

Pedagogical And Attitudinal Challenges Affecting Learning Of Science Among Students With Visual Impairment In Special Secondary Schools In Kenya

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Abstract:

Science is a field of study which use systematic observation and experiment to arrive at logical conclusions. Students with VI are expected to study science and achieve the same goals in the core curriculum like students with sight. Students with VI however face many challenges when learning science because they are expected to undertake processes like to classify, observe, undertake experiment and analyse data. These processes require sight. These challenges affect their enrolment and performance in the subjects. The study adopted a descriptive research design and was carried out in two special secondary schools for the VI in Kenya; Salvation Army, Thika School for the Blind in Thika, Kiambu county and Kibos School for the VI in Kisumu County. The participants in the study were two head teachers, seven science teachers and forty students in form two and three. Purposive sampling technique was used to select head teachers and science teachers while stratified sampling was used to select students in forms 2 and 3. Data were collected using from students using questionnaires and focus group discussion guide while interview guides were used to collect data from science teachers and head teachers. Thematic analysis was used to analyse qualitative data while quantitative data were analysed using descriptive statistics and presented using frequency distribution tables and percentages. The findings showed that students faced different challenges when learning science. These included instructional challenges whereby the students were instructed using expository and teacher-centered methods, resources related challenges whereby there was scarcity of reading resources which would increase access of students to science content. Curriculum related challenges were attributed to lack of adaptation in the science curriculum which led to presence of many abstract concepts to be learnt by the VI. The biology curriculum was adapted while those of chemistry and physics were not. The students had negative attitude towards learning science because they regarded the subjects to be difficult to understand and they had no interest in joining scientific fields after completing their secondary education. It was evident that a better learning outcome in sciences among the VI could be achieved by adapting the curriculum of all the science subjects and were assisting them to solve the problems they faced. This will make the content more accessible and the students will develop positive attitude towards the subjects.

Key Words: Attitudinal, Curriculum, Instructional, Science, Visual Impairment

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I. Introduction

Science plays a crucial role in development and this has made it an important subject matter in school curriculum across the world. Science is a field of study that involves arriving at conclusions after undertaking thorough evaluation and critical thinking that involves observations and experiments. (Oriahe, Uhumuavbi, & Aguele, 2010). Students with VI are expected to study similar curriculum with students with sight and should achieve the same educational goals. Cognitively, the VI have the same abilities as their sighted peers and are able to study and understand science subjects (Kumar, Ramasamy & Stefanich, 2001).

Learning of science among the VI is important. This is because it helps them develop crucial life skills that they can use in solving everyday problems. It also allows them gain knowledge and skills that allow them to develop necessary skills for observing, manipulating, and classifying phenomena. They are able to gain knowledge that they can apply in daily living. The skills they acquire make them become evaluative and systematic when solving everyday problems and are able to reason from cause to effect. (Mastropieri, & Scruggs, 1992; Maguvhe, 2015).

Despite science being an important subject, existing studies highlight that students with VI face different challenges when learning them. In a synthesis of literature, Cryer (2013) elaborated the challenges faced by students with VI when learning science included difficulty taking part in science processes like classifying,

observing, carrying out experiments in the laboratory and analysing data. Too much demand was placed on the memory of students due to lack of sight. The students were not able to observe and reach their own conclusions because they faced difficulty accessing science concepts in alternative formats. Maguvhe (2015) found that teachers had negative attitude towards students learning in science. The technologies for accessing content did not suit the learning needs of the students. The teachers lacked practical knowledge of the possibilities of the students and they did not undertake innovations on content and material when teaching the students. This influenced how students were instructed.

A study by Sahin & Yorek (2009) showed that students with VI faced different problems when learning science. They needed more time to read and carry out assigned activities because they were poor spellers and slow readers. The concepts presented to them were abstract and the learning resources provided for learning were not adapted. All these limited their access to content and reduced their understanding. Fraser & Maguvhe, (2008) found that students pursuing science subjects lacked adequate resources for learning science and the teachers did not solve the problems the students faced when learning. Sözbilir (2016) established that teaching of science in most classrooms was based on lecturing with slight adaptations on materials and instructional settings to suit the needs of the VI. Oral explanations were common and this made the students passive during learning.

Habulezi, Kefilwe&Malatsi, (2017) revealed that many learners believe science is difficult because there are many diagrams that they could not access or understand. The teachers on their part regarded that the VI were a nuisance in class and could not learn science. Yalo, Indoshi & Agak (2010), found that students with VI lacked appropriate learning materials in their preferred size print. Those which were available were not ideal for them but instead contributed to poor clarity and visual fatigue the diagrams were crowded in textbooks Njue, (2021) noted that the numerous challenges faced by the students affected their enrolment and performance in the subjects in the national examinations.

II. Material And Methods

The purpose of this study was to explore the challenges that affected the learning of science among students with VI in two selected secondary schools in Kenya.

Study Design: The study adopted a descriptive research design. This involved describing the behaviour of a subject (students and teachers) in its natural setting without influencing it in any way.

Study Location: The study was carried out in two special secondary schools for the VI in Kenya; Salvation Army, Thika School for the Blind in Thika, Kiambu county and Kibos School for the VI in Kisumu County. The two schools were chosen because they were mixed boarding schools that served the majority of the low vision and the blind students in Kenya.

Study Duration: The study was carried out from August 2021- April 2022.

Sample size: The study participants were two head teachers, seven science teachers and forty students in form two and three. This represented 38.9% of the target population.

Subjects & selection method: Purposive sampling technique was used to select head teachers and science teachers. The teachers teaching science subjects in form two and three were selected to participate in the study. The head teachers were selected because they offered administrative support that facilitated learning.

Stratified sampling was used to select students of forms 2 and 3. This involved dividing the student population into groups based on their gender and visual condition (whether low vision or totally blind). These groups were then used to form groups of five students which had a combination of both genders and both categories of visual conditions. Two groups from each class were randomly selected as a sample for the study. A total of 40 students were selected to participate in the study.

Procedure methodology:

The researcher obtained a letter to undertake the study from the graduate school of Kenyatta University and a research permit from the National Commission of Science Technology and Innovation (NACOSTI). Consent was sought from the selected schools and from the targeted participants. The participants who accepted to participate in the study filled a consent form. Questionnaires, Interviews and Focus group discussions were used to collect information from the respondents. Questionnaires and focus group discussion guide were used to collect information from the students. Questionnaire made it possible to collect information from many students on the challenges they faced when learning science. A focus group discussion guide allowed the students to elaborate in detail the challenges they faced when learning science.

Interview guides were used to collect data from science teachers and head teachers. These were used because the respondents had a lot of information to share, and it was possible to probe answers further and seek clarification on different issues. The allowed head teachers and science teachers to give detailed information on challenges faced by students when learning science.

Statistical analysis: Thematic analysis was used to analyse qualitative data. This involved transcribing the information and organizing them systematically by coding and classification of data based on the results of

the study. This minimized the responses. The data were reported in narrative form and respondents verbatim used during presentation of data to support the findings. Quantitative data from the questionnaires were analysed using descriptive statistics and presented using frequency distribution tables and percentages.

III. Result

The results for students were obtained from the questionnaires and focus group discussions and from interviews for science teachers and head teachers. The results highlighted that students faced many challenges which in turn negatively affected the learning of science. These were grouped into challenges related to instruction, challenges related to resources, challenges related to the curriculum and challenges related to attitude of students towards science.

Table 1: Shows challenges faced by SVI which were related to instruction

Challenges	Freq.	%
Inadequate time allocated for learning	35	87.5
Teachers teach fast	34	85
Difficulty writing/braille notes	29	72.5
Poor explanation of concepts	28	70
Concepts are visual	26	65
Teachers ignore weak students	14	35

Table 1 indicates that the learning of science was affected by the nature of instruction. Majority (87.5%) of the students reported that the time allocated for learning was inadequate, and almost a similar percentage (85%) responded that teachers taught fast. Slightly less than three quarters (72.5%) responded that it was difficult to complete writing and braille notes because teachers dictated them fast, while another similar proportion (70%) reported that the teachers did not explain concepts well. Slightly less than two thirds (65%) reported that most concepts were visual and needed good sight to be seen and understood while slightly more than a third (35%) responded that teachers ignored the weak students and only paid attention to those who learnt fast.

The responses from the students during FGDs gave a deeper insight into these challenges. One student reported, "Learning of science is difficult because many things are supposed to be observed and my sight is not good. We strain to see what is written on the wall by teachers". Another student reported, "The time provided to learn science is little and teachers teach fast. It is difficult to understand all things that are taught. When teaching is done fast the things taught look even harder". The teachers' sentiments were in concurrence with students' responses. One teacher shared, "Most of the students we teach are learn slowly and they require more time to understand what is being taught. The time that is allocated for learning may not be enough to teach and at the same time attend to all the needs of the students."

The results showed that there were many challenges which were related to instruction of students which affected the learning of science.

Table 2: Show the challenges faced by the VI when learning science related to resources

Challenges	No.	%
Difficult to maintain notes	34	85
Insufficient braille text books (blind)	13	81.3
Inadequate time to use the resources	31	77.5
Scarcity of learning resources	27	67.5
Shortage of large print text books (low vision)	15	62.5

Table 2 indicates challenges faced by students which were related to resources. Majority (85%) of the students shared that it was difficult to maintain their notes while majority (81.3%) of the totally blind students replied that braille books for science subjects were insufficient. Slightly more than three quarters (77.5%) of the students reported that there was inadequate time to use the resources while two thirds (67.5%) of the students complained of scarcity of learning resources which led to sharing. Less than two thirds (62.5%) of the low vision students reported that there was a shortage of large print text books.

The students elaborated on the problems further during the FGDs. One student shared, "We Braille notes as teachers dictate them. Braille papers are loose and have to be arranged and bound in order to be read again. Some brailled notes get lost before we bind them while others are incomplete because the teachers do not wait when placing new braille paper in the braille machine." Another student added, "When the braille notes are bound, they are heavy and bulky and difficult to keep because of lack of space for everyone to store." The responses from the teachers concurred with those of the students. One teacher responded, "Our students do not keep their notes

intact for future revision. Most of the students misplace their notes and by the time they are in form four, they miss complete notes which they should use when preparing for K.C.S.E exams.”

Another teacher responded, “We use different resources when teaching for example in biology, we use among others real objects, tactile diagrams and microscopes. Enough time should be given to students in order to use them and to understand what is being presented. Students need more time to carry out observations but the time allocated for teaching and using the resources is not enough.” Another teacher shared, “The available books for learning are worn out the latest editions in formats that suit the students are missing. There are also delays in buying the requested resources and by the time they are brought, most topics will have been covered without the resources. This limits understanding of concepts.” Another teacher added, “Braille textbooks are lacking and print books are not adapted. This causes the students to strain when reading. These challenges make them to rely on the notes that we give when teaching.”

The head teachers gave their input on the challenges related to resources. One head teacher reported, “We need money to purchase different resources but most times we lack the money. Delays are common with the disbursement of government funds for free secondary education. By the time they are disbursed most content will have been taught without the required resources and there are so many things needed in the school therefore we may fail to buy all that is requested.” Another head teacher added, “Students misuse the resources that we buy to assist learning. The number of books and lab apparatus are continuously reducing because they get lost or break during practical. Many books are also torn and worn out and this means constant buying.”

Table 3: Shows the challenges related to science curriculum that affects learning science by SVI

Challenges	Freq.	%
There are many concepts which are abstract	33	82.5
The curriculum is wide with many concepts	30	75
There are many technical terms in science	26	65
Math calculations are difficult to do	21	52.5
Scientific terms are difficult to spell	18	45

Table 3 indicates that more than four fifths (82.5%) of the students responded that most there were many abstract concepts in the curriculum which they found difficult to understand while three quarters (75%) pointed out that the curriculum was wide with many concepts to be mastered. Close to two thirds (65%) responded that there were many technical terms in science subjects which were difficult to understand. More than half (52.5%) had difficulty calculating mathematical problems that were common in science while less than half (45%) reported that they had difficulty spelling scientific terms.

The students’ responses during FGDs gave further explanations on these problems. One student reported, “There are many concepts taught in science which are difficult to understand. Teachers will teach a topic and before we have understood it well, they will have completed and moved to another topic. When we ask them why they rush, they respond that they have to complete the syllabus.” The response of one teacher concurred with those of the students. She shared, “There are many concepts that the students are expected to learn and master because the curriculum is broad. There are also many technical terms common in these subjects which worsen the problem because students fail to understand them. Most students spell poorly and this affect their results in the final exam especially in biology. It is difficult for us to teach slowly and individualize learning because we are expected to cover all the topics in the curriculum. This disadvantages the students because they may not be able to understand all the concepts.” One head teacher shared, “Science concepts are hard to be understood by the VI because they are abstract and the students need to learn by touch. Many times, these students learn without using learning materials that would make the concepts real to them. They end up covering the curriculum but what they have understood is less. This leads to poor performance.”

Another teacher explained, “Most students in our school have poor sight and this limits their pace of learning and understanding of concepts. I am aware that many concepts that I teach in physics are abstract because for the students to understand them, they should create a picture in their mind of what is being taught. Observation is important for this and when doing practical. Lack of sight makes it difficult to do practical well and to understand all concepts taught. Take an example of a pin-hole camera. A LV would need something big in order to see. Observing a small thing using a pin-hole would be an uphill task.” This point was further expressed by one head teacher, who shared, “Many aspects in science are not realistic for the visually impaired. For example, it is difficult for the students to read beaker readings which are too small, to ascertain and interpret color during titration experiments and in litmus paper and carrying out other observation which are common in science. The only adaptation is addition of time for students in exams and enlarging of print. Students are forced to learn the subjects especially biology because it is a requirement but they benefit little from it. When given a chance, they decide to leave chemistry and physics.” Another head teacher explained, “The concepts in the science curriculum are many and students find it difficult to understand. The curriculum is also not adapted except in biology. If the

curriculum developers would have adapted the curriculum in chemistry and physics by selecting areas that are easy to be studied by the students, the level of understanding by the students would improve and some students may decide to study them.”

Table 4: Shows challenges related to attitude of SVI towards science

Challenges	Freq.	%
It is hard to understand science	32	80
There is no reason why we should study science	30	75
Practical are tiresome and difficult	26	65
There is discouragement from friends	14	35
There is lack of self-motivation	14	35

Table 4 shows that more than three quarters (80%) of the students considered science subjects as hard to understand. Three quarter (75%) of the students responded that there was no reason why they should study science while almost two thirds (65%) considered practical to be tiresome and hard. Slightly more than one third of the students (35%) responded there were discouragement from their friends and a similar percentage (35%) lacked self-motivation to study the subjects.

The responses given during the FGDs elaborated further on the attitude of students towards sciences. One student asked, “How does chemistry help the VI? The things taught are not helpful after school. The subjects will not help all.” Another student added, “There is no need to learn science. I have not heard of a blind engineer or medical doctor who is VI. There is no reason to learn these subjects.”

One student reported of discouragement from other students. He shared, “When we talk with our friends especially those in form four, they tell us not to put too much effort on what may not help in future. We accept what they say.”

The teachers agreed with the students. One teacher explained, “Most of the students we teach are reluctant to learn the concepts in detail. When teaching chemistry to SLV, they ask me how the concepts we teach will help them after school. They rarely finish the assignments that we give them and this makes it hard to assess if they understood what was taught or not. These lead to low performance which is discouraging.” Head teacher B explained further, “To be honest, the performance in science cannot be compared with those of humanities or languages. This is because the students lack self-motivation and do not think critically. They also do not revisit what they have been taught. This leads to low performance.”

These findings indicated that students’ attitude towards the subjects affected learning.

IV. Discussion

The results showed that students with VI faced different challenges when learning science and these affected the general learning outcome in the subject.

Instructional challenges

Instruction is an important aspect of learning. The instructional approach adopted during learning significantly impact the learning outcome. Learning of science by SVI should adopt a multi-sensory approach which will allow the students to use the remaining senses for learning. A hands-on approach should also be adopted to allow students touch the learning resources availed for learning. It is evident from the findings that most concepts were taught visually using textbooks and writing on the chalk wall and the teachers taught fast giving little time for the students to interact with the teacher and the resources. Poor explanation of concepts by teachers led to knowledge gaps among the students.

Giving verbal illustrations and teaching fast makes it difficult for the VI to understand and retain concepts. The teachers understand that the students learn slowly and this calls for adaptation of teaching strategies to suit the learning needs of students. The teachers should not rush over what they teach because no meaningful learning occurs. Instead they should individualize learning and adopt different learning strategies which are learner centered. This will significantly improve the learning outcome in the subjects.

The findings were in line with those of Sahin & Yorek (2009), who found that The SVI required more time to learn science. Further, the students faced difficulty understanding abstract concepts because of lack of access to textbooks, library materials, and classroom presentations which were not adapted and were mainly visual. Findings of Njue (2021), and Sözbilir, (2016), further showed that teaching approaches in most science classrooms relied on lecturing and oral expositions with little adaptations, which made the students to be passive learners and therefore it was difficult for them to develop concepts The strategies used for learning did not actively engage the students leaving them rely on teachers for knowledge. The approaches used for learning science were less motivating and were responsible for poor learning outcome in the subjects.

Resource related challenges

Learning resources are an important component of learning. They increase access to concepts and assists in better understanding of what is learnt. The use of resources during learning makes learning real, interesting and meaningful. The findings showed that there was scarcity of large print textbooks and Braille book for the students. These are important rearing resources which allow students to explore further what they had been taught or to seek for better understanding of content already learnt. Scarcity of these resources creates high dependency on teachers for knowledge a factor that leads to limited learning. The students further faced problems completing and maintaining their notes. These notes are important for reference and revision without which, the students cannot prepare adequately for their exams. It is imperative that students should be assisted to bind and store their notes well for future use.

The inadequacy of crucial learning resources and, the lack of time to use them affected the quality of instruction and retention of concepts. Sharing limits the interaction which the students have with the resource and the learning unique needs of the student may not be met. The challenges of access and inadequacy of the resources affect the learning process negatively because the students were not able to learn on their own, and when teachers did not provide alternative resources, it became difficult to learn the subjects. The findings are in line with findings of Yalo, Indoshi & Agak (2010) who found that students lacked preferred large print books and this caused visual fatigue making it difficult to learn concepts well. According to findings of Fraser & Maguvhe (2008), limited resources and lack of adaptation from teachers contributed to students viewing science as difficult and this made it difficult for them to pursue science subjects.

Curriculum related challenges

The curriculum is an important aspect of learning because it shows what should be learnt. A science curriculum for SVI should consider the unique learning needs of the students and incorporate aspect of learning that can be learnt with ease and safely. The responses given by students, teachers and head teachers indicated that the science curriculum was wide with many abstract concepts. This was an indication of lack of adaptation that would select particular areas that are meaningful to the SVI. The nature of the curriculum made it difficult for students to conceptualize what they learn and acquire knowledge. That the lack of adaptation of chemistry and physics subjects was the reason behind the responses that there were many things to be learnt, there were difficult calculations to work on and technical terms they could not understand.

Lack of sight made it difficult for students to understand the concepts which were abstract. Adequately adapting the curriculum will incorporate concepts which the students can learn with ease and which teachers can easily adapt the learning resources. The findings indicate that the nature of science curriculum and content taught affected the ability of students to learn well. Better learning outcome could be achieved by differentiating the curriculum to suit the students. The findings were in line with those of Sahin & Yorek (2009), who found that many science concepts were abstract to students without sight, making the subjects difficult. Findings of Agesa (2014), showed that students faced challenges with the curriculum because it was not differentiated, leading to too much work with limited support, which made understanding of concepts difficult.

Challenges related to the attitude of students

The attitude that students develop towards the subjects affected learning. Negative attitude develops when what is being learnt is not interesting or when the strategy used for presenting is not appealing. The response by students that there is no need to study science because it may not help them after completing form four education indicate that there was a need to explain to them the benefits of acquiring knowledge in the subjects which will be applied in day to day living and not necessarily for joining different careers. Teachers teaching science should present the content in an attractive manner that will make the subjects enjoyable. They should also counter the advises that students give each other which propagates the idea that sciences are difficult and it is not necessary to learn them. This may also improve the motivation of the students to the subjects. The findings concurred with those of Habulezi, Kefilwe & Malatsi (2017), who revealed that students had negative attitude towards science because they considered the subjects to be tough and difficult to understand. This affected the learning of the subjects.

V. Conclusion

It is important for the VI to learn science. Meaningful learning outcome is possible when instruction is learner-centered and when the learning resources are adequate and adapted to fit the learning needs of the students. The content that they learn should also be adapted so that what is presented is relevant to them; the teachers should also individualize learning and should encourage the students to like the subjects. An improved attitude will lead to improved learning outcome. The teachers should try as much as they can to help the students to solve the problems they and a better learning outcome in sciences among the VI could be achieved.

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