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**Instructional Methods Challenges and Their Influence on Performance of
Chemistry among Students with Blindness in Rwanda: A Critical Literature
Review**

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Instructional Methods Challenges and Their Influence on Performance of Chemistry among Students with Blindness in Rwanda: A Critical Literature Review

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Abstract

Purpose: Currently, students with blindness face many challenges in school settings which include those that affect their performance in subjects such as Chemistry. The purpose of our study is to establish instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda.

Methodology: The paper used a desk study review methodology where relevant empirical literature was reviewed to identify main themes and to extract knowledge gaps.

Findings: The study found that some difficulties that blind students face during Chemistry lessons were caused by traditional classroom instructions, the use of sensory audition which lacked specialized laboratory labelling, libraries without Chemistry brailled reference books and many others. They also concluded that teachers are very important in determining the learners' academic performance but this can only be realized if and when instruments are availed for instructional purposes by teachers to the learners in visually impaired schools.

Unique Contribution to Theory and Practice: The study recommended that facilities and instruments are availed for instructional purposes by teachers to the learners in visually impaired schools. This is because the knowledge of teachers on the content of assigned subject affect the student's outcome. Also, the teaching of Chemistry to learners with visual impairment should be done by a specially trained teacher who is conversant with the use of these specialized devices.

Keywords: *instructional methods, challenges, influence, performance, chemistry, students, blindness*

1.0 INTRODUCTION

Globally, Science and Chemistry in general have not been accessible for students with blindness. Fields such as Chemistry, Physics, Engineering, and Mathematics use visually presented concepts and information which has not been available for students with blindness. According to Hanushek (2007) teaching is highly stressful career if resources and working environment is not favorable hence poor performance of the learners. Equipment and reagents, if Braille labeled and the students with blindness are equally well orientated in the laboratory, will authenticates improvement of learning environment for learners with VI hence improved performance.

A study by Walker (2012) in Australia about parents and teachers view on performance of learners with disabilities established that, involving parents and teachers is a source of success on education is stability among these students. In the United States, assessment for placement is done by a team of professionals such as; special education teachers, parents, psychologists, school nurse and other medical professionals, social workers and counselor (Niparko, 2000). Their system of special education allows for placement on a continuum, ranging from full mainstreaming to a public school for learners with blindness. Special schools are reserved for severe cases (Cawthon, 2001). In Germany, most learners with Special Needs (SN) are assessed and placed in special schools according to different categories of disabilities and those with blindness have their own special schools (Houghton, 2003). It is worthwhile to note that learners with blindness are properly examined and placed in the most appropriate programs for proper learning for a better academic performance. Correct placement and provision of right resources and equipment are what is deemed vital for improved performance of learners with blindness in Chemistry.

A study carried out by Mwangi (2014) on pedagogical challenges facing Mathematic teachers of learners with visual impairment at Thika primary school for the blind showed that learning resources were inadequate, and it led to poor performance of learners with VI in the subject. The study employed both qualitative and quantitative methods of data collection in which questionnaires and interview schedules were used to collect data. The study recommended that schools be adequately equipped with resources that effectively support the teaching of Mathematics and Computer education be incorporated in the teaching to enhance understanding of the subject content. According to Kumar, Ramasamy and Stefanich, (2001) students with blindness have the same range of cognitive abilities as sighted students.

Rwamagana is one of the schools for the blind which needs adapted laboratory facilities and equipment to facilitate learning of such subjects. Lack of adapted equipment and facilities in schools for the learners with blindness equally causes stress and discomfort in teachers' delivery of the subject content as well. Those at Rwamagana can equally be high performers in Chemistry just like their counterparts with vision if the playing field is leveled enough for them. Learners with blindness if well accommodated with adapted equipment facilities can master higher-order science concepts just like sighted students (Jones et al., 2006). The performance of learners with blindness in Chemistry at Rwamagana is wanting, hence causing fear hatred and dislike of the subject in the learners and the school community at large.

A study by Stefanich and Norman (1996) showed that students with blindness could become scientists in areas such as chemists if given a stronger foundational base in the relevant subjects at school and higher learning institutions. Indeed, most students with blindness have cognitive abilities equivalent to their peers with vision which seem to be underrated as a result of lack of

vision, unequipped laboratories with gargets to aid their scientific experiments, committed and resourceful teachers to aid experiment with these learners in the laboratories etc. (Ingrid Lewis, 2009). As inclusion of people with blindness in public schools is increasing and their academic ability widely recognized, teaching aids should be made available. Nevertheless, if these materials cannot be obtained elsewhere, the teacher should make his or her own methods (Frampton, 2006).

Agrawal (2004) suggests that while preparing material for students with blindness, suitable principles should be kept in mind. These include maximizing of the duplicated material, the modification of format and content for necessary adaptation, the substitution of ideas and rare omissions under unavoidable circumstances. The low vision devices for learners with low vision such as magnifying lenses, spectacles, reading stands and large print books may be availed to low vision learners. There is also need for physical infrastructures like the walk ways, toilets and corridors to be accessible by learners with VI, (UNESCO, 2005). The most intimidating reality in Rwamagana School for the blind is lack of adaptive laboratory equipment unlike Ethiopian government who has established Adaptive Technology Center for the Blind (ATCB-<http://www3.sympatico.ca/tamru>). This ATCB is specializing in the transfer and promotion of adaptive technology for the blind and those with impaired vision (Tamru, 2005).

The Jomtien declaration on Education for All (EFA, 1990) world conference which recommended that all children have a right to education regardless of industrial differences. Majority of an estimated 150 million learners throughout the world remain deprived of learning opportunities. Despite advances in education in developing countries, less than five per cent of children with disabilities go to school to access education (UNICEF, 2000).

In Rwamagana School for the blind, students with blindness achieved lower grades in Chemistry compared to other subjects like Biology, English and Geography, (REC, 2014). The researcher wanted to identify the challenges which make them perform dismally in Chemistry. This is evidenced by the results from Rwanda Examination council (REC) (2014) which showed the mean score in Geography as 55%, 62% in History, 60% in English, 56% in Biology and 32% in Chemistry for students with blindness.

To minimize challenges facing learners with disabilities, the government of Rwanda designed policies which focuses on promotion of quality education for learners with special needs. This is to ensure favorable conditions that permit learners with special needs to enroll in all classes and subjects, remain in and complete school. Also, establish a system of regular monitoring, evaluation and reporting on the implementation of the national policy for learners with special needs education, improving quality and delivery by ensuring appropriate infrastructure, as well as curriculum content and methodology. In addition, provision of appropriate learning materials, establish mechanisms for planning and coordination of efforts to improve educational outcomes for learners with special needs in Rwanda. (MINEDUC, 2007). Besides these policies, adaptation of curriculum and laboratories for learners with VI in Rwamagana is wanting. Poor performance in Chemistry limits competitiveness of learners with blindness in job market thus, the need for the researcher to find out challenges faced by learners with VI in the subject.

1.2 Statement of the Problem

Despite the efforts made by government of Rwanda to uplift the standard of education, Chemistry as a subject has had low or none enrolment by students with blindness. The concepts of the subject

ought to be synchronized well by learners with blindness to enhance their performance in the subject. It is equally a concern of parents, teachers, researchers and other stakeholders to design strategies to increase classroom success for learners with special needs.

Studies have shown that students with blindness are as bright as their sighted counterparts. They have the potential of studying Chemistry in order to widen their job market. However, their dreams are shattered by a variety of challenges. Government's agencies like the Ministry of Education in Rwanda (2007) and scholars like Klines (2006) have raised concerns relating to performance and standard of learners with blindness in Chemistry. Establishing existing strategies of improving adaptation of laboratory equipment, relevant of methods used by teachers, and availability of appropriate teaching aids to enhance academic performance of learners with blindness were central to this investigation. It was against this backdrop that a study on challenges influencing performance of students with blindness in Chemistry at Rwamagana stood in need of investigation by this researcher. As such, this study attempted to determine challenges influencing poor performance in Chemistry by students with blindness.

1.3 Objectives of the Study

The general objective of the study was to identify instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda.

1.4 Significance of the Study

The state of performance in Chemistry at Rwamagana School for the Blind in Rwanda in regards to national examination results for students with blindness was a major concern. It is expected that the findings of this study would help improve this condition. For example, to furnish laboratories with adapted equipment and reagents, orientate learners with blindness fully with brailled equipment and reagents, and qualified and determined teachers to promote learning for learners with blindness in the country.

The researcher hope that the findings of the study should also help educational stakeholders to develop programs to help the learners with visual impairment especially those with blindness. The study findings should also help curriculum developers to develop appropriate curriculum for students with blindness. Also, the findings may provide information to schools' leaders by indicating the needs in term of equipment, materials and other school facilities. In addition, Rwamagana school for the Blind may use the information found to overcome those challenges and to make students with blindness successful in all subject at the same level.

2.0 LITERATURE REVIEW

2.1 Teaching and Learning Chemistry in Schools to Students with Blindness

Today, a full spectrum of educational settings is available for students with blindness, from attending regular classes in the local school district to living in a residential school. Candiya (2006). In Africa, some of the problems are; lack of basic means of communication, infrastructure, materials and equipment, which remains the greatest obstacles for implementing plans on educating students who are blind (Tamru, 2005).

According to Richard (2010), legal blindness is a visual acuity of 20/200 or less in better eye with correction or visual field less than 20 degrees. Currently, students with blindness face many challenges in school settings which include those that affected their performance in subjects such

as chemistry. According to Dorothy (1981) the barriers for students with blindness wishing to study chemistry have been primarily attitudinal barriers based on a concern for safety.

Traditionally, Science and Mathematics are areas which are inaccessible and challenging to those teaching learners with blindness. This implies that disciplines such as Chemistry, Physics, Engineering, Biology and Mathematics are rife with visually presented concepts and information. Visual impairments can affect the teaching of individual learners' ability and potentiality in science subjects regardless of age, gender, race or social economic status (Kirk, and James, 2003). Some learners with blindness take notes while their laboratory aide describes the events of each experiment. Others perform various tasks in the laboratory during experiment. Those with blindness are unable to perform experiment because of non-adaptation in the laboratories.

Learners who lack a major sense such as vision may construe the world in different ways than those with full sensory equipment (Ostad, 2000). Therefore, learners with blindness need to be provided with opportunities, concrete experiences and activities in order to acquire what sighted learners acquire naturally. Teachers of Chemistry should be aware that all learnt effortlessly by sighted learners must be put into a programmed instruction for those with blindness. Bishop (1978) says that experiences often absorbed by the sighted spontaneously, must be specifically taught to learners with little or no vision. Some content in chemistry requires vision. According to Lowenfeld, (1981) such visual ideas could be converted into non-visual experiences to enable learners with VI to acquire the required learning experiences. Therefore, adaptation of Chemistry material is essential to keep the learning outcomes at par with sighted learners. The principles of material production should be duplicated as possible modifications where necessary, substitution whenever appropriate and even omission of some inevitable topics (Lowenfeld, (1981).

In Rwanda, the 1994 genocide resulted in an increase in disability because of different factors, mainly, the violence which lead to the breakdown of vaccine and rehabilitation services. Available statistics indicate that very few children who are blind are receiving quality education in Rwanda, either through inclusive or segregated education, and that provision (especially in special schools) is primarily in urban areas (Ingrid, 2009).

Khurshid (2008) observed that the performance of students with blindness can be good if they are taught by trained and specialized teachers for quality academic performance. He also demonstrated that the performance outcomes are determined by qualified teachers. This argument is backed by Umar-ud-Din, et al (2010), who found that the knowledge of teachers on the content of assigned subject affect the student's outcome. They summed up that teachers are very important in determining the learners' academic performance but this can only be realized if and when facilities and instruments are availed for instructional purposes by teachers to the learners.

2.2 Instructional Methods and their Application Teaching Chemistry

The potential of an education system is directly related to the ability of its teachers (Gitonga, 1990). Hence, the more qualified and better trained teachers are the easier it is to effect curriculum implementation. Gitonga further points out that the success or failure of any innovation in teaching ultimately lies on the receptiveness and flexibility of the classroom teacher. According to Hanushek (2007), teaching is highly stressful career if the resources and the environment are not conducive. This suggests that Chemistry teacher have to be conversant with various teaching

methods that are effective in achieving the set objectives and the working environment should promote teaching and learning.

According to Naylor (2001), basic resources such as textbook, lab equipment and classroom supplies are often inadequate thus do not meet teachers' needs. Thabo Fako (2010) found that there is increase and expansion in education while resources levels have not been improved. Lack of resources makes teachers' work more difficult and increases their stress levels. In such a case, teachers' stress is extended to learners which make them fail. Learners with blindness can be good achievers in Science subjects if adaptation and modification in laboratories and libraries is adequately done to facilitate their learning. Lack of these results to poor academic performance of student with blindness in Chemistry. When teachers embark on the demands of their learners, it would therefore, force them to modernize the teaching methods that befit the standard, need and challenges of their students.

According to Clamp (2003), teachers of learners with VI should thoroughly understand and employ scientific approaches and strive for mastery of comprehension. This can be done through the teachers' involvement in ensuring practice in handling and managing adapted instruments well. Effective teaching requires knowing and understanding learners and pedagogical strategies since learners learn through experiences which teachers provide. This emphasizes need for the learners' active participation in the classroom activities. This also implies that the teacher's role is to offer opportunities that will lead to learners centered activities in class which would enhance performance in Chemistry. Opportunities of that nature can only be realized if teachers used teaching methods that encourage learners' participation in class.

2.3 Challenges Faced by Teachers when Teaching Chemistry Concepts

In Africa, some social attitudes about blind people influence the thinking of blindness as uselessness to limit advancement in other educational opportunities (Belay, 2005). Negative attitude is a social barrier that leads to poor performance in Chemistry. People with disabilities often face challenges in their daily lives due to attitudinal barriers related to their disability (Milsom, 2006). Teachers find it difficult perfecting their subjects when their learners are withdrawn. Lack of improved teaching materials depresses them the more.

Montalvo, Mansfield, & Miller (2007) found that students with greater effort in education demonstrated a higher degree of persistence in schooling when they like their teachers, hence better grades. Owiyo (2012), in his study to determine the relationship between anxiety and classroom performance of pupils in Rachuonyo North District, critically analyzed the implication of counseling on the relationship between anxiety and performance. He found that any guidance and counseling in an educational setting must address the needs of the clientele if it is to be effective. A learner with visual impairment develops anxiety as a result of vision barrier hence poor academic performance.

Lack of self-concept, self-esteem and stigmatization in learners with VI makes them withdrawn hence it becomes difficult for teachers to impart teachable materials to them. A study by Libarente (2012) on teacher-pupil relationship found that relationship is the most powerful elements within the learning environment that forms the basis for social contact in which learning takes place.

2.4 Empirical Review

Ahmed, (2018) conducted a study on principals' perception of factors contribution to student's poor performance in chemistry in public secondary schools in Wajir County, Kenya. This study was guided by the following objectives: to establish the factors contributing to poor performance in chemistry, to find out students' attitude towards Chemistry and its effect on chemistry performance, establish Chemistry teacher's attitude towards their learners' ability in Chemistry and establish the influence of the principal on resources mobilization for teaching Chemistry on students' achievement in Chemistry. The study employed descriptive survey design. Questionnaires were used as a means of data collection from principals and students while the teachers were provided with interview schedules. Stratified random sampling was used. The sample population consisted of 4 public secondary schools in the Sub County, 4 principals, 16 teachers of Chemistry, and 160 form four students who take Chemistry in those schools. Various factors contribute to poor performance as perceived by the principals. On attitude of the learners towards the subject, the students have a negative attitude towards Chemistry despite the fact that they are interested in careers that need the knowledge of Chemistry; this has affected the performance in the subject. Secondly, motivation of the teacher did not seem to affect performance in the Sub County. However, a small percentage of teachers noted that availability of instructional resources was a motivating factor for them. The instructional resources however were not adequate. The teachers responded that factors that affected the performance of Chemistry in their schools, apart from availability of instructional materials, were learners' academic ability and student attitude towards the subject. On instructional resources, all the schools have a library which is not well equipped, with Chemistry books. The laboratories were underutilized due to the preference of teacher demonstration over practical activities during learning of the subject by Chemistry teachers. Habaswein Sub County, Wajir County can therefore be attributed to, negative attitude of the students towards the subject especially towards the practicals, inadequate resources, and underutilization of resources. The school management should provide more instructional resources in form of a variety of Chemistry textbooks for the students in the library. Teachers of Chemistry should organize motivation talks that would help alleviate the negative attitude towards Chemistry. They should also expose their students to more individualized or group based practicals, adopt a practical approach while teaching and in conjunction with the school management.

Ogembo, (2013) carried out a study on determinants of students' poor performance in Chemistry in public secondary schools of Kwale county, Kenya. A sample of 482 forms three students from 9 public secondary schools were randomly selected using both simple and stratified random sampling to participate in a descriptive interactive survey study. The students and their chemistry teachers were provided with questionnaires while Chemistry teachers, their Principals and the District Quality Assurance and Standards Officers [DQASO] were orally interviewed. Data obtained from the study as well as physical observation of the nature of the teaching and learning resources and the conduct of both the practical and theory chemistry lessons were analyzed using SPSS software. Results showed that student' background characteristics; attitude factors particularly Chemistry teacher's negative perception of their learners' abilities; inadequate use of resource in the teaching and learning process and negative socio-cultural factors as well as inappropriate learning environment were the main causes of the students' persistent poor performance in Chemistry in Kwale County. It is recommended that the Ministry of Education

through its various agents should, among other things, enhance supervision of curriculum implementation in schools, increase the amount allocated for tuition and release the funds in good time to enable prompt acquisition of learning materials. School managements, in conjunction with other stakeholders, should enhance teacher motivation and provide more and better teaching and learning facilities to enable a more conducive environment for learning. Finally, Chemistry teachers must enhance their teaching approaches by adopting a more practical approach to the teaching and learning practices that would motivate the students to perform better in the subject.

A study by Musyoki (2015) was carried out to investigate determinants of students' achievement in chemistry and the proposed strategies used to improve its achievement. The targeted population was school principals, chemistry teachers and forms 3 students and where 25 principals (38%), 25 chemistry teachers and 250 form 3 students constituted the sample size. A total of 300 respondents were used to derive the findings and conclusion of the study. The researcher adopted stratified sampling to select public schools and students per school were randomly selected while one chemistry teacher and the principal in the sampled school automatically became respondents in the study. Questionnaires for principals, chemistry teachers and students were used to collect data and the results obtained were presented using both descriptive statistics for quantitative data by SPSS program while qualitative data was presented thematically in line with the study objectives. The findings of the study indicate that the perception of students towards chemistry was negative as observed by 64% of the chemistry teachers and 64% of the principals. Teaching experience was found to be significant in determining students' achievement in chemistry in secondary schools as agreed by 60% of teachers and 72% of the principals but academic qualification was insignificant. ICT materials and facilities were found to be available but were not used during teaching and learning of chemistry. Failure to use ICT facilities was due to majority of teachers not being trained to use them in addition to many having not attended ICT seminars and workshops. Based on the findings the study concluded that students' perception in chemistry determines its achievement in examinations and that most students do not have positive attitude in chemistry. ICT materials and facilities are available but not used during teaching and learning of chemistry. Also, various teaching and learning resources are not adequate in many schools. The study recommends that the Government and school authorities should through the allocation of funds, materials and apparatus for sciences teaching make school laboratories more adequate for effective implementation for Chemistry curriculum so as to enhance students' performance. Students should be exposed to more laboratory applications and activities so that they can recognize laboratory materials and equipment.

2.5 Research Gaps

A knowledge gap occurs when desired research findings provide a different perspective on the issue discussed. For instance, Musyoki (2015) carried out a study to investigate determinants of students' achievement in chemistry and the proposed strategies used to improve its achievement. A total of 300 respondents were used to derive the findings and conclusion of the study. Questionnaires for principals, chemistry teachers and students were used to collect data and the results obtained were presented using both descriptive statistics for quantitative data by SPSS program while qualitative data was presented thematically in line with the study objectives. The findings of the study indicate that the perception of students towards chemistry was negative as observed by 64% of the chemistry teachers and 64% of the principals. Based on the findings the study concluded that students' perception in chemistry determines its achievement in examinations

and that most students do not have positive attitude in chemistry. ICT materials and facilities are available but not used during teaching and learning of chemistry. Also, various teaching and learning resources are not adequate in many schools. On the other hand, our study focused on instructional methods challenges and their influence on performance of Chemistry among students with blindness.

Secondly, a methodological gap can be identified from the research, for example, Ahmed, (2018) conducted a study on principals' perception of factors contribution to student's poor performance in chemistry in public secondary schools in Wajir County, Kenya. The study employed descriptive survey design. Questionnaires were used as a means of data collection from principals and students while the teachers were provided with interview schedules. Stratified random sampling was used. Various factors contribute to poor performance as perceived by the principals. On attitude of the learners towards the subject, the students have a negative attitude towards Chemistry despite the fact that they are interested in careers that need the knowledge of Chemistry; this has affected the performance in the subject. Secondly, motivation of the teacher did not seem to affect performance in the Sub County. However, a small percentage of teachers noted that availability of instructional resources was a motivating factor for them. The instructional resources however were not adequate. The teachers responded that factors that affected the performance of Chemistry in their schools, apart from availability of instructional materials, were learners' academic ability and student attitude towards the subject. On instructional resources, all the schools have a library which is not well equipped, with Chemistry books. However, our study employed use of desktop literature review method.

3.0 METHODOLOGY

The study adopted a desktop literature review method (desk study). This involved an in-depth review of studies related to instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda. Three sorting stages were implemented on the subject under study in order to determine the viability of the subject for research. This is the first stage that comprised the initial identification of all articles that were based on instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda. The search was done generally by searching the articles in the article title, abstract, keywords. A second search involved fully available publications on the subject on instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda. The third step involved the selection of fully accessible publications. Reduction of the literature to only fully accessible publications yielded specificity and allowed the researcher to focus on the articles that related to instructional methods challenges and their influence on performance of chemistry among students with blindness in Rwanda which was split into top key words. After an in- depth search into the top key words (instructional methods, challenges, influence, performance, chemistry, students, blindness), the researcher arrived at 3 articles that were suitable for analysis. These are the findings from the research.

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4.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Teaching is highly stressful career if resources and working environment is not favorable hence poor performance of the learners. Correct placement and provision of right resources and equipment are what is deemed vital for improved performance of learners with blindness in Chemistry.

The study found that some difficulties that blind students face during Chemistry lessons were caused by traditional classroom instructions, the use of sensory audition which lacked specialized laboratory labelling, libraries without Chemistry brailled reference books and many others. Therefore, learners with blindness need to be provided with opportunities, concrete experiences and activities in order to acquire what sighted learners acquire naturally

They also concluded that teachers are very important in determining the learners' academic performance but this can only be realized if and when instruments are availed for instructional purposes by teachers to the learners in visually impaired schools.

4.2 Recommendations

The study recommended that facilities and instruments are availed for instructional purposes by teachers to the learners in visually impaired schools. This is because the knowledge of teachers on the content of assigned subject affect the student's outcome. Also, the teaching of Chemistry to learners with visual impairment should be done by a specially trained teacher who is conversant with the use of these specialized devices. Chemistry teachers have to be conversant with various teaching methods that are effective in achieving the set objectives and the working environment should promote teaching and learning.

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