

## VALIDATION OF THE DEVELOPED AUDIO-VISUAL INSTRUCTIONAL PACKAGE FOR TEACHING ACID BASE TITRATION IN SECONDARY SCHOOLS IN DUTSIN-MA METROPOLIS

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### Abstract

*This study developed and validated audio-visual instructional package for teaching acid base titration in secondary schools in Dutsin-Ma Metropolis. The research method adopted was design and development research (DDR). The target population was all senior secondary school II chemistry students as well as the chemistry teachers. An intact class of 59 students and 30 chemistry teachers were used for the study. Researchers' designed rating scale was used to collect data from the sampled used for the study. The instrument was pilot-tested using twenty (20) respondents who did not take part in the main field study. The reliability analysis of the data collected was analysed using Cronbach Alpha which yielded a coefficient of 0.83. After the administration of the instrument and its collection from the respondents, the data collected was analyzed using descriptive statistics of frequency counts and percentages to answer the research questions and t-test inferential statistics was used to test the hypotheses. The findings of the study indicated that, both chemistry students and chemistry teachers confirmed that the audio-visual instructional package developed for teaching acid base titration was suitable and appropriate for teaching the said concept. In addition, the use of audio-visual instructional package favour chemistry teachers more than the students while its usage also favours female more than the male students. Based on these findings, it was recommended that training and re-training in the effective use of audio-visual instructional package should be arranged by the government and the school authority for students and lecturers to be able to use it effectively.*

**Keywords:** Validation, Quality, Development, Audio-Visual, Acid Base Titration, Dutsin-Ma Metropolis

### Introduction

This is a digital age where the contemporary students are digital native. *Digital native learners* process information quickly, enjoy multi-tasking and gaming. These are children raised with the computer who are capable of thinking differently and as well developing hypertext minds. These characteristics exhibited by these students call for teachers to invest heavily in the digital learning materials so as to be able to meet the needs of these contemporary students. One of the digital learning materials that the students can learn with is the use of 'Audio-visual Instructional package'.

Audiovisual education is the educational instruction delivered by materials that use the senses of sight and hearing to stimulate and enrich learning experiences. (Sandbox Networks Inc, 2021). In this system of education, audio-visual aids are the most prominent tools. According to the Webster dictionary (2020), audio-visual aids is defined as training or educational materials directed at both the senses of hearing and the sense of sight, films, recordings, photographs, etc. used in classroom instructions, library collections or the likes. They are those devices which are used in classrooms to encourage the teaching and learning

process and make it easier and interesting. Rasul et al., (2011) describes audio -visual aids as the best tools for making teaching effective and the best means of disseminating knowledge. Examples of audio - visual aids are LCD project, Film projector, TV, Computer, VCD player, Virtual Classroom, Multimedia etc. Audio-visuals instructional package effective usage can be vital to the success of learners in any subject taught in the secondary.

Audio-visual resources are instructional materials that appeal to the senses of sound and sight. They assist the teacher to teach and help students to learn effectively. Audio-visual resources form a very important part of the method of teaching in our secondary schools. In the light of this, Kochhar (2004), observes that the most outstanding development in modern education is the increase in the use of supplementary devices by which the teacher through the use of one sensory channel helps to clarify, establish and correlate accuracy, explain concepts, interpret, appreciate, increase knowledge, rouses interest and even evokes worthy emotions and enriches the imagination of students.

Dike (2000) also explained that students forget because of lack of interest and opportunity to use the knowledge they have gained later on. Audio-visual resources can therefore contribute to the clarity of information presented by allowing students to visualize what is learned. Thus, the saying: What I hear, I forget. What I see, I remember. What I do, I know. Samuel (2012) unanimously agreed that audio-visual materials are very important and useful in education because the normal learner in so far as the function of his perception are concerned, gains understanding in terms of multiple impression records through the eye, ear, touch and senses. This therefore emphasizes that human beings learn more easily and faster by audio-visual processes than by verbal explanations alone. Audio- visual materials when effectively used will lessen major weakness of verbalism, humanize and vitalize subject matter, provide interesting materials needed, and also stimulate the initiative of the students.

Audio visual instructional material add life to learning experiences, as images and animations make words easier to comprehend and remember. It is of importance to note that the basic aim of education must be to lead students towards self-learning and life-long learning and this aim can be achieved through the use of audio-visual instructional material as it improves the learning capacities of individual students i.e., learning experience that is worth memorable (Singh, Sharma, Upadhy, 2012). Science is an indispensable component of human life activity; therefore, its absence could make life incomplete and ill-equipped for the students to live effectively in our modern age of science and technology. Audio-visuals are tool used to facilitate the learning experience of the individual and to make it more realistic and dynamic (Kinder, 2012). In teaching and learning of sciences, the use of audio-visual resources proves to be better instructional aids and according to Mgbodile (2009) it yields good result in all domains of learning, that is: the cognitive, affective and psychomotor domains respectively.

Some previous works that have been carried out on the use of audio-visual learning materials include: the work of Nwike and Anene (2013) which reported that there is significant effect of treatment with (audio visual aids) on students' achievement in sciences. Jonah, (2013) also reported that there is statistically significant difference in the academic performance of students when they are taught with audio visual aids than those taught without them. This finding of Dale in Carton, (2015) equally claimed that when audio-visuals are integrated into teaching and learning, it provides more learning experiences as students can see and touch. It was further said that students are not that attentive, motivated and interested in classroom situation when they are compelled to that classroom session that is in function without the use of audio-visual (Sampath, Pannneerselvam & Santhan, 2013). Yusuf (2009) found that audio-visual aids improve male and female students' comprehension in sciences. Thus, the use of audio-visual aids will help to make abstract concepts better understood and enhance academic achievement. This assertion is in line with Jamiu, (2010) who discovered that audio-visual instructional material improves male and female students' academic performance in sciences in senior secondary school. The work of Alio and Ezemaenyi (2010) also agreed with this view, these authors reported no significant difference in mean scores of male and female students taught with audio-visual instructional materials. Olatoye and Adekoya (2010) also reported that gender has no significant effect on students' achievement in some aspects of science when audio-visual instructional resources are used.

Chemistry is one of the important science subjects taught at senior secondary schools (SSS) level. It is one of the core subjects that science students are required to pass at credit level in order to qualify for admission into tertiary institution to pursue science-based programmes. In spite of this central and important position

of chemistry among other sciences and other disciplines, studies revealed that academic achievement of students in chemistry at SSCE has consistency been very poor and unimpressive as reported by Muhammad, (2018). Many factors have been suggested as contributing to this poor performance of students in Chemistry especially in acid-based titration reaction as reported by WAEC chief examiner (Chief Examiner Report ,2018). Added to the above, West African examination council (WAEC 2009, 2010 and 2011) noted some poor performance in the practical chemistry examination. Therefore, there seems to be no doubt that chemistry students have difficulty with the chemistry practical examinations and most especially in acid base titration. However, previous studies have been on checking the effect of audio-visual materials but none has really been on actual development and validation of audio-visual resources. This current study therefore is out to fill gap in this area.

### **Purpose of the Study**

The main purpose of this study is to examined the quality of the develop audio-visual instructional package for teaching acid base titration in Secondary Schools in Dutsin-Ma Metropolis. Specifically, the study looks at:

1. The rating of secondary school chemistry students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.
2. The rating of secondary school chemistry teachers on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.
3. Difference in the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.
4. Difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis

### **Research Questions**

The following questions are raised to guide the conduct of this study:

1. What is the rating of secondary school chemistry students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?
2. What is the rating of secondary school chemistry teachers on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?
3. What is the difference between the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?
4. What is the difference between the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?

### **Hypotheses**

Theses hypotheses are tested for the study at 0.05 Alpha level.

**Ho1:** there is no significant difference between the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

**Ho2:** there is no significant difference between the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

### **Methodology**

This study adopted the design and development research. It is a type of research that focusses on the process of developing a product that involves context and situation analysis as well as the evaluation of a product as reported by Norlidah, Dorothy and Zaharah (2013). The target population of the study was all senior secondary school II students studying chemistry as a subject as well as the chemistry teachers in secondary schools in Dutsin-Ma Metropolis. Simple random sampling technique was used to select an intact class of fifty-nine students consisting thirty-three (33) males and twenty-six (26) females. In addition,

thirty (30) chemistry teachers were selected for the field study using purposive sampling technique. The instrument used in collecting data is rating scale which is used to elicit responses from both students and teachers. The instrument consists of two sections, section one has to do with the biodata of the respondents while section two has to do with statements relating to the quality of the audio-visual instructional package. The instrument was pilot-tested using twenty respondents who do not take part in the main study and reliability of the instrument was established using Cronback Alpha. The value arrived at after the analysis was 8.3. After the administration of the rating scale and collection of the research instrument, the data collected was analyzed using descriptive statistics of frequency counts, percentages, mean, standard deviation and inferential statistics of t-test and thus answered the research questions and the test hypotheses generated to guide the conduct of the study.

## Results

### Research Question One

What is the rating of secondary school chemistry students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?

**Table 1:** Students' rating on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis

Item	Mean	Standard Deviation
Relevance of the chemistry concept (Acid Base) discussed in the audio-visual instructional package	3.66	0.633
Quality of visual illustration used in the audio-visual instructional package	3.81	0.541
Quality of the font style and font size used in typing the content	3.78	0.618
Content of the audio-visual instructional package in addressing the objectives of the lessons	3.81	0.473
Audio content of the audio-visual instructional package	3.73	0.665
What is the overall rating of this audio-visual instructional package?	3.76	0.536
<b>Grant Mean =3.758</b>		<b>3.466</b>

The result from table 1 reveals that the total grand mean of students' rating to be 3.758 which is greater than the cut – off mark of 2.50. This then implies that the audio-visual instructional package developed for teaching acid base titration in secondary schools in Dutsin-Ma Metropolis is of good quality and is suitable for teaching the said concept in Chemistry subject. Likewise, the total standard deviation is equal to 3.466. This implies that, the data points are clustered closely around the mean value.

### Research Question Two

What is the rating of secondary school chemistry teachers on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?

**Table 2:** Teachers' rating on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis

Item	Mean	Standard Deviation
Relevance of the chemistry concept (Acid Base) discussed in the audio-visual instructional package	3.633	0.718
Quality of visual illustration used in the audio-visual instructional package	3.566	0.817
Quality of the font style and font size used in typing the content	3.600	0.621
Content of the audio-visual instructional package in addressing the objectives of the lessons	3.333	0.844
Audio content of the audio-visual instructional package	3.566	0.727
What is the overall rating of this audio-visual instructional package?	3.730	0.665
<b>Grant Mean =3.571</b>		<b>4.392</b>

The result in table 2 indicated that the total grand mean of teachers' rating to be 3.758 which is greater than the cut – off mark of 2.50. This then simply means that the audio-visual instructional package developed for teaching acid base titration in secondary schools in Dutsin-Ma Metropolis is appropriate for teaching the said concept in Chemistry subject. However, the total standard deviation is equal to 4.392 which signifies that the data points in this result are far from the mean score value.

### Research Question Three

Is there difference in the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?

### Hypotheses One

**Ho1:** there is no significant difference in the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

**Table 3:** t-test analysis of difference in the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

Group	N	X	Std	df	t	Sig. (2-tailed)	Decision
Students	59	21.90	3.252				
Teachers	30	22.22	3.254	87	0.439	0.662	Ho1 Rejected

The result of independent t-test in the above table shows that, there is significant difference in the rating of chemistry teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis. This is because  $t(87) = 0.439$ ; sig (2-tailed) = 0.662 and  $p < 0.05$ . The difference is favour of the teachers. The hypothesis one is hereby rejected.

### Research Question Four

Is there difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis?

### Hypothesis Two

**Ho2:** there is no significant difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

**Table 4:** t-test analysis of the difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis.

Group	N	X	Std	df	T	Sig. (2-tailed)	Decision
Male	33	22.00	3.142	57	1.736	0.880	Ho2 Rejected
Female	26	23.27	2.255				

The result of independent t-test in the above table 2 shows that, there is significant difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis. This is because  $t(57) = 1.736$ ; sig (2-tailed) = 0.880 and  $p < 0.05$ . The difference is the favour of female. The hypothesis two is hereby rejected.

### Discussion

The audio-visual instructional package developed for teaching acid base titration in secondary schools in Dutsin-Ma Metropolis is of good quality and is suitable for teaching the said concept in Chemistry subject as reported by the chemistry students. This finding is in line with the finding of Eno and Onasanya (2023) on development and evaluation of digital subject materials for teaching computer studies in Nigeria where the end users confirmed the digital material is suitable for the intended users.

The audio-visual instructional package developed for teaching acid base titration in secondary schools in Dutsin-Ma Metropolis is appropriate for teaching the said concept in Chemistry subject as reported by the chemistry teachers. This found is in consonance with the findings of Eno and Temitayo (2023) on development and evaluation of mobile learning application for teaching selected computer concepts in secondary schools in Ilorin Metropolis.

Also, there is significant difference in the rating of teachers and students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis. The difference is in favour of teachers. This finding negates the work of Chukwuemeka (2010) which reported that the female teachers have inadequate proficiency skills in using internet for teaching and learning process.

There is significant difference in the rating of male and female students on the quality of the developed audio-visual instructional package for teaching acid base titration in Dutsin-Ma Metropolis. The difference is in favour of female. This finding is contrary to the work of Yusuf and Balogun (2011) who also found no significant difference between male and female student-teachers' attitudes in the use of ICT.

### Conclusion

The end users (both students and teachers) confirmed the audio-visual instructional package developed for acid base titration in chemistry is appropriate for the concept but the chemistry teachers and female students enjoy its usage more.

### Recommendations

Based on these findings, the following recommendations are made:

1. The university authority should provide more fund for the development of audio-visual instructional package for teaching acid base titration and other concepts in chemistry.
2. Training and re-training in the effective use of audio-visual instructional package should be arranged by the government and the school authority for students and lecturers to be able to use it effectively.
3. Educational technology support staff should be recruited by the school authority to train teachers and students in the effective use of audio-visual instructional package for teaching and learning purposes.

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