EFFECTS OF TACTILE DIAGRAMS ON THE ACADEMIC ACHIEVEMENT OF STUDENTS' WITH VISUAL IMPAIRMENT IN AGRICULTURAL SCIENCE IN DEKINA LOCAL GOVERNMENT AREA OF KOGI STATE, NIGERIA.

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Abstract

The purpose of this study was to determine the effect of tactile diagrams on the academic achievement of students' with visual impairment in agricultural science in secondary schools in Dekina Local Government Area of Kogi State. Two major variables such as gender and school type were put into consideration. Two research questions and one hypothesis were formulated to guide the study. The study employed pre-test post/test quasi experimental design. The population of the study comprises of all the ninety-four (94) SS1 to SS 3 (32, 33 and 29 respectively) students of C.M.M.L. Special School, Iyale, in Dekina Local Government Area of Kogi State. 14 students with visual impairment which was made up of 9 males and 5 males constituted the sample for the study. The instrument for data collection was a 12-item 'Agricultural Science Achievement Test' (ASAT). The instrument was face and content validated by three (3) Agricultural science and measurement and evaluation experts. Using Cronbach alpha coefficient, a reliability index of 0.72 was obtained. Instructional packages involving use of tactile diagram and lesson plans for the visually impaired was developed by the researchers. The two research questions were answered using Mean and standard deviation while the only hypothesis was

tested using t-test statistics. The study revealed that students with visual impairment have greater chances of mastering the images as compared with sighted. Students with visual impairment scored higher in Agricultural Science achievement test than some of those students without visual impairment. No significance difference exisence between male students who are visually impaired and their female counter-parts. It is recommended that teachers should be encouraged to improvise and modify local materials that can easily be used in designing tactile learning materials for students during teaching and learning process.

Keywords: Effect, Tactile diagrams, Academic achievement, Visual Impairment and Agricultural Science.

Introduction

Agricultural Science was included as a core subject into the curriculum of the Senior Secondary Schools by the Federal Republic of Nigeria. The inclusion was aimed at broadening the learners' knowledge and skills in the course as a way of making them to develop interest in modern farming practices (Federal Republic of Nigeria (FRN) 2008).

Generally, students develop poor attitude towards the course because of its practical inclination. Their performance to some extent has been very poor even with normal students. This poor achievement (performance) is particularly more evident among learners with visual impairment. This is due to the fact that vision is a major channel through which students perceive their immediate environment which if distorted impedes the development of visual concept. Students with visual impairment often face more challenge especially when tactile or embossed diagrams are not provided.

The term visual impairment is used to describe all degree of visual impairment ranging from partial visual impairment to total blindness. In support, Ozoji (2005) described this as children in whom the sense of vision is defective and this could range from ability to see a little to total blindness. This children are visual disables when they cannot perform visual tasks. In this case, such a child is blind as he cannot read ordinary/bold print. It means the child must read through Braise (a special system of dot reading for the blind). Visual impairment occurs in different forms. These include person with visual impairment and this condition has adverse effect on academic achievement (Omede, 2009).

Students with visual impairment often experience difficulties in science educational environment with the overwhelming mass of visual materials to which they are exposed. These include textbooks, laboratory experiments, field trips. Special attention are not given to students with visual impairment in terms of subject matter and materials employed by the teacher. The poor achievement of students in science subjects (Agricultural science inclusive) is discouraging. Omede (2009) observed and stated that the teaching of science concepts to visually impaired pupils have over the

years posed a challenge to teachers. The authors observed that the poor performance is largely due to poor instructional methods and materials among other factors.

Agricultural science involves observations, experimentation and handling of physical materials for practical work and demonstrating an effective instructional strategy such as the use of tactile diagrams is necessary in teaching abstract concepts to students with visual impairment. Bodang and Amwe (2014) described tactile diagrams as images that use raised surfaces so that a visually impaired person can feel them. They are used to convey non-textual information such as maps, paintings, graphs and diagrams. The National Centre for Tactile Diagrams (2011) defined tactile diagrams as images designed to be touched rather than looked at. Such images are used as maps, painting, graphs and diagrams in a way that the concept is conveyed in vivid form in the mind of the students with visual impairment. Consequently, the provision of tactile diagrams in teaching agricultural science to students with visual impairment has a significant impact on their academic achievement (Smith, 2010). Similarly, tactile diagram will enable students who are visually impaired to derive meaning from diagrams very easily. In a more comprehensive form, tactile diagram is a systematic method of teaching, presentation of facts, ideas, skills and techniques to visually impaired students. The question now is whether the use of tactile diagram will have positive or negative impact on the academic achievement of students with visual impairment in Agricultural Science in senior secondary schools in Kogi State.

The following research questions guided the study

a) What is the relative achievement scores of students with visual impairment taught agricultural science with the use of tactile diagrams?
b) To what extent does gender influence the achievement scores of students with visual impairment in Agricultural science achievement test (ASAT)?

The main purpose of the study was to examine the effects of tactile diagrams on the achievement of students with visual impairment in Agricultural science. Specifically, the study intends to:

a) determine the relative achievement scores of students with visual impairment taught agricultural science with the use of tactile diagrams.
b) compare the mean score performance of male and female students with visual impairment in Agricultural Science Achievement Test (ASAT).

One null hypothesis guided the study:

Ho: There is no significant difference in the Agricultural science mean achievement scores of boys and girls with visual impairment as measured by their mean scores in Agricultural science achievement test (ASAT).

Methodology

The study adopted pre-test post-test post-test quasi research design. The study population comprises of all the 94 senior secondary school visually impaired students of CMML Special Secondary School, Iyale in Dekina Local Government Area of Kogi State. The target sample population comprised of 14 (9 males and 5 females) students with comparable ability and comprised of boys and girls between the age range of 18 – 22 years. The sample for the study was gotten using stratified sampling technique. The same technique was used in assigning the students to the experimental and control groups. In addition, all agricultural science teachers in the school formed part of the study. The instrument for data collection was the Agricultural Science Achievement Test (ASAT). The Agricultural Science Achievement Test (ASAT) consist of a 12 – item that was used to determine the achievement of visually impaired students in Agricultural Science. The test items were extracted from Comprehensive Agricultural Science textbook for Senior Secondary Schools. The test items were validated by Agricultural Science and Test and Measurement experts. Both groups were given the pretest and then taught. The experimental group made use of tactile diagram in learning Agricultural Science while the control group (non – visually impaired students) was taught using the conventional method. At the end of the treatment (after a week), both groups received the post test and data were collected and analysed accordingly. Administration of the achievement test to the students was done with the help of the agricultural science teachers.

The research questions formulated for the study was analysed using mean and standard deviation while the only null hypothesis would be tested using t-test statistics. In this study, the mean gain difference refers to the difference between the pretest and post-test mean results. If the mean gain difference is positive, it means it has a plausible effect and if it is negative, it has an adverse effect.

Results and Discussion

The study results were presented as follows:

Research Question 1.

What is the relative mean achievement scores of students with visual impairment taught agricultural science with the use of tactile diagrams? This question was answered by the data analyses shown in Table 1.

Table 1: Relative mean achievement scores in agricultural science achievement test (ASAT) to visually impaired students taught with the use of tactile diagrams:

Group	Symbol	Pretest	Posttest	Mean Gain Difference
	N	14	80	
Tactile diagrams	X	48.77	67.58	18.81
(Experimental	SD	4.49	7.78	
Method)				
	N	14	80	
Conventional	X	46.34	62.48	16.14
Lecture Method	SD	4.31	6.27	
(Control)				

N = Number of subjects, X=mean, SD = standard deviation.

Table 1 shows that prior to the use of tactile diagrams (experimental method) in the teaching of agricultural science by agricultural science teachers in the experimental and control group, their mean score were 48.77; 46.34 while their standard deviations were 4.49 and 4.31 respectively. The mean score of the experimental group is slightly higher than the control group during the pretest. But after the treatment which was teaching the experimental group (students), the post test mean scores for the experimental students improved appreciably from 48.77 to 67.58 while the standard deviation show an increase from 4.49 to 7.78. In the case of the control group, there was mean scores increase from 46.34 to 62.48 with a standard deviation of 4.31 to 6.27 showing a slight closeness of the test scores.

The table also shows that the mean gain difference was 18.81 for the experimental group (tactile diagrams) and 16.14 in conventional lecture method. This therefore implies that students (impaired subjects) taught

agricultural science with the use of tactile diagrams performed better in the achievement test than their counterparts taught with conventional lecture method. A moderate performance difference exist between the experimental and control group subjects.

Research Question 2

To what extent does gender influence the achievement scores of students with visual impairment in Agricultural science achievement test (ASAT)?

Table 2: Mean Academic Achievement Scores of Male and Female Students taught Agricultural Science with the experimental (tactile diagrams) and the control group.

Gender	Methods	Symbol	Pretest	Posttest	Mean Gain Difference
Male	Tactile diagram (experimental) group 1	N	9	9	
		$\bar{X}$	46.33	74.95	28.62
		SD	3.66	5.34	
Female	Tactile diagram (Experimental group 2.)	N	5	5	
		$\bar{X}$	48.05	67.88	19.83
		SD	4.07	7.59	
Male	Conventional method (Control group 1)	N	55	55	
		$\bar{X}$	45.55	64.38	18.83
		SD	3.59	4.30	
Female	Conventional method (Control group 2)	N	25	25	
		$\bar{X}$	47.33	59.12	11.79
		SD	4.888	6.53	

N = Number of subjects, $\bar{X}$=mean, SD = standard deviation.

Table 2 above shows that the pretest mean scores of the students taught with the two methods of teaching i.e. female) male use of tactile diagram (experimental groups 1) and (experimental group 2 i.e) are 46.33 and 48.05 with standard deviation of 3.66 and 4.07 respectively. The highest is with

that of the female fold of the experimental group. That of the control group male had mean score of 45.55 and female had 47.33 with standard deviation of 3.59 and 4.88 for male and female respectively. In the post test male and female students with visual impairment taught with tactile diagrams (experimental groups 1 and 2) had mean scores of 74.95 and 67.88 with standard deviations of 5.34 and 7.59 and mean gain difference of 28.62 and 19.83 respectively. That of the control group male had mean scores of 64.38 while female had 59.12 with standard deviations of 4.30 and 6.53 and mean gain difference of 18.83 and 11.79 respectively.

The results further shows that the difference in post-test mean scores is highest among male students (visual impaired) taught with the use of tactile diagrams followed by female taught with the same approach.

In the case of variability of test scores, the standard deviation obtained in each case showed a minimal spread of scores. On a general note, the study revealed that both male and female students taught with the use of tactile diagrams had higher mean scores than their male and female students taught with conventional lecture method. In both of the methods, male students performed far better than their female counterparts when their mean gain difference of 28.62 and 18.83 and 19.83 and 11.79 are critically examined and considered.

Testing of Hypothesis

Ho: There is no significant difference in the Agricultural Science mean achievement scores of male (m) and female (f) with visual impairment as measured by their mean scores in Agricultural Science achievement test (ASAT).

Table 3: t-test of mean test scores of male and female students with visual impairment taught Agricultural science with tactile diagrams as measured by their mean scores in Agricultural Science Achievement Test (ASAT).

Gender	Mean ($\bar{X}$)	N	Standard Deviation (SD)	Df	T-val Decision	T-cal	Level of Sign.
Male	74.95	9	5.34	13	1.960 NS	1.890	0.05
Female	67.88	5	7.57				

N = Number of subjects; Df = Degree of Freedom; T-value = Table value;

NS = Not Significant. T-cal = Table calculated. Sign = Level of Significance.

NS = Not Significant.

Table 3 above shows that the t-calculated is 1.890 as against the table value of 1.960 at 0.05 level of significance. As the t-calculated (1.890) is less than the t-value of 1.960, the null hypothesis formulated is then upheld showing that no significance difference exist between the performance of visual impaired male and female students taught agricultural science with the use of tactile diagrams based on their mean scores in the agricultural science achievement test (ASAT).

The following findings were deduced from the study.

1. Visual impaired students taught agricultural science with the use of tactile diagrams performed better in the achievement test than their counterparts taught with conventional lecture method.
2. A moderate performance difference exist between students with visual impairment taught agricultural science with the experimental groups (use of tactile diagrams) and the non – visual impaired (normal) students taught with the conventional lecture method (without tactile diagrams).

3. There exist a difference between the post test mean scores among both male and female students and that of their pretest mean scores.
4. The post test mean scores is highest among male students with visual impairment taught with the use of tactile diagrams than those of their female counterparts.
5. Both male and female students taught with the use of tactile diagrams had higher means scores than their male and female counterparts taught with conventional lecture method.
6. No significant difference exist between the performance of visual impaired male and female students taught agricultural science with the use of tactile diagrams.

Comparing the two methods of teaching visually and non-visually impaired students, students taught with tactile diagrams performed better than those taught with conventional lecture method. This therefore shows that tactile diagrams used for teaching agricultural science enables students with visual impairment to become more interested in the learning. This is in line with the study carried out by Okebukola (1993) which indicates that students had a positive attitude towards tactile diagrams and benefited maximally from it during science classes. In addition, teachers strongly agree that students with visual impairment participate actively in Agricultural science lessons when tactile diagrams are used. The mean scores of the students exposed to tactile diagrams were higher than those who were not. This is in line with Minagawa, Ohnishi and Sugie (1996) when they revealed that students with visual impairment have greater chances of mastering the images as a sighted child learns foundational concepts from being read aloud from infancy, so too the vision impaired child. Male students with visual impairment taught with the use of tactile diagrams performed better than their female counterparts. It was reported by Ibitoye (2005) and Adenyika and Mutula (2006) that difference exist between the performance of male and female students in the science and other science related courses like agricultural science. They further added that performance was better with male group. Also it is evident from the findings of this present study that male students performed better in the ASAT than their female counterparts. This agrees with the finding from the study of Daluba and Audu (2005) when they both found out those male students (75.5%) performed better in agricultural

science than their female (60.19%) counterparts. The reason deduced from the disparity was that agricultural science is a practical and skill oriented course which is more inclined to males than females because of their femine nature as a group of people in the society.

There is no significant difference between the performance of visual impaired male and female students taught agricultural science with the use of tactile diagrams. This agrees with Okebukola (1993) who maintained that gender has no significant effect on the academic achievement of students with visual impairment.

Conclusion and Recommendation

Students with visual impairment experience difficulty in understanding science concepts due to limited vision since science requires vision. Teaching agricultural science to students with visual impairment requires considerable effort on the part of the teacher who is expected to select appropriate methodology and materials to suit the individual needs of the students. This is aimed at making learning more interesting; promote active participation and real life experiences amongst learners. Therefore, tactile graphics or diagrams should be used in science classrooms to provide necessary information to aid understanding.

Recommendations

The following recommendations are proffered:

1. Teachers of visually impaired students must consider the individual who will be using the tactile aid; his or her background, experience with graphic materials, cognitive and language level etc. This will help the teacher ensured that the particular aid is appropriate.
2. The provision of assistive devices (electrical, optical and non – optical) should be highly encouraged in schools. This provides visually impaired students the opportunity to access information that is not available to them due to the nature of materials available in the classroom.
3. Teachers of visually impaired learners should adopt the principles of improvising and adapting instructional materials and tactile teaching aids should be carefully selected by teachers to enable students with visual impairment understand the science concepts and study tactile diagrams correctly.
4. Appropriate methodology should be selected by the teacher of Agricultural Science as this will make learning interesting, promote active participation and bring real life experiences as much as possible to the learners.

References

Adeyinka, T. and Mutula, S.M. (2006). Gender Differences in Computer Literacy and Among Undergraduate Students at the University of Botswana, Implication for Library use. Retrieved October 23, 2008 from http/myais.fsktm.um.educ.my/23631.

Bodang, R. and Amwe, R.A. (2014).Effects of tactile Models on the Academic Achievement of Pupils with Visual Impairment in Primary School.*The Journal of the National Council for Exceptional Children 16(1) 88-94.*

Daluba, N.E. and Audu, T.A. (2005).Comparing the Academic Performances of Sandwich and Regular Students in Science, Technology and Mathematics Education (STME).Implications for Standards.Sandwich/Part Time Programme and Science, Technology and Mathematics Education in Nigeria. (Omonu, J.B.; Audu, T.A. & Agashi, P.P. eds. Ankpa: A Publication of the School of Sciences, Kogi State College of Education, Pp. 47-52.

Federal Republic of Nigeria (FRN, 2008).*National Policy on Education.*Abuja: NERDC Press.

Ibitoye, S.J. (2000). The Relationship between Student Entry Qualification and Academic Achievement in Agricultural Education at Kogi State College of Education, Ankpa.*Teacher Education Journal (TEJ) 2(1) 51-56.*

Minagaws, H. & Ohnishi, N., Sugie, V. (1996). *Tactile Audio diagrams for blind persons. 1EEE4 (4), 431 – 437 Retrieved* from *http://www.nchi.nih.gov/m/pubmed/8973970/.*

National Centre for Tactile diagrams (2011). Art/Design/Media Subject Centre.The Higher Education Academy.University of Herfordshire.Hardfield.Retrieved on 21 April, 2015 from *http.www.adm.heacademy.ac.uk/resources/resources-by-topic/content.*

Okebukola, P.A. (1993). *Making College Science Transparent Through the use of Concept Maps.*A paper presented at the annual meeting of NERTST. Atlanta Georgia.

Omede, A.A. (2009). Challenges of Educating the Visually impaired in Nigeria: Strategies for Improvement. *Journal of the National Association for Science, Humanities and Education Research* 7(3) 114-119.

Ozoji, E.D. (2005). *Element of rehabilitation.*Jos – Nigeria: Deka Enterprise Limited.

Smith, B. (2010). Assistive technology for the visually impaired students. Brighthub inc. Retrieved on 21st April, 2015 from *http.//www./brighthub.com.educaiton/special/article/7453.9.aspx.*