

REFERENCIA: Olatoye, R.A. (2017). Effect of Teaching Using Charts, Real Specimens and Videos on Secondary School Students' Achievement in Mammalian Skeletal System Concepts. *ENSAYOS, Revista de la Facultad de Educación de Albacete*, 32(2). Enlace web: <http://www.revista.uclm.es/index.php/ensayos>  
- Consultada en fecha (dd-mm-aaaa)

## **EFFECT OF TEACHING USING CHARTS, REAL SPECIMENS AND VIDEOS ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MAMMALIAN SKELETAL SYSTEM CONCEPTS**

### **EFECTO DE LA ENSEÑANZA MEDIANTE EL USO DE GRÁFICOS, MUESTRAS REALES Y VIDEOS SOBRE EL RENDIMIENTO DE LOS ESTUDIANTES DE SECUNDARIA EN LOS CONCEPTOS DEL SISTEMA ESQUELÉTICO DE MAMÍFEROS**

**Rafiu Ademola Olatoye**

Faculty of Education, Federal University Dutsin-Ma, Katsina State, Nigeria

Recibido: 23/09/2017

Aceptado: 05/12/2017

#### **Abstract:**

Low performance of students in biology has been reported by many researchers. This is attributed to different factors, among which lack of adequate and appropriate instructional materials is one. Instructional materials help both the teacher and the learners in teaching-learning processes. The study investigated the effect of teaching using charts, real specimens and videos on secondary school students' achievement in mammalian skeletal system concepts. Charts, real specimens and videos were used to teach the experimental groups while lecture method was used to teach the control group. A 4X2 pre-test, post-test quasi-experimental design with control group was used in which a hundred and twenty randomly selected Senior Secondary School II (SSS II) Biology students were drawn from four schools. An instrument developed by the researcher Mammalian Skeletal System Achievement Test (MSAT) was used for data collection. The reliability coefficient of MSAT was 0.796. The data was analyzed using Analysis of Co-variance (ANCOVA) and Scheffe post-hoc test analysis. The findings of this study show that there is significant main effect of treatment on students' achievement in mammalian skeletal system concepts [ $F_{3, 111} = 10.489$ ;  $p < 0.05$ ]. Hence, students performed significantly at different levels in the four groups. The findings also indicate that there is no significant interaction effect of treatments and gender on students' achievement in mammalian skeletal system concepts [ $F_{3, 111} = 1.013$   $p > 0.05$ ]. Real specimens and videos are the best instructional materials that can be used in teaching; they tend to raise the students' achievement. It is therefore recommended that teachers should develop the technique of integrating different types of instruction materials especially real specimens and videos into their teaching. Educational training programmes should be made available for teachers, which will help to improve their competencies and skills of effective utilization of instructional materials.

**Keywords:** Charts, Real specimens, Videos, Achievement in science, Mammalian Skeletal System

#### **Resumen:**

El bajo rendimiento de los estudiantes en biología ha sido presentado por muchos investigadores. Esto se atribuye a diferentes factores entre los cuales están la falta de materiales

de instrucción adecuados y apropiados. Los materiales didácticos ayudan tanto al profesor como a los alumnos en los procesos de enseñanza-aprendizaje. Este estudio investigó el efecto de la enseñanza utilizando gráficos, muestras reales y videos sobre el rendimiento de los estudiantes de secundaria en los conceptos del sistema esquelético de mamíferos. Se utilizaron gráficos, especímenes reales y videos para enseñar a los grupos experimentales, mientras que se utilizó el método de lectura para enseñar al grupo de control. El estudio utilizó un diseño cuasi-experimental pre-test, post-prueba 4X2 con grupo de control en el que se seleccionaron ciento veinte estudiantes de Biología de Secundaria II (SSS II) seleccionados al azar en cuatro escuelas. Un instrumento desarrollado por el investigador Mammalian Skeletal System Achievement Test (MSAT) se utilizó para la recopilación de datos. El coeficiente de confiabilidad de MSAT fue 0.796. Los datos se analizaron mediante el análisis de covarianza (ANCOVA) y el análisis de prueba post hoc de Scheffe. Los hallazgos de este estudio muestran que existe un efecto principal significativo del tratamiento en el rendimiento de los estudiantes en los conceptos del sistema esquelético de mamíferos [ $F_{3, 111} = 10.489$ ;  $p < 0.05$ ]. Por lo tanto, los estudiantes se desempeñaron significativamente en diferentes niveles en los cuatro grupos. Los hallazgos también indican que no existe un efecto de interacción significativo de los tratamientos y el género en el rendimiento de los estudiantes en los conceptos del sistema esquelético de mamíferos [ $F_{3, 111} = 1.013$   $p > 0.05$ ]. Los especímenes y videos reales son los mejores materiales de instrucción que se pueden usar en la enseñanza; ellos tienden a aumentar los logros de los estudiantes. Por lo tanto, se recomienda que los maestros desarrollen la técnica de integración de diferentes tipos de materiales de instrucción, especialmente especímenes y videos reales en su enseñanza. Los programas de capacitación educativa deben estar disponibles para los maestros, lo que ayudará a mejorar sus competencias y habilidades de utilización efectiva de los materiales de instrucción.

**Palabras clave:** Gráficos, especímenes reales, videos, logros en la ciencia, sistema esquelético de mamíferos

## 1. Background of the Study

Developing students' interest in science and technology is one of the objectives of science education. With global scientific and technological advancement occurring rapidly, declining students' achievement in science courses is a worldwide concern that has led to science education reform efforts on an international scale (Ozcan & Genc, 2016; Torres & Vasconcelos, 2017). Today's society depends on development of science and technology (Uzunboylu & Tugun, 2016). Teachers are expected to devise ways of improving the interest and achievement in science and science-related disciplines. No nation can afford to neglect science education at any level of education and hope to thrive in any field of human endeavour. Science education is vital for useful living in any society. It is at the Centre for producing resources necessary for socio-economic, scientific and technological development needed for advancement of any nation. Olatoye (2002) was on the opinion that science education lays foundation for work in science-related fields by giving the students necessary information about certain knowledge, skills, and attitude. Much has been said about secondary school students' poor performance in science generally and biology in particular. Okoye and Okeke (2007) noted that performance in biology has been declining over the years.

Several factors have been identified by researchers as being responsible for the persistent poor performance recorded in biology especially at Senior Secondary Certificate Examinations. Usman (2003) opined that lack of qualified science teachers to be one major root cause.

Abdullahi (2007) and Ogbeba and Ogbeba (2007), were of the view that methods employed by science teachers for teaching science in schools are unsuitable. They pointed out that most science teachers put more emphasis on theoretical aspects rather than practical aspects of science and most science teachers lack mastery of their subject matter. Ayodele (2006) supported this view when he identified a major factor that lowers students' achievement in science subjects to be lack of appropriate and effective methodology of science teaching. Ogunmade, Okediya and Bajulaiye (2006) opined that lack of essential facilities, apparatus, resources and instruments for teaching science is another major contributing factor of poor achievement of students in science. Some of these include lack of teachers, lack of educational amenities like laboratories, poor attitude and lack of interest on the part of the students, laziness, large class size/ high teacher student ratio, poor teaching methods by teachers, loaded syllabuses, and family background of the students (Uzunboylu, Bicen & Vehapi, 2017). Despite the fact that many educationists believe that effective use of instructional aids has influence on children's performance in school, considering the fact that teaching require effective use of instructional aids that will facilitate meaningful learning, not much empirical studies have been carried out in recent times to support this assertion (Achebe, 2008; Demirok, Baglama & Besgul, 2015; Palma, Russo & Egizio, 2017). Besides, much of the data available on this topic are theories and opinions of individuals. It is also not certain that such studies have been carried out in biology.

In order to have good understanding and retention of what is being taught in class by teachers, an effective use of instructional aids is required. Harmer (2001) maintains that instructional aids make learning process easier, which is why teacher should use it for better learning. As we are all aware of the fact that today's age is the age of science and technology, the teaching and learning programs have also been affected by it. The process of teaching and learning depends upon the different types of equipment available in the classroom (Olagunju, 2000). Instructional materials are materials of visual, audio and audio-visual categories that help to make abstracts concepts and ideas more concrete in the teaching-learning processes. They are materials that help teachers in arousing the pupils' interest and enhance the level of students' achievement. The use of instructional materials in teaching Biology is very important because it provides a concrete basis for conceptual thinking, which motivates pupils to learn more (Ajala, 1997; Edessa, 2017).

There are many different types of instructional materials available these days, we have Visual aids, Audio aids and Audio-visual aids. Visual aids are the ones that appeal to the sense of vision. Example are pictures, photos, models and charts. Audio aids involve the sense of hearing example of such aids are: radio, tape recorders, audio files and mp3. Carpenter and Olson (2012) examined the effect of teaching new vocabularies through pictures, and their results showed that teachers and students had positive attitudes toward using pictures in teaching and that visual materials are an effective method in the vocabulary development of the learners. Olagunju (2000) in her research report stated that instructional materials enhance teaching-learning processes and that it improves the students' cognitive achievement. Nwike and Catherine (2013) stated that students learn and perform better when they are taught with instructional materials because using instructional materials gives the students the chance to view, feel, listen and touch the material during teaching, which help to arouse the students' attention and interest on the process of teaching and learning. The cognitive domain of learning should develop knowledge and intellectual skills. It also includes the recognition of specific facts and concepts that help to develop abilities and skills of the learners (Bulduk, 2016; Umutlu, 2017). Therefore the importance of teaching using charts, videos and real specimens in teaching and learning of mammalian skeletal system concepts in secondary schools cannot be over

emphasized considering its effect on developing the students' intellectual skills and hence promote retention and understanding the concepts more.

Therefore there is need for examination of the situation in order to obtain a possible solution to the problem identified. This study therefore investigates the extent to which teaching using charts, videos and realia effect on secondary school students' achievement in mammalian skeletal system concepts.

**1.2 Hypotheses**

The null hypotheses were tested at 0.05 level of significance using a two tailed test.

**H0<sub>1</sub>:** There is no significant main effect of treatment on students' achievement in mammalian skeletal system concepts.

**H0<sub>2</sub>:** There is no significant effect of gender on students' achievement in mammalian skeletal system concepts.

**H0<sub>3</sub>:** There is no significant interaction effect of treatment and gender on students' achievement in mammalian skeletal system concepts.

**H0<sub>4</sub>:** There is no significant interaction effect of treatments (charts, realia and videos) and gender on students' achievement in mammalian skeletal system concepts.

**2. Methodology**

**2.1 Research Design**

This study employed a quasi-experimental (4X2) pre-test, post-test experimental design with three experimental groups and one control group. Gender was used as a moderating variable. Pre-test was administered to the respondents (Biology students) in the four groups before the treatment. The first experimental group was taught using charts, the second experimental group was taught using real specimens, the third experimental group was taught using videos and the last group that is the control group was exposed to conventional teaching method. The research design is represented in Figure 1.

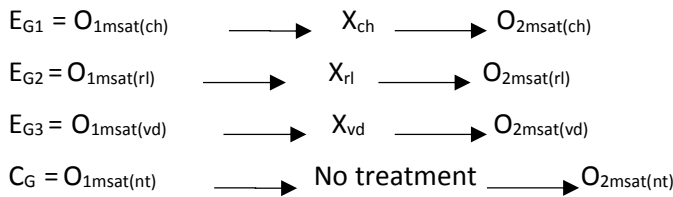


Figure 1: Illustration of Research Design

Groups	Pre-test	Treatment	Post-test
1 <sup>st</sup> experimental group (charts)	O <sub>1msat(ch)</sub>	X <sub>ch</sub>	O <sub>2msat(ch)</sub>
2 <sup>nd</sup> experimental group (real specimens)	O <sub>1msat(rl)</sub>	X <sub>rl</sub>	O <sub>2msat(rl)</sub>
3 <sup>rd</sup> experimental group (videos)	O <sub>1msat(vd)</sub>	X <sub>vd</sub>	O <sub>2msat(vd)</sub>
Control group	O <sub>1msat(nt)</sub>	No treatment	O <sub>2msat(nt)</sub>

Table 1: Randomized control-group Pre-test Post-test Design

**Where:**

$E_{G1}$  represents first experimental group

$E_{G2}$  represents second experimental group

$E_{G3}$  represents third experimental group

$C_G$  represents control group

$O_{1msat(ch)}$  represents pre-test scores for group taught using charts (1<sup>st</sup> experimental group)

$O_{1msat(rl)}$  represents pre-test scores for group taught using real specimens (2<sup>nd</sup> experimental group)

$O_{1msat(vd)}$  represents pre-test scores for group taught using videos (3<sup>rd</sup> experimental group)

$O_{1msat(nt)}$  represents pre-test scores for group without treatment (control group)

$O_{2msat(ch)}$  represents post-test scores for group taught using charts (1<sup>st</sup> experimental group)

$O_{2msat(rl)}$  represents post-test scores for group taught using real specimens (2<sup>nd</sup> experimental group)

$O_{2msat(vd)}$  represents post-test scores for group taught using videos (3<sup>rd</sup> experimental group)

$O_{2msat(nt)}$  represents post-test scores for group without treatment (control group)

$X_{ch}$  represents treatment for group taught using charts (1<sup>st</sup> experimental group)

$X_{rl}$  represents treatment for group taught using real specimens (2<sup>nd</sup> experimental group)

$X_{vd}$  represents treatment for group taught using videos (3<sup>rd</sup> experimental group)

S/N	Groups	Male	Female	Total
1	1 <sup>st</sup> Experimental group (using charts)	17	13	30
2	2 <sup>nd</sup> Experimental group (using real specimens)	18	12	30
3	3 <sup>rd</sup> Experimental group (using videos)	20	10	30
4	Control 4 no treatment	15	15	30
	Total	70	50	120

Table 2: Sample used for the Study

**2.2 Target Population**

The population for the study comprised of all senior secondary schools students in the ten (10) senior secondary schools in Dutsin-Ma Local Government Area (LGA), the total number of the students is two thousand three hundred and forty-nine (2,349)

**2.3 Sampling Techniques and Sample**

In selecting the schools that the researchers used in the study, simple random sampling technique was used to select four schools. In each school the researchers randomly selected thirty (30) students in each school. Thus a total of one hundred and twenty (120) students that were used for the study.

**2.4 Research Instrument**

An instrument developed by the researchers titled 'Mammalian Skeletal System Achievement Test' (MSAT) was used for data collection. The instrument contains two parts, part 1 is the respondent's background information while part 2 contains thirty (30) multiple choice items adapted from past examination questions of Joint Administration and Matriculation Board

(JAMB 1978-2013), West African Examination Council (WAEC, May/June, 1988-2013) and National Examinations Council (NECO, June/July, 2003-2013).

MSAT comprised thirty items based on mammalian skeletal concepts. This was used in determining the academic achievement of biology students before and after the treatment. MSAT consists thirty (30) objective test items; each item has four options (A, B, C, and D). The instrument was developed based on the six Bloom's taxonomy of educational objectives. Knowledge has 9 items, comprehension 7 items, application 5 items and 3 items each for synthesis, analysis and evaluation.

## 2.5 Validation of Research Instrument

The instrument was given to two biology teachers with at least minimum qualification of BSc. (Ed) Biology in two of the sampled schools for their own inputs. Validation is required to find out:

- Whether the items in the instrument match the ability of the students.
- Suitability of test items to the concepts to be taught (Mammalian Skeletal System).
- Whether the language used was clear, unambiguous and correct.
- Adequate content coverage.

After the experts have made their suggestions, corrections were made.

The reliability coefficient of the instrument was estimated using test-retest reliability method. The instrument was administered and then re-administered on the same respondents (25 students) after two weeks. The scores of the first test and second test were compared to ascertain the reliability of the instrument. The schools and students used for establishing the reliability of the instrument did not take part in the major study. The test-retest reliability coefficient for MSAT is 0.796.

## 2.6 Procedure for Data Collection

There were four groups, three experimental groups, the first experimental group was taught using charts, the second experimental group was taught using real specimens, while the third experimental group was taught using videos. The control group was taught without any instructional material; traditional method was used. Before treatment, the researcher administered pre-test to the students, then the teaching which lasted for 5 weeks, then 1 week was used for revision and administration of post-test.

## 2.7 Method of Data Analysis

The data collected was analyzed using Analysis of Co-variance (ANCOVA). Scheffe post-hoc analysis was used to further explain the basic findings of the study. Hypotheses were tested at 0.05 level of significance using a two-tailed test.

### 3. Results

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected Model	313.710	8	39.214	4.519	.000
Intercept	1798.448	1	1789.448	197.068	.000
MSAT pretest	3.207	1	3.207	.370	.544
Treatment	276.513	3	92.171	10.489	.043*
Gender	13.060	1	13.060	1.487	.308
Treatment * Gender	26.361	3	8.787	1.013	.390
Error	963.282	111	8.678		
Total	21583.000	120			
Corrected Total	1276.992	119			

\*Significant ( $p < 0.05$ )

Table 3: ANCOVA of effect of treatments and moderating variable on students' achievement in mammalian skeletal system concept

#### Interpretation of Finding on Research Hypothesis 1

$H_{01}$ : There is no significant main effect of treatment on students' achievement in mammalian skeletal system concepts.

In table 3, there is significant main effect of treatment on students' achievement in mammalian skeletal system concepts [ $F_{3,111} = 10.489$ ;  $p < 0.05$ ].

#### Interpretation of Finding on Research Hypothesis 2

$H_{02}$ : There is no significant main effect of gender on students' achievement in mammalian skeletal system concepts.

In table 3 there is no significant effect of gender on students' achievement in mammalian skeletal system concepts [ $F_{1,111} = 1.487$ ;  $p > 0.05$ ]. Therefore whether the students are males or females, gender does not influence achievement in mammalian skeletal system.

#### Interpretation of Finding on Research Hypothesis 3

$H_{03}$ : There is no significant interaction effect of treatment and gender on students' achievement in mammalian skeletal system concepts.

In table 3, two-way interaction effect of treatments and gender does not have effect on achievement in mammalian skeletal system concept. [ $F_{3,111} = 1.013$ ;  $p > 0.05$ ]. Since the main effect is significant but the interaction effect with gender is not significant, it then means that the treatments do not depend on gender to be effective. In other words, the treatment is not gender sensitive and will be effective irrespective of students' gender.

	Sum of squares	Df	Mean square	F	Sig.
Contrast	276.513	3	92.171	10.621	.000*
Error	963.282	111	8.678		

\*Significant ( $p < 0.05$ )

Table 4: Univariate tests of the mean scores of the four groups

In table 4, there is significant difference in the students' mean scores among the four treatments (charts, real specimens, videos and lecture) [ $F_{3, 111} = 10.621$ ;  $p < 0.05$ ]. Therefore students performed significantly at different levels in the four groups. This indicated that the treatments may not be equally effective. It is therefore important to compare the four groups two by two to find out the group(s) that cause(s) the difference. This is the reason why table 4.3 is vital.

(I)Treatment	(J)Treatment	Mean diff. (I-J)	Std. Error	Sig.
Charts	Real specimens	-3.360	.764	.000*
	Videos	-1.846	.772	.018*
	Lecture	.557	.789	.482
Real specimens	Chart	3.360	.764	.000*
	Videos	1.514	.769	.051
	Lecture	3.917	.785	.000*
Lecture	Charts	-.557	.789	.482
	Real	-3.917	.785	.000*
	Videos	-2.403	.793	.003*
Videos	Charts	1.846	.772	.018*
	Real specimens	-1.514	.769	.051
	Lecture	2.403	.793	.003*

\*The mean difference is significant at 0.05 level

Table 5: Pair- wise comparisons of the four groups

The essence of pair wise comparisons is to explain the cause of the significant difference reported in table 4. In table 5, there is pair-wise comparison; the groups are compared two by two. There is no significant mean difference between using charts as instructional aids and using lecture method in teaching students mammalian skeletal system concepts. But there is significant difference between using real specimens as instructional materials and using lecture method to teach mammalian skeletal system concepts. Using real specimens as instructional material is significantly better than using lecture methods to teach. Also there is significant difference between using videos as instructional aids and using lecture method. Using videos as instructional aids is better than using lecture method to teach.

There is significant difference between using charts as instructional aids and using real specimens as instructional aids. Using real specimens as instructional aids is significantly better than using charts as instructional aids. There is no significant difference between using real specimens as instructional aids and using videos as instructional aids. Though using real specimens is at least better than using videos as instructional aids. There is significant difference between using charts as instructional aids and using videos as instructional aids. Using videos is significantly better than using charts to teach.



Treatment	Gender	Mean	Std. Error	Sig.
Charts	Male	12.816	.715	.730
	Female	10.815	.821	
Realia	Male	15.689	.761	.832
	Female	14.663	.761	
Lecture	Male	11.400	.664	.740
	Female	11.118	.932	
Videos	Male	13.367	.695	.681
	Female	13.957	.853	

Table 6: Mean scores of male and female students in the four groups (Pairwise comparison)

The findings in Table 6 are graphically presented in Figure 2. The interpretation follows the Figure.

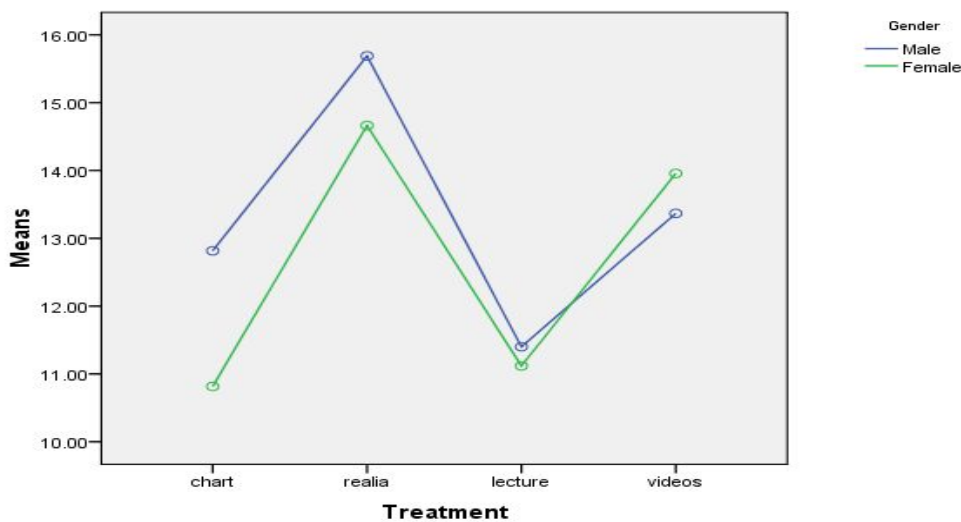


Figure 2: Mean plot of interaction effect of treatments and gender.

In Figure 2, using real specimens is the best type of instructional materials that can be used in teaching mammalian skeletal system concepts. The performance pattern is the same for male and female students in each of the teaching groups.

#### 4. Discussion of Findings

The finding of this study is that there is significant main effect of treatments on student achievement in mammalian skeletal system. This finding is in line with the study of Nwike and Catherine (2013) who found out that there is significant effect of treatment (instructional materials) on students' achievement in science. Also Ifeoma (2013) supported this view, she reported that there is statistical significant difference in the educational performance of students when they are taught with instructional materials than when they are not taught with them. This finding was also supported by Dale (1969) that each instructional material provide

different learning experiences and that one instructional material may provide more learning experiences than another instructional material, for example real objects provide more learning experiences than videos and charts.

Another finding is that there no significant effect of gender on students' achievement in mammalian skeletal system. Alio and Ezemaenyi (2010) also supported this view. They reported no significant difference in mean scores of male and female students taught with instructional materials. Olatoye and Adekoya (2010) also reported that gender has no significant effect on students' achievement in some aspects of science when different teaching methods were used.

The findings of this study also identify using real specimens and videos as the best instructional materials to be used in teaching mammalian skeletal system concepts than charts, this is due to the fact that real specimens and videos make classroom more interesting. Making a classroom interesting is a fundamental way for teacher to encourage and make students learn without forcing them. Real specimens and videos enable students to be more creative and active in learning. This agree with findings of Gambari and Zubairu (2008); Achebe (2008) and Moreno and Mayer (2000), who found that students taught with multimedia acquired better knowledge, and improved comprehension skills than other groups. This finding is also in line with Edgar Dale's cone of experiences (Dale, 1969). Dale introduced the cone of experiences as a "pictorial device" for showing the progression of learning experiences from direct first hand participation to pictorial representation and on to purely abstract, symbolic expression. He arranged the learning experiences from the point of view of learners in order of increasing abstractness or decreasing concreteness. The cone indicates that real direct experience have least abstractness and maximum concreteness, followed by contrived experiences which are not very rich, concrete and direct as real life direct experience. The series followed down to verbal symbols which has the least concreteness and maximum abstractness. The cone is presented in Figure 5.1.

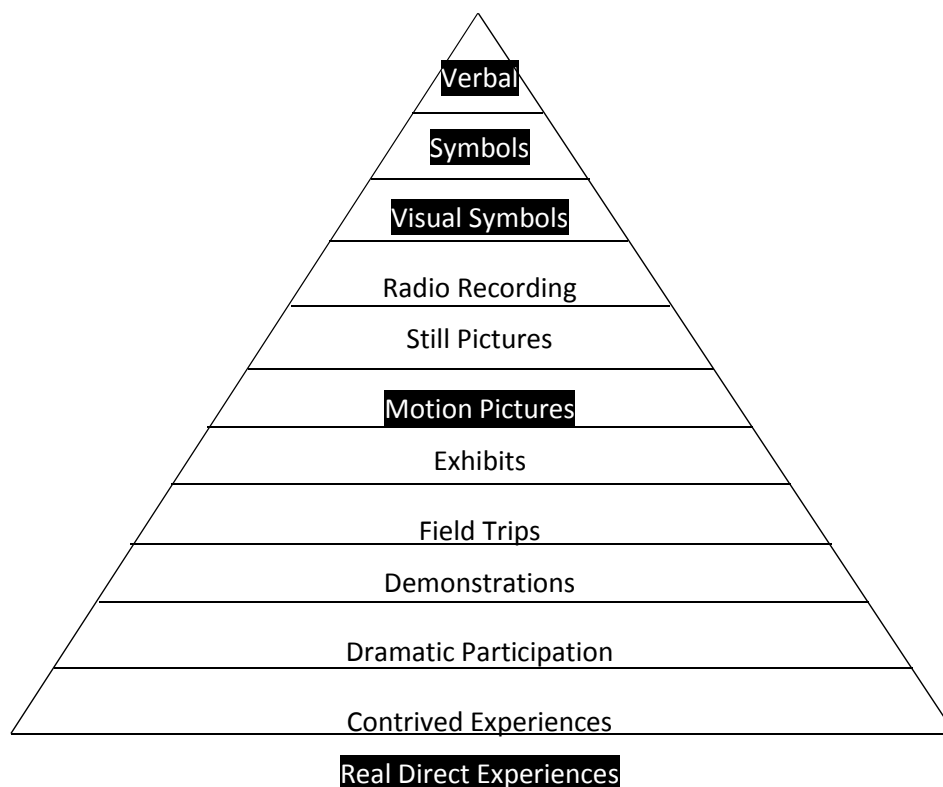


Figure 3: Edgar Dale's cone of experience (1969).

In Figure 3, the shaded parts are the ones that the researchers used in this study and a close look at the figure reveals that using Real Direct Experience (real specimens) was the best instructional materials to improve students' achievement, then Motion Pictures (Videos) followed by Visual Symbols (Charts) while Verbal Symbols (Lecture) was the least in terms of promoting learning.

But Okwo and Asadu (2002) contradicted this finding when they reported that all instructional materials were found to be equally effective with no significant difference effect among the means when used for teaching.

## 5. Conclusion

It has been emphasized that the students' achievement in biology is unstable, even though efforts has been made to encourage the intellectual skill and personal growth of the students in science. The major cause of the poor performances is attributed to among others, lack of effective use of appropriate instructional materials for teaching science. However, this study provides empirical support to the fact that performance of students in mammalian skeletal system (Biology) could be greatly improved if the teachers make good use of instructional materials which are relevant to the concepts the teacher is teaching Use of real specimens and videos in teaching mammalian skeletal system aids students' achievement more than using charts or teaching without instructional materials. Another important finding in this study is that these teaching materials will increase students' performance irrespective of gender. The treatment given to the four groups have significant effects on academic achievement though, the respondents in real specimens and videos groups performed higher than those in charts and control/lecture groups. The findings of the study show that using real specimens and videos to teach has most significant effect on the achievement of students in mammalian skeletal system concepts.

## 6. Recommendations

Taking into consideration the findings and conclusion of this study the researcher wishes to point out the following recommendations:

1. Government should invest more in educational system, so that enough grant would be allocated for making instructional materials available.
2. Educational training programmes and in-service training should be made available to teachers which will help to improve their competencies and skills of effective use of instructional materials while teaching.
3. Teachers are advised to integrate different types of instructional materials while teaching and effective choice of instructional materials should be made by the teacher which should be relevant to the topic or concepts he/she is going to teach the students.
4. School management and other stakeholders should assist teachers who desire to improvise instructional materials, this can be done through assisting them with money that would supplement the cost of the improvisation or may sponsor the whole process.

## References

- Abdullahi, S. A. (2007). *Education and democracy in Nigeria: Vision 2020*. Retrieved April 20, 2015 from <http://www.nigeriainamerica.com/articles> retrieved.
- Achebe, A. E. (2008). Effect of videotape instructional package on achievement and retention in food and nutrition at senior secondary school level in Minna, Niger State. *Journal of Science Teaching and Mathematics Education*. 1(1), 33-39.
- Ajalla, A. A. (1997). Availability of educational of pre-vocational agricultural science in secondary schools in Anambra state. *Journal of research in learning and teaching*. 1(1), 12-23.
- Alio, B. C. & Ezeamaenyi, O. (2010). Effects of instructional materials on students' achievement in science. *Journal of Education for Professional Growth Association of Educationists for Professional Growth in Nigeria*. 6(1), 2-10.
- Ayodele, O. O. (2006). Building a sustainable science curriculum in Nigeria; accommodating local adaptation, leveraging technology and enhancing Ares of improvement for quality assurance. *Journal of Science Teachers Association of Nigeria*. 1(7), 121-140.
- Bulduk, B. (2017). Contemporary illustration methods and new application areas on illustrations: Interaction induced animated illustrations. *Global Journal of Arts Education*, 6(3), 77-84. doi: <https://doi.org/10.18844/gjae.v6i3.1699>
- Carpenter, S. K. & Olson, K. M. (2012). Are pictures good for learning new vocabulary in a foreign language? Only if you think they are not. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 3(8), 92-101.
- Dale, E. (1969). The cone of experiences, Chapter 4 in *Audio-Visual Methods in Teaching*, (3<sup>rd</sup> ed.), Hinsdale, IL: The Dryden Press.
- Demirok, M. S., Baglama, B., & Besgul, M. (2015). A Content Analysis of the Studies in Special Education Area. *Procedia-Social and Behavioral Sciences*, 197, 2459-2467.
- Edessa, S. (2017). Impacts of insufficient instructional materials on teaching biology: Higher education systems in focus. *Cypriot Journal of Educational Sciences*, 12(1), 02-08. doi:
- Gambari, A. I. & Zubairu, A. A. (2008). Impact of videotape instructional package on achievement and retention in primary science among primary pupils in Niger State, Nigeria. *Paper presented at the Meeting of the 2nd SSSE Annual National Conference*, Federal University of Technology, Minna, Nigeria.
- Harmer, J. (2001). *The practice of English language teaching (3rd ed.)*. London: Longman.
- Ifeoma, M. M. (2013). Use of instructional materials and educational performance of students in integrated science (A case study of unity schools in Jalingo, Taraba State, Nigeria), *IOSR Journal of Research and Method in Education*. 3(4), 07-11.
- Moreno, R. & Mayer, R. E. (2000). A coherence effect in multimedia learning. The case of minimizing irrelevant sounds in the design of multimedia instructional messages. *Journal of Educational Psychology*, 9(7), 117-125.
- Nwike, C. M. & Catherine, O. (2013). Effects of use of instructional materials on students' cognitive achievement in agricultural science. *Journal of Educational and Social Research*. 3(5), 103-107.
- Ogbeba, J. A. & Ogbeba, E. A. (2007). Material resources for effective Biology teaching in senior secondary schools of Benue State. *Multi-disciplinary Journal of Research Development*. 9(2), 134 – 140.

- Ogunmade, T. O., Okediyi, S. A. & Bajulaiye, A. A. (2006). The status of resources in secondary science teaching and learning in Lagos State, Nigeria. *Proceedings of the 47th Science Teachers Association of Nigeria Annual Conference*. Pp. 30-35.
- Okoye, B. E. & Okeke, O. C. (2007). Efficacy of eliminating superstitious beliefs strategy of achievement and knowledge retention in Genetics among Secondary School Students. *Journal of the Science Teachers Association of Nigeria*. 42(1&2), 73-77.
- Okwo, F. A. & Asadu, C. O. (2002). Comparative effect of three modes of mediated instruction on secondary school students' achievement in physics. *International Journal of Arts and Technology Education*. 2(1), 137-144.
- Olagunju, I. (2000). Strategies and utilization of improvised biology of instructional materials and students' achievement and attitudes in Ekiti State secondary schools, Nigeria. *International Journal of Research in Education*. 3(2), 42-56.
- Olatoye, R. A. (2002). A causal model of School factors as determinants of Science Achievement in Lagos State Secondary Schools. *An unpublished Ph.D. Thesis*. University of Ibadan, Ibadan.
- Olatoye, R. A. & Adekoya, Y. M. (2010). Effect of project-based, demonstration and lecture teaching strategies on senior secondary students' achievement in aspect of agricultural science. *International Journal of Educational Research and Technology*. 1(1), 19-29.
- Ozcan, D., & Genc, Z. (2016). Pedagogical Formation Education via Distance Education. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(2), 347-360.
- Palma, R., Russo, C., & Egizio, F. (2017). A better school organizational performance? Yes, but how?. *Contemporary Educational Researches Journal*, 7(1), 35-43. doi: <https://doi.org/10.18844/cej.v7i1.482>
- Torres, J., & Vasconcelos, C. (2017). Models in science and for teaching science: Data from an intervention programme. *International Journal of Learning and Teaching*, 9(1), 308-318. doi: <https://doi.org/10.18844/ijlt.v9i1.2225>
- Umutlu, D. (2017). Effects of different video modalities in flipped english writing classes on students' writing scores. *New Trends and Issues Proceedings on Humanities and Social Sciences*, 3(7), 60-66. doi: <https://doi.org/10.18844/prosoc.v2i7.1986>
- Uzunboylu, H., & Tugun, V. (2016). Validity and Reliability of Tablet Supported Education Attitude and Usability Scale. *Journal of Universal Computer Science*, 22(1), 82-93.
- Uzunboylu, H., Bicen, A. & Vehapi, S. (2017). The analysis of research problems regarding physical education lecture. *Ponte*, 73(5), 244-259.