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Research Paper

Communication Challenges of Teaching Science to the Deaf and the Strategies Ghanaian Basic School Teachers are using to mitigate them during Teaching Science to basic school Pupils with deafness

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ABSTRACT:
Purpose: *The study was to identify the challenges associated with the communication of scientific terms, principles and procedures during the teaching of science to Ghanaian basic school pupils with deafness and the strategies teachers are using to mitigate them.*
Method: *The study was carried out using the Pragmatist Approach and the Concurrent Triangulation Mixed Methods Research Design. The Homogenous Purposive Sampling Technique was used to select the three schools for the study based on the number of pupils with deafness in them and the Multi-Stage Census Sampling Technique was used to the select thirty-two (32) respondents. The respondents were made up of three (3) head teachers, twenty (20) science teachers and nine (9) science teacher support staff (resource persons) based on their duties in relation to the teaching of Science to pupils with deafness in the selected schools. Both qualitative and quantitative data were collected using semi-structured interviews, structured checklist and a closed-ended questionnaire. For the data analysis, thematic analysis was used to analyse the qualitative data that is the data from the semi-structured interviews and descriptive statistics was used to analyse the quantitative data that is the data from the checklist and questionnaire.*
Results: *The study identified insufficient relevant previous knowledge of the pupils with deafness in both the content and language of science, lack of standard or uniform hand shapes/hand forms (sign language) to communicate the science terms, principles and procedures being imparted, inadequate visuals to communicate concepts that are difficult to explain in sign language or illustrate through diagrams and sketches and the lack of teachers and resource persons (interpreters) with dual knowledge in science and special education (EHI) as the major challenges Ghanaian Basic School Teachers faced during the teaching of Core science to pupils with deafness.*
To curtail these challenges, the teachers appreciated the linguistic limitations of the pupils with deafness, thus, they (the teachers) aimed at getting the pupils to understand and assimilate the science terms, principles and procedures (knowledge and concepts) being imparted, the skills being taught and to acquire the vocabulary associated with them by using role play, demonstration, picture cards and illustrations. The teachers also constantly repeated the taught concepts and made conscious efforts to assist the pupils to note and identify the similarities and differences between words that are being used with ample emphasis on the correct spelling of the words.
Conclusion: *This study has shown that the challenges Ghanaian Basic School Teachers faced during the teaching of science to basic school pupils with is widespread from teacher factors through pupil factors to school factors like lack of adequate teaching and learning resources. The strategies teachers are using to overcome the identified challenges vary from school to school with the common ones being role playing and demonstration, picture cards and illustrations and a constant repeated the taught concepts. The key revelation made is that none of the teachers involved in the study and their supporting staff (resource persons) had dual knowledge of Science Education and Special Education (EHI). This is a grave concern that calls for imminent action because for the teaching of science to pupils with deafness to reach appreciable levels then teachers teaching science to them and the support staff (resource persons) should have significant expertise in both the content and language of science.*
Key Terms: *Pupils with deafness, Impairment and Science teacher*

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I. INTRODUCTION:

Science is one of the four core subjects examined at the basic level of education in Ghana to develop in pupils a scientific culture which aligns with the country's strategic programme of achieving scientific and technological literacy in the shortest possible time. This is due to the fact that sound scientific culture is an antithesis to superstition and a catalyst for national development. Thus, the focus of science teaching at the basic level of education in Ghana is to: (i) inculcate scientific literacy and culture for all so that people can make informed choices and (ii) produce competent professionals in the various science disciplines (The Ministry of Education, 2012a, b & c). Consequently, the teaching of science at the basic level involves a systematic observation of natural events and conditions and the understanding of the knowledge, skills and concepts being imparted in order to discover the facts underlying them (Bell, Urhahne, Schanze & Ploetzner, 2010; Flores & Rumjanek, 2015; Campbell & Jobling, 2012; Kimani, 2012). Accordingly, Gudyanga, Wadesango, Eliphanos and Gudyanga, (2014) and Andrews (2017) the teaching of science should be an enquiry directed activity that helps learners gain a deeper understanding about themselves and the nature of the things around them. Thus, during the teaching of science, especially during the teaching of science to persons with deafness, the focus should be on the learner rather than the teacher. Teachers must therefore guide learners to construct new knowledge or acquire new skills by using pre-existing knowledge, experiences, exploration and information (Lang, 2014). Consequently, teachers must provide enough avenues for students with deafness to conduct investigation and exploration during their science studies and to communicate their discoveries using the appropriate science terms.

Akram, Mehboob, Ajaz and Bashir (2017) reconnoitred the teaching of scientific concepts to Grade VIII Pakistani students with and without deafness. The researchers found that the students without deafness scored higher on Science tests than their counterparts with deafness because teachers and parents believed that the students with deafness could not learn scientific concepts as a result of their hearing loss and so they (the students with deafness) were not involved in first-hand exploration and investigation during science lessons. However, the simultaneous presentation of verbal information with non-verbal materials facilitated a better understanding of concepts by the students without deafness resulting in their faster learning and better retention of facts to the detriment of those with deafness. Additionally, Im and Ok-Ja (2014), Kimani (2012) and Adam (2017) posited that teaching strategies that focus on written expression and enquiry skills through scientific activity can improve the literary (language) proficiency of students with deafness as well as increase their learning success in science.

Kimani (2012) indicated that students with deafness in Kenyan schools are not performing creditably. This, she designated, was due to the fact that though there are enough textbooks for teaching students with deafness in Kenyan elementary schools, the students with deafness did not benefit from them (the available textbooks) because the design of the textbooks did not meet to their learning needs. She added that effective communication during lessons was also quite difficult because majority of the hearing teachers lacked sufficient proficiency in the Kenyan Sign Language – the language of instruction in Kenyan Schools for the Deaf and so majority of the students with deafness did not benefit from classroom discourse.

A study of the Chief Examiners' Reports on Integrated Science at the Basic Education Certificate Examination (BECE) over a six year period in Ghana showed that the reports consistently raised issues such as basic school pupils consistently exhibiting poor spelling of key words and terms, writing wrong facts to most of the posed questions and inability to apply scientific knowledge to explain physical phenomena (West African Examination Council 2010; 2011; 2012; 2013; 2014 & 2015). The reports, however, did not make categorical statements about the pupils with deafness who took part in the examination though statistics at the GES headquarters (Special Education Division) indicated an abysmal performance of pupils with deafness in science. In the year 2015 for instance, only twenty (20) pupils with deafness out of the two hundred and thirteen (213) presented for Integrated Science at the Basic Education Certificate Examination (BECE) had proficient levels (aggregate 1 to 6) in the subject representing 9.38% but their actual aggregates were 4, 5 and 6

Additionally, in Ghana, students with deafness have not been given the opportunity to study Elective Science subjects at the Secondary Technical School for the Deaf (the only secondary technical school for persons with deafness in the country) like all the other secondary technical schools (Dosoo, 2011). One important factor accounting for this, according to Dosoo (2011), is the low achievement scores of pupils with deafness in Integrated Science at the Basic Education Certificate Examination. It is worth noting that pupils with deafness in Ghanaian basic schools study under three different settings namely; the segregated or special school setting, the mainstreamed or unit school setting and the integrated or inclusive school setting but study the same curriculum and write the same exams as basic school pupils without deafness. Thus, if basic school pupils without deafness have issues with the teaching of Science to the extent that it is reflected in their BECE outcomes and basic school pupils with deafness are exhibiting low achievement scores in Integrated Science at the BECE to the extent that they have not been given the opportunity to study Elective Science at the senior high school level, then there is the need to conduct an in-depth study into the challenges Ghanaian basic school teachers face during the teaching of science to pupils with deafness and the strategies they are using to overcome them with ample emphasis on communication of scientific terms, principles and procedures.

II. METHODOLOGY:

The Pragmatist Approach was used to carry out the study using The Concurrent Triangulation Mixed Methods Research Design. The researcher used three (3) tools to collect the data for this study. The tools that were used for the data collection were structured observation checklist, semi-structured interviews and a closed-ended questionnaire. The underpinning of items on the instruments were imbedded in the research questions based on the variables of the study.

Observation checklist: The researcher, with the assistance of two research assistants, used a structured observation checklist to collect the needed data through lesson observations. Kankam and Weiler (2010) noted that most often than not, actions are more evidential than words, thus, when a researcher sees what happens in context, it enables or him or her to have a better understanding of the events and occurrences while at the same time identifying other important issues that might have been overlooked although people might change their behaviour thereby making it difficult to tell which occurrences are important to note. For this study, the checklist was used to register the occurrence of incidents and events (communication challenges Ghanaian basic school teachers faced during the teaching of science to pupil with deafness and strategies they were adopting to overcome them) using a five-point Likert scale. The options and points on the Likert Scale ranged from Very Good (VG) = 5, Good (G) = 4, Average (A) = 3, Below Average (BA) =2 to Poor (P) = 1.

The checklist was employed as a tool for carrying out the observation in this study because it accorded the researcher an opportunity for consistency in observation over the stipulated time, varied settings and among the different observers. Also, the checklist allowed the researcher to determine the frequency of events and occurrences. Although the checklist is easy to create and use, it has the disadvantage of being specific to a particular situation or phenomena (Creswell, 2013).

Semi-structured interviews: The face-to-face form of semi-structured interview was used to collect data from the head teachers and the science teacher support staff (resource persons). The semi-structured interviews were used as one of the data collecting tools for this study because Creswell (2008) noted that although semi-structured interviews have structured questions the order can be rearranged based on the interviewer's perception of what seems most appropriate at each point in the discussion or interview session and also provides the researcher the opportunity to probe further into raised issues by asking relevant questions that had not been included in the interview guide. This flexibility made room for the omission of inappropriate questions, ask for the clarification of issues raised in the discussion and for the addition of follow-up questions. Also, semi-structured interviews have the ability to gather data on more intangible aspects of the school's culture such as values, assumptions, beliefs, wishes and problems. As a result of this realization, the researcher deemed semi-structured interviews an appropriate tool to collect data for this study since the tool had the advantage of supplying large volumes of in-depth information based on the respondents' opinions, beliefs and feelings about the situation in their own words (Creswell & Creswell, 2018; Ary, Jacobs & Razavieh, 2003).

The face-to-face form of interview also enabled the researcher gather much information from non-verbal responses such as facial expression, tone of voice and avoidance of questions to get a deeper understanding of what the respondent is saying (Kankam & Weiler, 2010; Cohen, Mannion & Morrison, 2007). However, the tool takes a long time to administer and so the researcher cannot get to many people over the given time frame, therefore, the researcher used the tool on the head teachers and science teacher support staff (resource persons) because of their small numbers. Two semi-structured interview guides were used. One for the head teachers and the other for the science teacher support staff (resource persons).

The interview items focussed mainly on communication challenges the teachers faced during the teaching of science to the basic school pupils with deafness and the strategies the teachers were using to overcome them.

Questionnaire: A five (5) point Likert Scale questionnaire was prepared and used to collect data from the science teachers. The questionnaire had two parts labelled A and B. Part A was used to collect the demographic data of the respondents and it had nine (9) items. Part B had fifteen items and was used to collect data on the communication challenges of the teachers and the strategies they were using to overcome them during the teaching of science to pupils with deafness.

The researcher considered the questionnaire a data collecting instrument because according to Cohen, Mannion and Morrison (2007) questionnaires are simple to administer and the collected data is also easy to analyse. Additionally most of the respondents in a given study are familiar with the questionnaire and the data it seeks to collect. Furthermore, questionnaires have the added advantage of providing the researcher an opportunity to reach a large sample size at a relatively low cost.

The researcher adopted the questionnaire as a tool to collect data irrespective of the sample size of the Science teacher respondents because Zeldin, Britner and Parages (2008) opined that questionnaires provide anonymity to research respondents because the researcher will not be able to identify which respondent made a particular statement. Borg (2013) recorded that teacher respondents are usually not comfortable with interviews for fear of

intimidation, accordingly, the researcher considered the questionnaire a reliable tool to obtain valid data from the Science teachers.

Validity of instruments: For this study, both face and content validity were used to ensure the validity of the data collected via the instruments. Face validity according to Ofori and Dampson (2011) concerns itself with the respondents' acceptability of the instrument and the motivation to respond to them. To achieve face validity of the instruments, the salient issue in each item on the instruments was highlighted to serve as a prompt to the respondents on the demands of each item in order to facilitate a quick understanding and response.

The content validity of an instrument concerns itself with the examination of the qualitative extent to which the specifications of the test items match the specific purpose for which they were designed (Zeldin, Britner & Parajes, 2008). For this study, emphasis of content validity was placed on the challenges associated with communication of scientific terms, principles and procedures in a science lesson or classroom for basic school pupils with deafness and the strategies teachers are using to overcome them.

To enhance the validity of the collected data, the researcher used the checklist with the help of two research assistants (the observation team). The observation team met for deliberations on how the observations were to be made and how the collected data will be organized before recording was made. Additionally, all the semi-structured interviews were tape recorded, transcribed and sent back to the interviewees for modification, rejection or confirmation before they were accepted by the researcher as collected data. This was done after the researcher had sought the assistance of her supervisors in the design of the instruments. After discussing the objectives of the study, the supervisors assisted to reshape the items on the instruments before they were used to collect the needed data.

Reliability of instruments: To ascertain the reliability of the instruments, the data derived from both the questionnaire and checklist during the pre-testing of the instruments based on the subscales that were used were entered into the Statistical Package for Social Sciences (SPSS) version 16.0 to compute the Cronbach Alpha co-efficient. This was done to determine the internal consistency and inter-rater consistency of the various subscales. After the analysis of the items on the instruments, a Cronbach Alpha co-efficient of 0.94 was obtained for the items on the questionnaire and 0.75 was obtained for the items on the checklist. Ofori and Dampson (2011) noted that a Cronbach Alpha of 0.70 or more is considered reliable, thus, the researcher deemed both the questionnaire and checklist reliable instruments for the collection of the needed data.

Dependability of instruments: The dependability of instruments denotes the ability of the validated tools to elicit the data that will bring out results which will enable the researcher to deduce findings and draw conclusions that are verifiable and reliable. To ensure the dependability of the findings and conclusions of this study, clear questions that reduced the biases and subjectivity of the researcher during the interview sessions were used (Kusi, 2012).

To further ensure the dependability of the data obtained via the semi-structured interviews, the researcher made a transcription of all the collected data and sent them back to their corresponding respondents for cross checking and rejection or confirmation of the ideas presented. The respondents were made to read through the transcriptions and where necessary, they made the necessary corrections and further inputs. After this process, the researcher again read through the transcriptions to the respondents in order to give them another chance to modify or reject the ideas presented. This was done because Zeldin, Britner and Parajes (2008) asserted that in order to get a dependable data from an interview schedule, the researcher should always ensure that the collected data (i) concurs with the wishes of the respondents (ii) the results of the collected data makes sense and (iii) the collected data is consistent and dependable such that others intending to conduct the same study will obtain similar if not same results.

Credibility of instruments: Credibility essentially requires of the researcher to link the findings of the research study to reality in order to demonstrate the truth of the research findings (Tracy, 2010). Korstjens and Moser (2018) asserted that primarily credibility is concerned with the features of truth and value. To ensure the credibility of the data gathered by the semi-structured interviews, there was a prolonged engagement with the research participants by the researcher to foster member check and triangulation.

The researcher ensured prolonged engagement with the interviewees by asking them various questions based on the on the variables of the study. Additionally, the researcher encouraged the interviewees to give examples to support their claims. The researcher also asked follow up questions when there was the need for clarification of some of the issues raised. These were done to ensure that the findings made represented plausible information drawn from the interviewees' original data and that the collected data was a correct interpretation of the participants' original views.

All the transcripts were sent to the interviewees to enable them correct the interpretations and to challenge what they perceived to be wrong interpretations. After the necessary corrections, the researcher resent the data to the interviewees for confirmation before the data was admitted as a finding. This was done to fulfil the underpinnings of member check as a factor of credibility (Creswell, 2014; Zeldin, Britner & Parages, 2008). The collected data from the two categories of interviewees (the head teachers and the Science teacher support staff or

resource persons) were then triangulated to gain a complete understanding of the issue under study (Guest, MacQueen & Namey, 2011).

Pre-testing of instruments: The instruments that were used to carry out the study were pre-tested at the Sekondi School for the Deaf (SEKDEAF) from 18th July, 2016 to 22nd July, 2016 with the help of two research assistants who have been trained by the researcher. This was done after the Headmaster of the school had been contacted by the researcher with an introduction letter from the Head of Special Education Department, University of Education, Winneba seeking the consent and assistance of the school to carry out the pre-test.

The Headmaster introduced the researcher to the Head of Science Department and tasked him to assist her (the researcher) to get access to the teachers, pupils and school facilities for teaching science. Eight (8) Science teachers, two (2) Science teacher support staff (resource teachers) and the headmaster of the school were involved in the pilot study. Four (4) Science lessons were observed. On Monday 18th June 2016 a science lesson was observed in JHS 2, Wednesday 20th July 2016 another lesson was observed in 'Prep' to JHS then on the 22nd of June, 2016 one lesson was observed at BS 2 and last lesson was observed at BS 5.

The Science teachers were given the questionnaires to respond to after their lessons so that they will remain natural in their lesson delivery since they did not know exactly what was being observed. This was done to prevent the teachers from teaching to the questionnaire. The feedback obtained from the science teachers on the questionnaire was that the main issues in each statement item on the questionnaire should be highlighted to give the respondents a basis of clarity on the demands of each of the items because this will foster understanding and promote accuracy of responses.

The instruments were pre-tested to measure time cost for their administration, identify any possible challenges that might be associated with the data collection procedures and to prepare the researcher for the full-scale study. This was done because Schade (2015) posits that a research instrument needs a small scale preliminary study to evaluate its testability, time cost, adverse events and statistical variability in an attempt to improve upon the study design prior to the performance of a full scale study.

The purposive sampling technique which is a non-random sampling technique was used to select the classes to be involved in the pre-test based on the classes that had science on the days the researcher visited the school as stated on the school's time table.

Access and ethical consideration: In the perception of Ofori and Dampson (2011), it is required of every researcher to respect the site where a study takes place and to protect the rights and welfare of research participants and all other parties and individuals associated with the study. In showing respect to the study site, Creswell (2012) contends that a researcher should obtain permission before entering the site. To meet this requirement, informed consent was obtained from the authorities in all the schools before the study began. This process was facilitated by the researcher presenting a written request to the schools and showing her student's identity card as an evidence of her status. The researcher interacted with the head teachers on different occasions in their schools to brief them on the aim of the study and the likely influence the research findings will have on the teaching of science to pupils with deafness in Ghanaian basic schools.

The head teachers agreed with the researcher on days and times to have meetings with the research participants. At these meetings, the researcher explained to the research participants the rationale for choosing their schools for the study and the likely influence the findings of the study were perceived to have on the teaching of science to pupils with deafness in Ghanaian basic schools. The research participants were also made aware that their participation in the study was voluntary and that they had the right to abstain or withdraw from the study at any point if they so desired. They were also advised not to write their names on the questionnaires to ensure their anonymity.

Before the first observation in each of the classes, the science teachers introduced the researcher and the research assistants to the class and assured the class that the study/recordings were strictly for academic purposes, thus, they (the students) should feel at home around us. The pupils posed a few questions to the researcher before the lessons began.

Data Collection Procedures: The three (3) instruments were used to collect the needed data concurrently. The instruments used were the semi-structured interviews, a closed-ended questionnaire and an observation checklist. According to Kankam and Weiler (2010), when a researcher uses multiple instruments to gather pertinent data for the same study, it offers him or her the opportunity to investigate the phenomena over a broad spectrum thereby reducing ambiguity, speculation and guessing.

The semi-structured interviews were used to collect data from the head teachers and the Science teacher support staff (resource teachers). The Science teachers involved in the study responded to the items on the questionnaire after they have been administered by the researcher. The researcher personally trained two people on using the observation checklist to assist her use the instrument for the data collection. During the training session, consensus was reached on what to look out for and how scoring was to be done. Both research assistants were teachers. One was an M. Phil. Special Education student with a B. Ed. Degree in Special Education (EHI) and the other was an

M.Ed. Management and Administration Degree holder with a B.Ed. in Basic Education. With the help of these two research assistants the researcher used the checklist to observe classroom activities (lesson delivery).

The researcher conducted the face-to-face interview sessions with the head teachers and the resource persons using the interview guides for the two groups of respondents. Before the interviews, the researcher sought their consent to use a tape recorder to audio tape the proceedings for transcription. They were assured by the researcher that the transcriptions will be sent back to them for perusal and confirmation or editing before being admitted as collected data. Each interview session lasted approximately thirty (30) minutes.

The science teachers for pupils with deafness in the selected schools and the Science teacher at the Ebo Barton-Oduro Science Resource Center Abora near Cape Coast were also given the questionnaires to complete and return to the researcher at the end of the day. The questionnaires were collected on the same day to ensure a high retrieval rate (Kankam & Weiler, 2010).

Data Analysis Procedures: The aim of data analysis is to change collected data into relevant information that will answer the posed research questions (Suen & Ary, 2014; Creswell, 2012 & Wilson, 2010). The data analysis procedures were carefully studied and selected to ensure that the research design, instrument for data collection and the research approach were consistent with each other. To achieve this feat, the researcher matched each analytical approach to a specific data based on the variables of the study because the variables formed the subthemes that governed the data collection. The demographic data was analysed collectively and the other data was analysed based on the research questions that were raised to guide the study.

Analysis of qualitative data: The qualitative data for this study was derived from the face-to-face semi-structured interviews held with the head teachers and the Science teacher support staff (resource persons). The data from the semi-structured interviews were deducted by thematic analysis. By the thematic analysis process, the researcher reads through the given information vies-a-vies recording comments besides the actual transcriptions. In the perception of Zeldin, Britner and Parajes (2008), Tracy (2010) and Babbie (2010), thematic analysis of collected data keeps the researcher's thoughts out of the data records while at the same time connecting the analysis made to the discussion session. In carrying out the thematic analysis, the researcher identified the major categories of the collected data and the issues that came under each of the categories based on the subthemes (variables) of the study. For this study, the researcher aimed at exploring the communication challenges teachers faced during the teaching of science to basic school pupils with deafness as the teach scientific terms, principles and procedures and the strategies they are using to overcome them.

Analysis of quantitative data: The researcher used the Statistical Package for Social Sciences (SPSS) version 16.0, a descriptive statistical tool to calculate the means, composite means and standard deviation of the data collected via the questionnaires and checklists. Each item on both the observation checklist and the science teacher questionnaire was independently analyzed to give an objective and vivid picture of the event under study and to present the collected data in a simplified manner by presenting the results on tables and pie charts (Creswell, 2008; Babbie, 2010).

The data gathered from the observation checklists and the Science teacher questionnaire was analyzed using the major categories and prominent subthemes (variables) based on the research questions. The response levels pivoted on consecutive integers ranging from Strongly Agree (SA) = 5, Agree (A) = 4, Undecided (U) = 3, Disagree (D) = 2 to Strongly Disagree (SD) = 1 for all the positive statements. For the negative statements, the response level pivoted on consecutive integers ranging from Strongly Agree (SA) = 1, Agree (A) = 2, Undecided (U) = 3, Disagree (D) = 4 to Strongly Disagree (SD) = 1. The given responses were tallied according to the themes represented in the research questions and scored according to the five-points presented on the Likert Scale.

In the scoring of data from the checklists, the responses Very Good (VG), Good (G), Average (A), Below Average (BA) and Average (A) and Poor (P) were used. The ratings were Very Good = 5, Good = 4, Average = 3, Below Average = 2 and Poor = 1. The collected data was then presented on tables to enhance an easy understanding and interpretation of the observations made and where necessary a pictorial representation via pie charts were given. Summarily therefore, the quantitative data of this study was analyzed using descriptive statistics with respect to the objectives that were derived from the aim of the study and the research questions.

Ali (2016) revealed that the descriptive statistical technique is used to describe the basic features of the data in a study by providing simple information about the sample and their measures or actions. The descriptive analysis helped the researcher to determine the means and composite means (mean of means) for the variables explored in the study. The mean for each item of the variable was deduced and used to determine the composite mean (mean of means) for that variable.

III. RESULTS

The study showed that during the teaching of science to pupils with deafness in the selected schools, the teachers were wary of the linguistic limitations of the pupils. Some of the communication challenges identified were visual distractions to the pupils with deafness and the inability of the pupils to effectively speech read the

science teachers since they (the pupils) did not have adequate science vocabulary. Consequently, they were unfamiliar with most of the words being used in the lessons.

Additionally, the pupils were unattached to the science teachers during lessons because language and communication increases relationships but the teacher-pupil relationship in science lessons were very restricted because the pupils were quite passive since they had difficulties understanding the teachers. Furthermore, they could not contribute effectively to classroom discourse there by making most of the lessons teacher-centred. In the lower classes such as Basics One, Two and Three for instance, the children exhibited a high degree of the lack of experiential knowledge both in the content and language of science. This made communication and lesson delivery very difficult for the teachers since the pupils could not adequately use the sign language for academic purposes.

Although the science teachers were mindful of the language barriers of the pupils with deafness, they (the Science teachers) focused more on getting the pupils to understand and assimilate the concepts being imparted, the skill being taught and to acquire the language associated with them. The teachers did this through a constant repetition of the concepts while making conscious efforts to assist the pupils with deafness note and identify the similarities and differences between the words that are being used with much emphasis on the correct spelling of the words.

Additionally, the Science teachers wrote chalkboard summaries in ways that the pupils with deafness can read independently and understand on their own. The chalkboard summaries however did not follow the grammar and syntax of the English Language. Nonetheless, the teachers taught Science to the pupils with deafness in accordance with the content and dictates of the Moe/GES/WAEC approved Science Curriculum as much as they could because the schools did not have most of the resources and materials suggested in the Science Curriculum.

The teachers also alerted distracted students by using hand signals or asking other pupils to tap on the shoulder of the distracted pupil to enhance communication during lesson delivery. They also assessed the pupils with deafness as part of the teaching process and at the end of the lesson to ascertain what they (the pupils with deafness) have learnt in a particular lesson and to deduce the efficiency of the communication strategies used.

In the communication of scientific concepts, skills and terminologies to pupils with deafness during the teaching of science in the selected schools, the science teachers with or without the assistance of an interpreter mostly used the sign language. The Science teachers also used pictures, chalkboard and cardboard illustrations, demonstration, dramatization and role play to communicate the scientific concepts, skills and terminologies to the pupils with deafness. The Science teachers also used mimics, sketches and diagrams to communicate phenomena that do not have signed forms or hand shapes to the pupils with deafness.

IV. CONCLUSION

This study has provided insight into the communication challenges teachers face during the teaching of science to pupils with deafness and some of the strategies they are using to mitigate the identified strategies. The key revelation made is that none of the teachers and resource persons involved in the study had dual knowledge of Science Education and Special education (EHI). This is a grave concern that calls for imminent action because for the teaching of science to pupils with deafness reach appreciable levels, teachers teaching science to them and their support staff (resource persons) should have significant expertise in that regard with much emphasis on addressing the communication needs of both the teachers and the pupils with deafness to enrich their science vocabulary to achieve higher optimum levels.

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