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Enrolment and Achievement of Persons with Special Education Needs in Secondary Schools in Science Subjects: Facts and Patterns

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Authors' contributions

This work was carried out in collaboration between authors MMO and IOJ. Author MMO designed the study, wrote the protocol and supervised the work. Authors MMO and IOJ developed the instruments for data collection, both carried out the field work and statistical analysis. Author MMO managed the analyses of the study. Author IOJ wrote the first draft of the manuscript. Author MMO managed the literature searches and edited the manuscript. Both authors MMO and IOJ read and approved the final manuscript.

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Original Research Article

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ABSTRACT

There are numerous studies on the practice of education curriculum, problems and prospects of special education programmes. However, studies on enrolment and achievement pattern of persons with special needs in science subjects are limited. This study is therefore designed to investigate enrolment and achievement of persons with special needs in science subjects in schools. This is a descriptive study involving eight secondary schools purposefully selected from three states in the South-western part of Nigeria. The schools had a range of 227 to 1543 students' population. The schools were both general (inclusive) and special schools. All the 55 senior secondary school students from two of these schools who offered science subjects specifically participated fully in the study. Twelve special education teachers from the sampled

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schools also participated. Five research questions were answered. Data was subjected to descriptive statistical analysis. The few students who offered science subjects achieved above average. Many of the students offering science subjects aspire to read medicine, nursing, building construction among other allied courses. They hope to work in hospitals, civil service, handicraft production and food production in that order among other places. However there are controversies on the views of the students on the reasons why science subjects are not popular among students with special education needs in Nigerian schools. It is hoped that Nigeria Teacher Educators may find means of encouraging and sustaining interest of students with special education needs in science subjects and science related disciplines in this prevailing technology-driven world.

Keywords: Nigeria; In-school persons with special education needs; science enrolment and achievement.

1. INTRODUCTION

Science is a systematic body of knowledge put together through investigations using some specific processes. The concepts, laws, theories about scores of topics in the various science subjects run spirally through preparatory, basic, senior and higher levels of education. Science deals with the manipulation of nature and its components [1]. It is man's relentless search for variables, patterns, concepts, definitions, description and explanation of the natural phenomena with a view to getting how Man can benefit maximally from nature. Technology is the harnessing of the principles and laws of nature, derived from science, to produce instruments and structures useful to Man in his day to day living activities [2].

Science and technology in the present world are regarded as major cultural products of human society which all citizens, irrespective of their occupational needs and physical state, should attain some level of consciousness in them as elements of human culture. Apart from being important for economic well-being, science and technology need to be seen in the perspective of a broadly liberal education. The President of the United States of America at a 2013 White House Science Fair in April 2013 [3] charged the officials involved in Federal Science, Technology, Engineering and Mathematics (STEM) education strategic plan to find means of creating all-hands-on-deck approach to STEM so that the subjects are lifted to the respect desired. The increasing influence of STEM subjects should be accompanied by a parallel growth in interest in their related subjects and in the understanding of basic scientific ideas and ways of thinking. However, on the contrary, the enrolment and achievement of secondary school students in the science and technology related subjects are not encouraging and do not match the obvious wide

and global importance of the subjects. With this discouraging enrolment of students in science subjects, it then becomes more worrisome to science educators how students who will even require some form of special assistance would be enrolling and achieving in science subjects. People with special needs incidentally make up a significant proportion of the world population. From a joint report of World Bank, about 15 per cent of the world's population, something like 785 million people have a significant physical or mental disability. This figure included about 5 per cent (5%) adolescents. The committee on STEM Education National Science and Technology Council 2013 even reported that the seemingly underrepresented minority are underrepresented in STEM education careers [3]. It will therefore be seriously out of place, if this proportion of people is not taken care of especially in the current technology driven world. The Nigerian Population commission report of the 2006 Census claims that 19 million Nigerians have one form of disability or the other. It becomes imperative then to investigate the pattern of enrolment and achievement in science by the proportion of students with special education needs. It is also possible however, to find out what this category of students aspire to become or how the education they are able to obtain while in school determines their career aspiration.

For persons with some form of affliction to do well in school work, they would need special schools. They would also need special instructional methods and supportive services that can meet their needs. Vocational education should form an integral part of their curriculum so that they can also have viable means of earning a living. Persons with special needs need to be provided with appropriate social, physical and psychological environment they need to develop their potentials to the fullest. Provision of special

schools may not necessarily be a better option so that such people would not be left alone in schools where they are unable to interact with their peers without special needs. Using a set of 300 physically challenged and non-disabled students, it was revealed by Eniola [4] that the non-disabled secondary school students have high real self, level of aspiration and academic achievement when compared with the physically challenged students. On the contrary, the physically challenged have high self-efficacy when compared with the non-disabled secondary school students. This is why the issue of inclusion is being popularised.

UNESCO describes inclusion as a process of addressing and responding to the diversity of needs of all learners through increasing participation in learning. It involves changes and modifications in content, approaches, structures and strategies, with a common vision which covers all children of the appropriate age range and a conviction that it is the responsibilities of the regular system to educate all children. Examples of such schools in the South-Western Nigeria are Methodist Grammar school, Bodija, Ibadan and Government School Eric-Moore, Lagos.

It is therefore necessary to find out the enrolment pattern of students requiring special treatment. There is need to have the relative proportion of students with challenges compared with other students without any form of challenges in schools. The study is thus designed to provide information on the enrolment and achievement pattern of persons with special needs in science subjects. The career aspiration of such students who offer science subjects, their challenges and motivation are also focused in the study.

The study is based on Equity theory advanced by Adams [5] as a social comparison theory of motivation. Social comparison theories generally focus on individuals feeling about how fairly they are treated compared to others. Maslow [6] hierarchy of needs makes it clear that there is a drive within individuals to achieve success. Persons with special needs, irrespective of their health conditions desire to be given equal treatment, in accordance with their respective challenges, on educational matters. For them to enrol in school and more especially show interest in science subjects means that they expect the society to provide them adequate and appropriate resources to produce that drive within to succeed.

2. PROBLEM STATEMENT

Studies on practices of special education curriculum evaluation, problems and prospects of special education programmes abound. However, there are limited studies on enrolment and achievement pattern of persons with special needs in science subjects. The study is thus designed to provide information on the enrolment and achievement of persons with special needs in science subjects. Information was sought on the proportion of students with special needs that are in special schools and in the inclusive schools with respect to their varying areas of challenges. The proportion of the students offering science subjects were also considered, their achievement pattern, their career aspiration and the conditions/frustration that sustain their interest in science were all put into considerations.

2.1 Research Questions

1. Are persons with special needs offering science subjects in the selected schools?
2. What is the pattern of career aspiration of in-school persons who offer science subjects in the senior secondary schools with respect to
 - (i) Proposed course of study after secondary school.
 - (ii) Proposed places of work after school. ?
3. What are the qualifications of teachers who teach science subjects in schools with persons with special needs?
4. How are the persons with special needs achieving in science subjects?
5. What are the views of in-school persons with special needs with respect to
 - (i) Most helpful/motivation conditions for offering science subjects.
 - (ii) Most disturbing frustrating conditions as they offer science subjects.

3. METHODOLOGY

The study is a descriptive study. All the students with different categories of special education needs in both special and inclusive schools in the South-West geo-political zone of Nigeria were the target population. Through multi stage

sampling procedures eight schools (seven inclusive, one special) were selected from three out of six states in the zone. The eight schools included one junior secondary school and six schools with both junior and senior secondary levels. The special school is a private secondary school for persons with hearing impairment (the Deaf School). All the fifty-five (55) students who specifically offered science subjects by choice in two of the schools with both junior and senior secondary levels were also purposely selected to take part in the study. Two variants of Science Students with Special Needs Questionnaire were used to gather data from the students and their teachers. The first questionnaire (Appendix A) has items on demographic characteristics of students, nature of impairment, career aspiration and proposed working place. This questionnaire was responded to by the students. The second questionnaire (Appendix B) has two sections, one on the school identification and the other on some school records about persons with special needs who offered science subjects. It was responded to by the science teachers of the students with special needs. The internal consistency of responses at trail stage estimated for the questionnaires were 0.52 and 0.71 respectively. Five research questions were answered. Frequency counts and percentages were used to analyse the data gathered.

4. RESULTS

4.1 Research Questions 1

Are persons with special needs offering science subjects in the selected schools?

In all the eight schools sampled, it is only in two schools that we have students who specifically offered science subjects. One of this is the special school for the Deaf where, a total of 50 students spanning through senior secondary classes 1,2 and 3 offered science subjects. The school had a total students population of 475. Five (out of 774) other students requiring special needs also offered science subjects in one of the inclusive school. The 5 students have different physical challenges. None of the students with visual special needs opted for science subjects. There is a general belief that the visually-impaired persons can hardly benefit from education especially science subjects. It is difficult to convince even some government officials about the use of pipette that is so graduated to indicate volume used when end point is reached in titration for the use of this

category of persons in chemistry practical for instance. It is therefore difficult to purchase equipment for them to benefit from science subjects. Equipment for the use of this category of person with which they can learn science subjects are not readily available.

4.2 Research Questions 2

What is the pattern of career aspiration of persons with special needs who offered science subjects at the senior secondary schools?

Tables 1 and 2 show the pattern of course of study, subsequent place of interest of senior secondary science students with special needs, and their career aspirations.

Table 1. Pattern of choice of academic programme persons with special needs hope to study at tertiary level. (N = 55)

Course of study	No. of students indicating interest (Percentage in parenthesis)
Medicine	13 (33.6)
Computer Science	7 (12.7)
Nursing	6 (10.9)
Building Construction	6 (10.9)
Automobile Engineering	4 (7.3)
Mechanical Engineering	4 (7.3)
Mathematics	4 (7.3)
Physics	3 (5.5)
Learn a trade	3 (5.5)
Biology	2 (3.6)
Pharmacy	2 (3.6)
Food Technology	1 (1.8)
Total	55

The students with special needs really aspire to study medicine, computer science and building construction. Other courses of interest in continuous descending order of interest are Mathematics, Automobile engineering, mechanical engineering, physics, and biology and food technology. Three (3) among the science students sampled representing 5.5% aspire to learn a trade after completion of their senior secondary education; these students have no intention of going for formal tertiary education. They are probably frustrated with learning of science and cannot foresee any success in their academic pursuits.

Hospital and ministries (i.e. working as civil servants) are the most desirable (20% each)

places where science students learning with special needs hope to work if they are eventually successful with their science related disciplines of interest. It is however unfortunate, as mentioned earlier, that none of those secondary school students sampled, with special needs have visual loss, though there was a report of a blind female undergraduate who offered chemistry as a teaching subject in the department of special education in the university where these researchers work. Two blind students that these researchers interacted with lamented that they could not offer science subjects because they were aware that they cannot be provided with enabling facilities. As noted by Eniola [4], the persons with visual impairment experience and live with unpleasant thinking on their inability to meet their career vocational goals and inability to secure a much anticipated performance for lack of competence. This set of people do upward social comparison, according to Planter [7], by observing that other people have it better than them in terms of available resources for learning science. They thus feel bad about themselves because of this.

Table 2. Pattern of the places where senior secondary school students with Special Needs would hope to work N = 55 (Percentage in parenthesis).

Places/Type work	No. industry interest
Ministry (Civil Service)	11 (20.0)
Hospital	11 (20.0)
Handicraft Production	8 (14.5)
Food production	7 (12.7)
Bank	5 (9.1)
Manufacturing Company	4 (7.3)
Teaching	3 (5.5)
Oil and Gas Company	1 (1.8)
Research Institute	1 (1.8)
Fashion and Entertainment	1 (1.8)
Vocational Training	1 (1.8)
Administrative jobs	1 (1.8)
Others (not specific)	1 (1.8)

4.3 Research Question 3

What are the qualifications of teachers who teach science subjects in schools with persons with special needs?

In the two schools where there were students with special needs offering science subjects, a total of twenty two (22) teachers were involved in the teaching of these students, handling various

subjects' areas. The teachers were distributed in terms of qualification as listed in Table 3:

In the special school for the deaf, all the teachers in the school, irrespective of their qualification and area of specialisation are made to go through training on sign language. There was a guidance counsellor in each school assign to the science students who offered counselling services to the students on regular basis. The Counsellor in the school was also trained in sign language.

Table 3. Distribution of the qualification of teachers who teach science students with special needs

Qualification	No. of teachers
Bachelor's Degree in Education (General) (B.Ed.)	12
Bachelor of Science B.Sc.	5
Master's Degree in Education (M.Ed.)	3
Bachelor's Degree in Special Education	2

The problem of educating people with special needs especially in the area of science subjects is that there are no specially trained personnel to handle the teaching of the subjects effectively. The teachers are teaching grudgingly except those who eventually develop special interest in the students, consequently the students are frustrated. The scarcity of trained personnel to teach students with special needs, especially in the areas of science, technology and mathematics (STM) education is a global problem.

4.4 Research Question 4

How are the persons with special needs achieving in science subjects?

The results of two schools from where there are many senior secondary school students requiring special needs are given in Tables 4 and 5, showing distribution of grades of student in the senior secondary school certificate examination of the 2012/2013 academic session.

In the school with hearing challenges (Table 4), only twenty-four students reportedly wrote the immediate past school certificate; out of which twenty (20) students wrote physics and ten chemistry while all of them wrote biology. The students performed averagely in Biology and

Chemistry though performance in biology is still better with more students passing at credit level. The twenty students who offered physics all perform creditably above average. Among those with hearing loss in the public inclusive school; only Basic Science and Biology were offered.

In the public secondary school, with students with hearing loss (Table 5), all the students performed above average; with almost 50% of the students scoring high at distinction level in Basic science. In biology, all the students who wrote the examinations passed, but at different grades of pass, about 25% passed at distinction level, 39% at credit coverage level and 35% just managed to pass. The science special needs students need to have their morale boosted to be well motivated to enrol and perform well in science subjects. Unfortunately some of the students with some form of impairments or another shy away from science subjects as if they cannot really do well. The teachers, parents and peers sometimes even encourage this type of feelings. Attitude towards the disabled is fraught with much pessimistic sympathising than empathising thus breeding feelings of learners' helplessness and upward social comparison in the individuals with disabilities.

4.5 Research Question 5

What are the views of the students on the:

- (i) *Most helpful/motivating conditions for offering science subjects?*
- (ii) *Most disturbing condition why they may be finding it uneasy offering science subject.*

Table 6 shows varieties of divergent views of students with special needs who offered science subjects on what help/motivate them and on those issues that pose challenges to them.

Reading through the students' views, it is obvious that some points are quite contradictory and controversial, it should be realised that these were the candid opinions of different students. Apparent helpful motivating points may actually be disturbing to another. There will always be individual differences even when the students are seemingly having same physical plights this also enjoins teachers to endeavour to adopt different teaching and leadership styles in classrooms and laboratories to accommodate different categories of student with respect to their motivations and learning styles.

5. DISCUSSIONS

The problem of educating people with special needs especially when it concerns science subjects, is a global problem, Billingslay et al. [8] reveal that high percentage of non-certificated educators staffed special education institutions in the United State of America. There is a continuous attempt to produce National Certificate of Education (NCE) special educators through e-learning distance programme in Nigeria to teach in the primary schools and junior secondary schools. In the investigation of the opinion of lecturers of the programme on the possibilities of producing NCE special educators through e-learning distance education programme much was revealed. It was reported that though there are positive opinions on the workability the programme might run into problem with teaching practice and courses involving demonstration. It was also admitted by 66.6% of the respondents that the absence of teachers and peers will negatively affect the quality of the graduate [9]. This shows the enormity of training teachers on how to handle people with special needs in schools.

Eleri [10] and Cook [11] listed out-dated and irrelevant curriculum, no guarantee for immediate employment and communication gap between scientists and the public among other possible reasons why youths and physically challenged adolescents are disenchanted with science and technology related subjects. To make persons with special needs do well in school and more especially enrol and achieve in the science subjects, the parents, teachers and the society at large should support them psychologically, and provide enabling environment by providing necessary facility and equipment. It should be noted that a child raised in a loving atmosphere, accepted and value grows to be self-centred, loving and trusting. But in most cases disable children don't enjoy such atmosphere, parent and siblings and family members often find it difficult to love and value disabled children and this is why many of them cannot have self-confidence while at school [12]. Eleri [13] corroborated this fact while evaluating the implementation of Elements of special education in NCE awarding institutions in Nigeria by revealing that many of the facilities, equipment and resources meant for the teaching of the content of the curriculum were not available. Instances where available they were grossly inadequate, consequently many of the students were not exposed to their uses.

Another outstanding problem of the disabled science students is the non-availability of professionally qualified personnel to teach them. The best some of them have is that once they find themselves in the special schools they quickly undergo some training just to enable them flow well in the environment. Eleri [13] also reported that some of the lecturers and teachers of youths with special needs really are not professionally trained in special education, but in areas such as educational psychology, guidance and counselling, educational management etc. This also corroborates the reports of Trait and Purde [14], Cook [11] and Praisner [15], they all berated poor qualification of personnel in special

education. Persons with special education needs can cope with science because they have the mental alertness for it, but they are constrained by the non-availability of necessary equipment and facilities especially those who desire visual aids.

Rockoff [16] cautions that the logical starting point to address the issue of youth (and children) with special needs achieving well at school is the quality of teachers instructing them. The students with challenges would require assistance to be fully equipped to acquire education of today's standard and for tomorrow's living.

Table 4. Distribution of Special Students' Grades in Certificate Examination of 2012/2013 a session in School for Persons with Hearing Impairment

Subjects	No. of students in Grades							
	A1	A2	B3	C4	C5	C6	P7	P8
Biology				1 4.17%	5 20.83%	16 66.62%	2 8.34%	
Chemistry					1 10%	5 50%	4 40%	
Physics	3 15%	2 10%	15 75%					

(N = 24); A1, A2, B3 – Distinctions; C4, C5, C6 – Credit Passes; P7, P8 – Ordinary Passes

Table 5. Distribution of Special Students' Grades in Certificate Examination of 2012/2013 session in an Inclusive Education Setting Involving Students with Hearing Impairment

Subjects	No. of students in Grades							
	A1	A2	B3	C4	C5	C6	P7	P8
Biology	9 11%	5 6.1%	7 8.5%			32 39%	18 22%	11 13.4%
Basic Science	8 21.6%	6 16.2%	4 14.81%	12 44.4%	7 25.9%			
s	NJ = 37			NS = 82				

A1, A2, B3 – Distinction; s; C4, C5, C6 – Credit Passes; P7, P8 – Ordinary Passes

Table 6. Views of students concerning helpful and disturbing points

Helpful/Motivating points		Disturbing/Challenging points	
1	Our teachers teach us well		Our teachers are the problem
2	Our teachers show that they really understand the subject		There is confusion in chemistry, we don't always understand
3	Our physics and chemistry teacher teach us with sense of seriousness, so that we will understand well.		Too many exercises and home work to cope with for science subject
4	Our teachers make us to realise our ambition		Students that are not having lessons disturb a lot by talking (even the deaf students make noise)
5	Fellow students are good		Many students are not serious
6	The students have interest in science and they read well		Reading habit of children
7	Strong desire to be a medical doctor in future		Some students are lazy
8	Desire to read more and gain knowledge		There is lack of equipment to teach us
9	Motivated by someone always read about		
10	The dream to become great.		

6. CONCLUSION

A significant proportion of Nigerian adolescents are living with some form of challenges consequently requiring special educational needs to make them benefit from school work, educational programme or even any form of vocational training. This study has been able to show that many special students both in special school or inclusive school did not enrol and subsequently do well enough in science subjects. These categories of people were unable to learn science because of inappropriate environment – physical, social and psychological. The very few who forged ahead to learn science were doing so in difficult conditions. These few special science students were very ambitious to contribute their quota by desiring to take up science related careers and work in places where they can contribute greatly to the society. The situations were even worse for persons with visual impairment they were really disenchanted at offering science subjects. This is in spite of their seemingly intellectual capacity and ability to concentrate fully at their studies since they would have limited distractions due to inability to see. Science students' teachers need to be equipped to teach students with special needs both in special schools and inclusive schools. Teachers need to know how to determine and access software and other assistive technology for the different categories of students requiring special needs. School Administrators and government at all levels should show more practical interest and commitment to provision of enabling environment, physical and psychological, materials and facilities in the society for those requiring special needs. Especially in this uncertain, complex and technology-driven world.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX A

Science Students with Special Needs Questionnaire I

The questionnaire is designed to gather information on physically challenged adolescent participation in science subjects. Kindly respond to the questions as faithful as possible, the exercise is purely for research.

SECTION A

1. Name of School _____
2. State _____
3. Age _____
4. Sex M F

5. Nature of your physical challenge

- (a) Visual impairment
- (b) Hearing impairment
- (c) Physical impairment
- (d) Learning disability
- (e) Gifted
- (f) Mentally retarded (MR)
- (g) Others (specify)

6. Do you want to go to higher institution when you complete secondary school

YES NO

7. If 'Yes' to question 6 above, what do you hope to study?

- (a) Biology _____
- (b) Chemistry _____
- (c) Physics _____
- (d) Mathematics _____
- (e) Chemical Engineering _____
- (f) Petroleum Engineering _____
- (g) Agricultural Engineering _____
- (h) Agricultural Science _____
- (i) Pharmacy _____
- (j) Medicine _____
- (k) Veterinary Medicine _____
- (l) Food Technology _____
- (m) Nursing _____
- (n) Dentistry _____
- (o) Biochemistry _____
- (p) Microbiology _____
- (q) Geography _____
- (r) Computer science _____
- (s) Building construction _____
- (t) Physiology _____
- (u) Physiotherapy _____
- (v) Learn a trade _____
- (w) Others (Specify) _____

8. On completion of secondary school, where do you want to work?

- (a) Oil and Gas Company _____
- (b) Manufacturing company _____
- (c) Ministry (Civil Service) _____
- (d) Research Institute _____
- (e) Food Production _____
- (f) Handicraft Production _____
- (g) Fashion and Entertainment _____
- (h) Teaching _____
- (i) Marketing industry _____
- (j) Vocational training centre _____
- (k) Bank _____
- (l) Hospital _____
- (m) Catering and decoration company _____
- (n) Administrative jobs _____
- (o) Counselling services _____
- (p) Social works _____
- (q) Others (Specify) _____

9. What do you find most helpful to you in pursuing your interest in science subjects in schools?

- (a) From teachers

- (b) From other students

- (c) Others (Specify)

10. What do you find most disturbing or as hindrance to you in pursuing your interest in science subjects in school?

- (a) From teachers

- (b) From other students

- (c) Others (Specify)

APPENDIX B

Science Students with Special Needs Questionnaire II

The questionnaire is designed to gather information on physically challenged adolescent participation in science subjects. Kindly respond to the questions as faithful as possible, the exercise is purely for research.

SECTION A

1. Name of School _____
2. State _____
3. L.G.A _____

SECTION B

Please give records of students with physical challenge that enrolled for science subjects in your school

SSI

No of students offering biology, chemistry and physics (at least any of 2 of these)

Boys _____

Girls _____

Please indicate number of students (from the total above) in terms of the physical challenge associated with them:

- (a) Visual impairment _____
- (b) Hearing impairment _____
- (c) Physical impairment _____
- (d) Learning disability _____
- (e) Gifted _____
- (f) Mentally retarded (MR) _____
- (g) Others _____
- (h) (specify) _____

SSII

No of students offering biology, chemistry and physics (at least any 2 of these)

Boys _____

Girls _____

Please indicate number of students (from the total above) in terms of the physical challenge associated with them:

- (i) Visual impairment _____
- (j) Hearing impairment _____
- (k) Physical impairment _____
- (l) Learning disability _____
- (m) Gifted _____
- (n) Mentally retarded (MR) _____
- (o) Others _____
- (specify) _____

SSIII

No of students offering biology, chemistry and physics (at least any 2 of these)

Boys _____
Girls _____

Please indicate number of students (from the total above) in terms of physical challenge associated with them:

- (a) Visual impairment _____
- (b) Hearing impairment _____
- (c) Physical impairment _____
- (d) Learning disability _____
- (e) Gifted _____
- (f) Mentally retarded (MR) _____
- (g) Others _____
(Specify) _____

Total No. of students in senior secondary school

Total No. of students with physical challenge

Please provide records of performance of students with different forms of physical challenge in your school in the last senior school certificate examinations, both WAEC and NECO.

No. of students with (amongst the physically challenge)

	A1	B2	B3	C4	C5	C6	D7	E8	F9
Biology									
Chemistry									
Physics									

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