors. After the pilot study, reliability coefficient of all the instruments was determined. This was done through administering instruments to the participants involved in the study at different times in close succession using test-retest method. This was done in two consecutive days after which correlation between the two sets of data was determined using Pearson Product Moment Correlation Formulae. For lesson observation schedule the researcher made two different observations. One was done during morning session and the other during afternoon session for a period of two days. The degree of agreement between the two observations was then evaluated by the researcher together with the supervisor. The items on the list were then reviewed and redefined for accuracy before the actual study.

Teachers teaching sciences subjects were given questionnaires to fill. They were also observed in their respective classes and both qualitative and quantitative data collected following observation guide prepared. Each class was observed twice a week for a period of one month. Brief discussions were conducted with science teachers to exhaust all the information required for this study. Interviews with the principal were held at her own discretion and the venue decided by her within the period of the study. Lastly students were given questionnaires to fill under the supervision of the researcher assistance in their classes. They were also observed in their respective classes on how they are participating in the learning process when different teaching strategies are being used. Data collected by the researcher was analyzed both quantitatively and qualitatively. Quantitative data from closed, open ended questionnaires and lessons observations schedules were analyzed and presented by descriptive statistics. SPSS Version 20.0 was used in the analysis of the

quantitative data while qualitative data was analyzed based on major themes and then reported in narrative form.

4.0 Results & Discussions

The findings revealed that 58.1% of the students were male while 41.9% were female. This implies that majority of the students were of male gender. In regards to teachers, 3 (60.0%) were male while 2 (40.0%) were female. This implies that most of the teachers were male. The results were summarized in Table 1:

Table 1: Teachers and Students' Gender

		Students		Teachers	
		Frequency	**Percent**	**Frequency**	**Percent**
Gender	Male	61	58.1	3	60.0
	Female	44	41.9	2	40.0
Total		105	100.0	5	100.0

On teacher qualification, the study revealed that 20% of the teachers had Diploma in Special Needs Education, 20% had Diploma in Education Science, 40% had Bachelor of Special Needs Education and 20% Bachelor of Education Science. This implies that majority of the teachers had a bachelors' degree of Special Needs Education. The responses were as shown in Table 2.

Table 2: Teacher Qualifications

n = 5	**Frequency**	**Percent**
Diploma in special needs	1	20.0
Diploma in education (science)	1	20.0
BED special needs education (special needs)	2	40.0
BED (Science)	1	20.0
Total	5	100.0

The teachers were asked the training they had after graduation, 20.0% had training in Kenya sign language, 40.0% had training in SMASSE, 20.0% had exam marking skills while 20.0% had no other training after graduation. In relation to teaching experience, 20.0% had a teaching experience of between 0 and 2 years, 40.0% between 3 to 5 years, 20.0% between 6 to 9 years and 20.0% above 10 years as shown in Table 4.3: This implies that majority of the teachers who participated in this study had other qualification to justify their presence at Ngala secondary school as teachers of deaf students. The results were summarized in Table 3:

Table 3: Training and Teaching Experience

n = 5		Frequency	Percent
Training	Kenya sign language	1	20.0
	SMASSE	2	40.0
	exams marking skills	1	20.0
	nothing	1	20.0
Teaching Experience	0 - 2 years	1	20.0
	3 - 5 years	2	40.0
	6 - 9 years	1	20.0
	> 10 years	1	20.0

Teaching Methods Teachers use on Deaf Learners in a science Class

Teachers and students were asked to state commonly used teaching method in science class. Their responses were as shown in Table 4:

Table 4: Teachers and students responses on commonly used teaching methods in sciences

n =5 (Teachers)		Learner centered	Teacher centered	Teacher + Learner centered
Teaching strategies	F	3	1	1
	%	60.0	20.0	20.0
n = 105 (Students)		Learner centered	Teacher centered	Teacher + Learner centered
Biology	F	17	32	56
	%	16.2	30.5	53.3
Chemistry	F	25	46	34
	%	23.8	43.8	32.4
Physics	F	26	49	30
	%	24.8	46.7	28.6

60.0% of teachers reported using learner centered method, 20.0% teacher centered method while 20% teacher-learner-centered method. Learners were equally asked to state the commonly used teaching method in sciences, in biology 17 (16.2%) revealed that teachers use learner centered method, 32 (30.5%) mentioned teacher centered method and 56 (53.3%) teacher and learner centered methods. In chemistry, 25 (23.8%) revealed that learner centered approach was being used, 46(43.8%) teacher centered, 34 (32.4%) teacher plus learner centered. In physics, 26 (24.8%) learner centered, 49 (46.7%) teacher centered and 30 (28.6%) teacher plus learner centered. However, when teachers were asked to rate students understanding of science subjects when teacher-centered method, learner-centered method and teacher-learner-centered methods were used; their responses were as shown in Table 5.

Table 5: Teachers responses on how students are likely to understand science in class when different teaching methods are used

n = 5 (teachers)		A lot	Little	Nothing
Teacher centered	F	2	2	1
	%	40.0	40.0	20.0
Learner centered	F	1	2	2
	%	20.0	40.0	40.0
Teacher + Learner	F	2	2	1
	%	40.0	40.0	20.0

Forty percent of teachers reported that students are likely to understand sciences in class a lot when teacher-centered method was used, 40% reported to understand a little while 20% nothing. On learner-centered method, 20.0% reported to understand a lot, 40% a little while 20.0% nothing. When teacher-learner-centered method is used, 40% reported to understand a lot, 40% a little while 20% nothing. Analysis of students' responses revealed that 22(21.0%) acknowledged that they understood a lot science when teacher centered method is used, 51 (48.6%) little and 32(30.5%) nothing. 19 (18.1%) revealed that learner centered approach made them understand science a lot, 48(45.7%) little extent and 38(36.2%) nothing. In regards to teacher plus learner method, 50 (47.6%) of the students revealed they understood science a lot, 46(43.8%) little and 9 (8.6%) nothing as shown in Table 6:

Table 6: Students responses on how they are likely to understand science when different teaching methods are used in class

n = 105 (students)		A lot	Little	Nothing
Teacher centered	F	22	51	32
	%	21.0	48.6	30.5
Learner centered	F	19	48	38
	%	18.1	45.7	36.2
Teacher + Learner	F	50	46	9
	%	47.6	43.8	8.6

Interview with the principal reported that learner-centered method was the best for teaching sciences. Observation in learning trends supports learner-centered method as it provided opportunity to each learner to demonstrate his/ her understanding of science knowledge in class. However, teachers' responses seemed to contradict the method they were using with what they believed was the best teaching method in science class. Inspite of them knowing that learner-centered method was the best method for teaching science; most of them were deliberately using teacher-learner-centered method.

These findings agree with Nwagbo (2010) who observes that, teachers usually shy away from more effective activity oriented teaching methods in preference for methods that are easy and mostly inappropriate. Even though learners had shown preference for teacher-learner-centered method; this teaching method had failed to guide science learning as majority of the teachers were already using it and the performance had not been good. Observations in class revealed this method cultivated passive learning in class. Most of the learners assumed the teacher was the sole knowledge in class and hence could not engage in self-directed studies without the teachers' input. They were actually passive recipient of the knowledge supplied by teachers in class.

Fosnote (1996) proceeded with caution that, in any learning environment, students should no longer be passive recipients of knowledge supplied by teachers and teachers should no-longer be purveyors of knowledge and classroom managers. It was indeed intriguing to see a Form Two student asking the teacher the meaning of water when he was teaching on materials necessary for the process of photosynthesis. This implied that learners solely depended on the teacher in all aspects of their learning. They could not understand the meaning of water which was a simple term a class one student should have been able to comprehend. These finding raised the need for a learner-centered approach, an approach that allows learners unlimited time and to move at a pace that allows for continuous monitoring of achievement of learning objectives giving instant feedbacks and timely intervention. Akubue (2008) studied on "Some Strategies for Effective Teaching in Social Studies" and he establishes that, the use of appropriate teaching strategy in class tends to bring about achievement of lesson objectives. Teachers were again asked to state teaching method they preferred when teaching practical, concepts, doing revisions and when demonstrating. Their responses were as shown in Table 7:

Table 7: Teaching method preferred when doing practical, explaining concepts, doing revision, and when demonstrating

		Learner centered	Teacher centered	Teacher + Learner
Practicals	F	3	1	1
	%	60.0	20.0	20.0
Explaining concepts	F	1	1	3
	%	20.0	20.0	60.0
Revision	F	3	1	1
	%	60.0	20.0	20.0
Demonstrating	F	2	2	1
	%	40.0	40.0	20.0

Sixty percent of teachers reported to prefer learner centered method during practicals, 20% preferred teacher centered and 20% opted for teacher plus learner method. When asked about explaining concepts, 20% preferred learner- centered 20% teacher-centered, while 60% teacher-learner-centered method. When doing revision, 60% reported to prefer learner-centered method, 20% teacher-centered method while 20% teacher-learner-centered method. When demonstrating 40% reported to prefer learner-centered method, 40% teacher centered method while 20% teacher-learner-centered method.

Analysis of the findings revealed, majority of teachers **(**71.4%) preferred learner-centered method when doing practical's while teacher-centered method was lowest at 0%. Teachers reported that, this method engages learners in the actual learning process. By manipulating materials by themselves, the learners were able to draw relationship between variables being studied in class leading to better understanding. Observations in learning trend equally support learner-centered method as it provided opportunity to all learners to demonstrate their understanding of subject matter in class.

These findings concur with Dewey (1964) who observes that, in any learning environment, the role of the teacher is that of challenging the learner to discover things for himself as cited by (Njeri 2012) when explaining the concept, majority of teachers (42.8%) preferred teacher-learner centered method while learner-centered method was lowest at 14.28%. The teacher stated that this method was worth as it involved learners in actual learning through questions and answer methods to ascertain those who were understanding and those who were only in class. However, observation

in class revealed that, the teacher remained the principal focus in the learning process. The teacher kept on repeating one concept every time but whenever he had to ask the students the meaning of the same concept; most of them responded by saying, *"I have forgotten".* Learning seemed to be more of drilling other than understanding. Ominde report of 1964 cautions on drilling method in learning as it neglect students activities and participation leading to low achievement in education. When doing revision, both learner and teacher-learner-centered method were viewed as best methods at 42.8% while teacher-centered as the worst at 12.5%. Teachers reported that, teaching and learning must be a coordinated effort if it's to achieve the intended purpose of benefiting the learner. If it was out of this, then the whole process was destined to fail.

When demonstrating, teacher-centered method was seen as the best method at (71.4%), while learner-centered method and teacher-learner-centered method at (14.28%). It was reported that some demonstrations were too hazardous to be handled by learners hence need for teachers to demonstrate such experiments. Though the school had a well-stocked laboratory some teachers took a completely different approach to their teaching. Some assigned students in groups and took a back seat in office storytelling as the students did demonstration in the lab by themselves. This was detrimental to them and to their success in sciences. These findings concurs with Ossai (2001) who states that, even in a good curriculum with a well-stocked laboratory, there will still be poor results in the hands of an incompetent teacher.

5.0 Conclusions and Recommendations

The study concluded that, learner-centered method was the best teaching method in science classroom. This method allows learners unlimited time to interact with the learning materials and to learn at a pace that allowed for timely intervention. The study also concluded that, most teachers are using teacher-learner-centered method in their teaching. According to observation done in class, the teacher-learner-centered method engages learners passively in the learning process. The study recommends that the Ministry of Education Science and Technology (MoEST) in conjunction with Quality Assurance and Standard Officers (QUASO) should intensify inspection of schools for the deaf to ensure that teachers were using correct teaching methods that allowed learners to occupy an active role in the learning environment. This study was delimited to secondary schools alone, a study should assess the effect of teaching methods on student's academic performance in primary schools for the deaf in Kenya.

References

1. Akubue, F.N. (2008). Some strategies in effective teaching with particular references to social studies. *The Journal of Education Research*, 14 (2), 201-209.
2. Baxter, G., Bass, K., & Glaser, R. (2000). *An analysis of notebook writing in elementary science classrooms.* Los Angeles: National Centre for Research on Evaluation and Student Testing.
3. Dewey, J., & McLellan, J. (1964). What psychology can do for the teacher. John Dewey on education: *selected writings*, 195-211.
4. Fosnote, C. T. (1996). *Enquiring Teachers; Enquiring Learners: A constructivist Approach for Teaching.* New York: Teachers College Press.
5. Garberoglio, C. L., Cawthon, S. W., & Bond, M. (2013). Assessing english literacy as a predictor of post school outcomes in the lives of deaf individuals. *Journal of deaf studies and deaf education*, 19(1), 50-67.
6. Ingosi, J. (2011). *Instructional strategies and students acquisition of science process skills in secondary schools in Kisii Central District of Nyanza Province, Kenya*: Unpublished master's thesis, Kisii University.
7. Maina, E. (2012). *Curriculum factors influencing student's performance in mathematics*. Unpublished master's thesis, Maseno University.
8. McIntosh, R. A., Sulzen, L., Reeder, K. & Kidd, D. H. (1994). *Making science accessible to deaf students*. American Annals of the Deaf.
9. Njeri, M. M. (2010). *A review of accelerated christian education programme and the implication of the 8:4:4 system of education*: Unpublished master's thesis, Kenyatta University.
10. Nwagbo, C. (2001). The relative efficacy of guided inquiry and expository method on the achievement in Biology of students in different levels of scientific literacy. STAN, 36(1-2).
11. Orodho, A. J. (2005). *Essential of education and social science research methods.* Masola Publisher.
12. Ossai, U. A. (2004). *Attitudes of biology teachers to research and research findings*. STAN Proceedings of the 45th Annual Conference.
13. Patton, J., Polloway, E., & Cronin, M. (1990). *A survey of special education teachers relative to science for the handicapped*. Unpublished Manuscript, University of Hawaii, Honolulu. Rev. Muhoro Secondary School for the Deaf; KCSE Performance Index, 2008-2013 Accessed from office of the Dean on 6 Feb 2013.
14. Roth, K., & Gainier, H. (2007). *What science looks like: an international perspective.* Retrieved from https://www.ascd.org/publications/education
15. Qi, S., & Mitchell, R. E. (2011). Large-scale academic achievement testing of deaf and hard-of-hearing students: Past, present, and future. *Journal of Deaf Studies and Deaf Education*, 17(1), 1-18.