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Adegbite Adenike Foluke
Department of Educational Technology University of Ilorin, Nigeria

Improvisation of drawing instruments for teaching basic technology in junior secondary schools, Oyo state

Adegbite Adenike Foluke

Abstract
This study evaluates the improvisation of drawing instruments for teaching basic technology in junior secondary schools, Oyo state. Improvisation serves as an acceptable alternative to learners in their subjects and as a source of information when the real thing is not available. The samples for the study were fifteen educational technologists. The instrument used for the study was a structured questionnaire. The data collected were analysed using frequency counts and percentage. The findings showed that Improvised Drawing Instruments can be developed based on Instructional Media Model to teach topics in Basic Technology. The assessment of the Drawing Instruments showed that the improvised Drawing Instruments were cheap, simple to produce for teaching and learning to achieve desired results. It is recommended that Government, Curriculum planners, authors should endeavour to include model for designing a specific instructional material under each topic of the Basic Technology text book so that the production of the relevant materials for such topic could be done easily by the teachers.

Keywords: Improvisation; Drawing Instruments; Basic Technology; Secondary Schools; Oyo State

Introduction
Science is a dynamic human activity concerned with understanding the workings of our world. This understanding helps man to know more about the universe. Without the applications of science, it would have been difficult for man to explore the other planets of the universe. Science comprises the basic disciplines such a Physics, Chemistry, Mathematics, Basic technology and Biology (Ogunleye 2002). Poor academic achievement in Basic technology could be attributed to many factors among which teacher's strategy itself was considered as an important factor. This implies that the mastery of Basic technology concepts might not be fully achieved without the use of instructional materials. The teaching of Basic technology without instructional materials may certainly result in poor academic achievement. There are lots of problems being encountered by the students due to inability of the Basic Technology teachers to use instructional materials to supplement their teaching. For the simple fact that these materials are not available in schools and this in turn brings about mass failure at the end of the term or session or even end of the programme at the junior secondary school level. Basic Technology has been a subject that many students have complained that it is difficult to learn and understand, hence many students have developed negative attitude towards it. One begins to ask what might be responsible for such a negative attitude from the learners - Is it the nature of the subject or teachers poor method of delivery the contents? Or is it the attitude of the teacher towards the subjects? Or lack of appropriate resources to teach the subject effectively? According to Franzer, Okebukola and Jegede (1992) professionally qualified science teacher no matter how well trained, would unable to put his ideas into practice if the school setting lacks the equipment and materials necessary for him or her to translate his competence into reality. there were inadequate resources for teaching Science subjects in secondary schools in Nigeria. The available ones are not usually in good conditions. Therefore, improvisation of teaching equipments is needed in secondary school in other to enhance teaching –learning process.

Research Questions
The following research questions were generated to guide the conduct of this study;

Correspondence:
Adegbite Adenike Foluke
Department of Educational Technology University of Ilorin, Nigeria

i What are the stages involved in the development of drawing instruments using ADDIE model?
ii How do the educational technologists rate the improvised drawing instruments?

Literature Review

Concepts of Improvisation

According to Eze (1995) **Improvisation** is a substitute for the readymade or imported material. Okeke (1990) urged teachers to produce their own aids in order to teach effectively. Everybody can be involved in the production of these alternatives – the teachers, learners, parents and all stakeholders in education. The locally made are usually tailored to meet the local challenges at very cheap or no cost at all. According to Anyakoha (1992) the involvement of teachers and learners in improvising materials gives students and teachers the opportunity to concretize their creativity, resourcefulness and imaginative skills. Improvisation embraces methods or teaching 'Strategies, materials, apparatus and aids (visual, audio and audio-visual) for effective and efficient teaching learning process. Individual or group of people has a role to play in order to improve our educational sector especially at this present hard biting economy by improvising some of the teaching materials that can halt learning as a result of exploring the use of local materials around us. The essence of the use of the local materials for teaching has long been advocated. This is mainly due to the realization than the use of costly imported material for teaching does not provide much opportunity for helping Nigerian students to explore and adapt to their environment. Maduabum (1996) argued that, if any subject is to be learnt well the teachers must look for resources beyond the class- room. He went further to say that the sole reliance on the inadequate school resources could create undesirable situation where-by most student in a class would be reduced to mere looker on learning about the subject taught by the teacher. It is therefore desirable that all teachers should endeavor to improve the quantity of their teaching through improvisation so as to make learning habit more pleasurable and effective i.e. the need to explore exhaustively their different localities with a view to identifying materials and using them to maximize advantage. Akinmoye (1994) sees improvisation as the act of designing a replica of something to make it function or play the role of the real thing using the available materials, Adeniran (2008), considered improvisation as the process of creating, or producing or devising useful instructional materials from everyday items around us. Maduabum (1996) quoting Eniayeju (1963) that improvisation in teacher education refers to the act of using alternative materials and resources to facilitate instruction whenever there is lack or shortage of specific first hand teaching aids, Okebukola (1981) viewed improvisation as the act of substituting for the real thing. Ehikioya (1983) in his own opinion says that improvised equipment is the material which is designed and / or constructed by the teacher himself or with the help of some artisans such as carpenter, trade centre, technical institute and polytechnic, such an equipment is generally not mass produced, rather ft is made by and for a specific teacher or school, In his own contribution, Balogun (1985), says improvised material is a self-made (teacher-made) for specific purpose and not generally produced in large scale while local production involves the utilization of local person as carpenters, blacksmiths etc to produce equipment which will meet the need of the school themselves so that the subject meant for can be taught effectively, Alonge (1983) concludes that improvisation is not only the production or substitution of materials or real thing, rather it is an activity in promoting curiosity, creativity, alertness, endurance and perseverance, all of which are indispensable to the learning as a whole in this direction it will be considered that improvisation is more beyond visualization and what can be produced.

Methodology

Research Design

This research study involved the design, development and validation of improvised drawing instruments made by wood for junior school basic technology students. The instructional System Design (ISO) model widely referred to as the "ADDIE" model formulated by Dick, Carey and Carey (2005) was adapted in designing and developing the instructional material. The model formulated by Dick et al (2005) was adapted for this production because of its composition. The model could provide a very good platform for revision between the various phases involve and hence produce a worthwhile result of production at the end.

The model was adapted rather than being adopted due *to* the fact that the peculiarity of the work could at one time or the other require the researcher to use his own discretion during the production process. The "ADDIE" model as stated by Dick et al. (2005), consists of five stages. These stages are; analysis, design, development, implementation and evaluation

Sample and Sampling Techniques

Purposive sampling technique was used to select the participants in this study and they were randomly selected to assess the improvised drawing instruments. The sample for this research were fifteen educational technologists. The production was subjected to formative evaluation of three different stages, these stages are; clinical evaluation or one to one stage, the small group stage and the field trial stage. Each of the stages aforementioned are recommended to consider specific number of samples to be selected for evaluation purpose as stated by Baine (1982) Manal and Robert (1997) and Dick, Carey and Carey (2005).

1. **Clinical evaluation or one to one stage:** Minimum of three (3) subjects to serve as representative of the target population.

2. **Small group stage:** Minimum of eight (8) subjects and a maximum of twenty (20) subjects to serve as representative of the target population.

3. **Field trial stage:** About thirty (30) subjects to serve as the representative of the target population from four schools which are closely equivalent in quality and then randomized.

Research Instrument

In an attempt to measure the level of acquisition of knowledge on the use of improvised drawing instruments on Technical drawing aspect of Basic technology by the students. The researcher designed the Basic technology Achievement Test. Drawing board is made from strips of

well-seasoned soft wood generally 25 mm thick. It is cleated at the back by two battens to prevent warping. One of the shorter edges of the rectangular board is provided with perfectly straight ebony edge which is used as working edge on which the T-square is moved while making Drawings. Compass is used for drawing circles and arcs of circles. The compass has two legs hinged at one end. One of the legs has a pointed needle fitted at the lower end whereas the other end has provision for inserting pencil lead. Circles up to 120mm diameters are drawn by keeping the legs of compass straight. For drawing circles more than 150 mm radius, a lengthening bar is used. Dividers are similar to compasses, except that both legs are provided with needle points. As with compasses, dividers are available in large and small sizes, and in pivot joint, and bow types. Pivot joint dividers are used for measurements of approximately 20 mm or more. For measurements of less than 20 mm, bow dividers should be used. Dividers are used to transfer measurements. To step off a series of equal distances, and to divide lines into a number of equal parts Triangles are used in combination with the T square or straightedge to draw vertical and inclined lines. They are usually made of transparent plastic, which allows you to see your work underneath the triangles. Two standard triangles are used by the drafters. One is the 30-60-degree triangle. The other is the 45-degree triangle. Protractors are used to mark or measure angles between 0 and 180°. They are semicircular in shape (of diameter 100mm) and are made of Plastic or celluloid which has more life. Protractors with circular shape capable of marking and measuring 0 to 360° are also available in the market.

Validation of the Instrument

The instrument was subjected to face and content validation by giving the instrument to fifteen educational technologists. They examined the achievement test items and necessary corrections would be effected fused on their advice. After the validation of all these instruments, the validation of drawing instrument was used as recommendation by Baine (1982), Manal and Robert (1997) and Dick and Carey (2005). The following stages were involved in the validation of drawing instrument in the study;

Stage l: Consultant (Expert) **validation**

The drawing instruments were given to experts to go through for correcting the mistake noticed and suggestions provided were considered so as to have effective and efficient result.

Stage 2: One to one validation

In this stage, a minimum of two lessons (each of 90 minutes operation) were organized. The researcher uses the instruments design for this stage to elicit responses. The report of the outcome of the one to one trial stage was made through the researcher's observation and the oral interview that was conducted at the end of the trial. The mistakes identified and suggestions offered were addressed by revisiting the drawing instrument produced.

Stage 3: Small group validation

At the small group validation, the researcher engaged between 8-20 students in a minimum of three lessons using drawing instrument to determine the effectiveness of the changes made after the one on one validation.

The researcher took note of the problems encountered during the lessons, as well as the possible effects the drawing instrument indicated during and after instruction. At the end the lessons, the researcher administered the questionnaire designed for: small group validation to the students. The students therefore instructed respond while the researcher considered their comments and used them to upgrade the drawing instrument developed.

Stage 4: Field trial validation

The students that took part in this validation were thirty in number. The students were taught using the drawing instrument developed. The teaching was done by the researcher and basic technology teachers in selected schools. The students' attitudes, skills acquisition and difficulties faced by the students, the students and the teachers engaged in using the material was observed and the necessarily correction was effected. The students were instructed to write down the information acquired during the lesson on their note books. The students were guided to follow the instruction carefully, they were asked to use the instruments to construct triangle. The responses of the students were marked to determine the extent to which they mastered the Improvised material used for technical drawing of Basic technology.

Procedure for Data Collection

Primary source of data collection was employed. Primary data was collected from respondents through issue of questionnaires. Some of the respondents who would be able to interpret and follow the questions in the questionnaires would be guided by the researcher and deliver the required information. The Principals of the selected schools were contacted in order to seek permission from them. The five Basic technology teachers in each school selected were given each of the improvised drawing instruments for construction in Basic technology.

Data Analysis Techniques

Responses from the various experts were collected and appropriate reports were written from the administration of the various research instruments. The mean, average score of the education technologists in this test was calculated in percentage and used to draw the conclusions about the efficiency of using drawing instruments for technical drawing in Basic technology.

Data Analysis and Presentation

The result derived from the analyzed data in line with the research questions are presented below.

Research question l: What are the stages involved in the development of drawing instruments using ADDIE model?

In designing the instructional package five major stages are involved as stated by Clark (2006). The stages are Analysis, Design, Development, Implementation and Evaluation.

Analysis: It was at this stage the researcher identified and determined the purpose for designing of Improvised drawing instruments. The researcher also states the objectives and selected the area of concern that form the

content of instruction of the improvised drawing instruments.

Design: It was this stage where the researcher produced the prototype of the drawing instruments with the specification of instruction. The statement of the learning objectives, construction and sequencing of the course content, formulation of assessment instruments and exercises were also put into consideration.

Development: The researcher harmonizes the content of analysis and design phases together to form the real production of complete package. It was at this stage the initial discoveries are process into a product that will assist the learners into becoming performers.

Implementation: This stage has to do with putting the package efficiency of the product developed or delivering the courseware to the learners.

Evaluation: This stage involved subjecting the package designed to the educational technologists to check in order to rectify necessary fault detected before the final production. It is regarded as formative evaluation.

Research Question 2: How do the Educational Technologists rate the improvised drawing instruments developed?

The responses from Educational Technologists/experts showed that the ADDIE model was adhered to in the process of designing and developing the improvised drawing instruments of Basic Technology. It was agreed that the improvised drawing instruments was functioning properly, cheap, effective and very simple enough to enhance teaching and teaming.

Table 1: Experts' Rating (Frequency Counts) of the Improvised Drawing Instruments
No of Items

No of Respondent	1	2	3	4	5	6	7	8	9	10	11	12
1	A	A	A	A	A	A	A	A	A	A	A	A
2	A	A	A	SA	SA	SA	A	SA	A	SA	A	D
3	A	D	A	A	SD	D	SA	D	D	SD	D	A
4	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	A	A
5	A	A	A	SA	D	D	SA	D	A	A	A	A
6	A	A	SA	A	A	A	D	A	D	SA	SA	A
7	A	A	D	A	A	A	SA	A	SD	A	SD	SA
8	SA	SA	A	A	A	D	A	D	SD	A	A	SA
9	SA	SA	A	A	A	D	A	D	D	A	A	A
10	A	A	SA	A	A	A	A	A	D	SA	A	SA
11	A	D	A	SA	A	A	A	A	D	SA	D	A
12	SA	A	SA	A	A	D	A	A	A	A	A	SA
13	A	SA	A	SA	A	A	A	A	SA	A	SA	SA
14	SA	A	SA	A	SA	A	SA	SA	SA	SA	A	A
15	D	D	D	SA	A	A	A	D	SA	SA	SA	A

This table one consists of 12 items rated by 15 educational technologist, SA Stands for strongly agree, A stands for Agree, D stands for Disagree while SD stands for Strongly Disagree. It is only number one expert that picked agree in all items. The number of Strongly agree responses of the experts stands as 52, for Agree is 97, Disagree, 26 while Strongly disagree, 5.

Table 2: Experts' Rating (Frequency Counts) Of the Improvised Drawing Instruments No of items

S/N	A	B	C	D	E	F	G	H	I	J	K	L	MEAN	%
1	3	3	3	3	3	3	3	3	3	3	3	3	3	75
2	3	3	3	4	4	4	3	4	3	4	3	2	3.3	83.5
3	3	2	3	3	1	2	4	2	2	1	2	3	2.3	58.3
4	4	4	4	4	4	4	4	4	4	4	3	3	3.8	95.8
5	3	3	3	4	2	2	4	2	3	3	3	3	2.9	72.9
6	3	3	4	3	3	3	2	3	2	4	4	3	3.1	77.0
7	3	3	2	3	3	3	4	3	1	4	1	4	2.8	70.8
8	4	4	3	3	3	2	3	2	1	3	3	4	2.9	72.9
9	4	4	3	3	3	2	3	2	3	3	3	3	2.9	77.9
10	3	3	4	3	3	3	3	3	2	4	3	4	3.2	79.2
11	3	2	3	4	3	3	3	3	2	4	1	3	2.8	70.8
12	4	3	4	3	3	2	3	3	3	3	3	4	3.2	79.2
13	3	4	3	4	3	3	3	3	4	3	3	4	3.4	85.4
14	4	3	4	3	4	3	4	4	4	4	3	3	3.6	89.6
15	2	2	2	4	3	3	3	2	4	4	4	3	3	75

Overall Average – 3.08, Overall % - 77.2%

This table 2 shows the interpretation of table 1. The rated items are being interpreted in figures.

SA = 4, A = 3, D = 2, SD = 1

The experts rated all items above 70% except item thee that 58.3% whereas the mean of all the items was above 2.3 points in all cases from the maximum of 4.0 points.

Table 3: Experts' Cumulative rating of the improvised drawing instruments

Variable	NO	SA	A	D	SD	TOTAL	Cum. Total	MEAN	%	DECISION
Education Technologist	15	52 28.9	97 54	26 14.4	5 2.7	180	556	3.08	77.2	Usable

Table 3 shows the Experts' Cumulative rating of the improvised drawing instruments. The table reveals the rating of the experts. For strongly agree the percentage is 28.9, Agree 54%, Disagree 14.4% while Strongly disagree is 2.7%.

Table 4: Experts' technical quality rating of the improvised drawing instruments.

S/N	A	B	C	D	E	F	G	H	MEAN	%
1	3	3	3	3	3	3	3	3	3	75
2	3	3	3	4	4	4	3	4	3.5	87.5
3	3	2	3	3	1	2	4	2	2.5	67.5
4	4	4	4	4	4	4	4	4	4	100
5	3	3	3	4	2	2	4	2	3	75.
6	3	3	4	3	3	3	2	3	3	75
7	3	3	2	3	3	3	4	3	3	75
8	4	4	3	3	3	2	3	2	3	75
9	4	4	3	3	3	2	3	2	3	75
10	3	3	4	3	3	3	3	3	3.125	78.1
11	3	2	3	4	3	3	3	3	3	75
12	4	3	4	3	3	2	3	3	3.125	78.1
13	3	4	3	4	3	3	3	3	3.75	93.8
14	4	3	4	3	4	3	4	4	3.65	90.6
15	2	2	2	4	3	3	3	2	2.625	65.6

Overall average – 3.11
Overall % - 78.7%

There were 8 items rated under technical quality. Two of the experts rated all items and their means of two experts rated items below 3 points in all cases. 13 other experts rated all items under technical quality above 3 point in all cases. The mean of means of experts stand at 3.11. Whereas the average overall percentage of experts rating stands at 78.7%.

Table 5: Experts' cumulative rating of the Technical quality of the improvised drawing instruments

Variable	NO	SA	A	D	SD	TOTAL	Cum. Total	MEAN	%	DECISION
Education Technologist	15	33 28	68 56	18 15	1 1	120	373	3.11	78.7	Standardized

Table 5 reveals the experts' rating of the Technical quality of the improvised drawing instruments. The technical quality table consists of 8 items in which the number of strongly agree that was picked is 33 with 28%, agree is 68 with 56%, disagree 18 with 15% while strongly disagree is 1 with 1%. The cumulative total of the experts stands as 373. The mean of the means stands at 3.11 while the overall percentage stands at 78.7%. The decision taken by the experts is that improvised drawing instruments are standardized.

Table 6: Experts' aesthetic quality (frequency count) rating of the improvised drawing instruments.

S/N	A	B	C	D	MEAN	%
1	3	3	3	3	3	75
2	3	4	3	2	3	75
3	2	1	2	3	2	50
4	4	4	3	3	3.5	87.5
5	3	3	3	3	3	75
6	2	4	4	3	3.3	82.5
7	1	4	1	4	2.5	62.5
8	1	3	3	4	2.8	70
9	2	3	3	3	2.8	70
10	2	4	3	4	3.3	82.5
11	2	4	1	3	2.5	62.5
12	3	3	3	4	3.3	82.5
13	4	3	4	4	3.8	94
14	4	4	3	3	3.5	87.5
15	4	4	4	3	3.8	94

Overall average – 3.07
Overall % - 76.7%

Table 6 reveals aesthetic quality and from the maximum of 4 point, only five experts mean rating fell below 3 points. Majority of the experts' mean rating was at 3 points and above while one experts mean rating stands at 50%. The mean of means of experts stands at 3.07. The average overall percentage aesthetic quality stands at 76.7%.

Table 7: Experts' Cumulative rating of the Aesthetic quality of the improvised drawing instruments

Variable	NO	SA	A	D	SD	TOTAL	Cum. Total	MEAN	%	DECISION
Education Technologist	15	20	28	07	05	60	183	3.07	76.7	Durable

Table7 contains the experts' cumulative rating of the Aesthetic quality of the improvised drawing instruments. The rating for strongly agree stands as 20 with 53.3%, Agree 28 with 48%, Disagree 07 with 11.7% while Strongly disagree stands as 0.5 with 8.3%. The cumulative total of the experts stands as 183. The mean of the means stands at 3.07 while the overall percentage stands at 76.7%. The decision taken by the experts is that improvised drawing instruments are durable.

Summary of Major findings

Based on the assessment done by educational technologists on the improved Drawing Instruments for Basic Technology, the result of research questions 1 and 2 are addressed as follows:

1. The improvised Drawing Instruments can be developed based on Instructional Media Model to teach topics in Basic Technology.
2. The degree of satisfaction with the Drawing Instruments by the experts was high with the positive response.
3. The validation of the Drawing Instruments showed that the improvised Drawing Instruments was cheap, simple enough to promote teaching and learning and had the power to produce the desired result

Discussion

The project was undertaken to develop and validate improvised Drawing Instruments for Junior school Basic Technology in Oyo state. The package was meant to teach Basic Technology in junior secondary schools. The various stages involved included the development of Drawing Instruments using ADDIE model, the validation of the improvised Drawing Instruments by educational technologists using an evaluation instrument to determine the effectiveness of the improvised Drawing Instruments developed. The results indicated that the improvised Drawing Instruments developed could be used for Basic Technology. The Education technologists results agreed with the earlier findings of Danmole (2008), that instructions package will help learners to have understanding and retention of the concept taught. Adeniran (2010) concluded that the evaluation of the package showed that it can deliver as expected from the traditional instruction. The findings of this research on the validation of the improvised Drawing Instruments by the educational technologists / experts are also supported by Danmole (2008) when it was concluded that improvisation serve as an acceptable alternative to learners in their subjects and also as a source of information. Asokhia (2009) concluded that teachers are bored by the chalk, talk, and demonstration method used in the classes without appropriate instructional materials to supplement teaching. Also from this research it is clear that teachers or subject experts show interest in using instructional package to ease teaching and enhance syllabus coverage. The subject experts have shown interest in using something different from the traditional instruction, which resist that they are ready to use it appropriately. The assessment indicated that the resistance box developed would be used and also contained an appropriate level of well-presented information for teaching drawing in Basic Technology.

Conclusion and Recommendations

Conclusion

It was concluded that the educational technologists are capable of developing instructional packages to teach concepts in education generally and particularly Basic Technology. Thus, if done properly and accordingly, it could bring about excellent performance in the teachers' job and learners in their learning. The role of the subject experts could also be used to educate rather than just to inform the students with the instruments. The use of these instruments for instruction could make the teacher a tutor of his/ her students which is an extremely noble function than repeating acquired information. The improvised drawing instruments could be used in a classroom setting to produce an effective teaching and learning in a shortest possible time. The educational technologists responses revealed that the model adopted for the development of the improvised drawing instruments was in line with instructional technology media design. It was unanimously agreed by the educational technologists (experts) that the instruments were simple, light in weight, cheaper and very effective for the promotion of teaching and learning.

Recommendations

Based on the findings of this study and the purpose of the study outlined in chapter one of this report the following recommendations are made:

1. Improvised drawing instruments should be used as a means of conducting drawing aspect of Basic Technology.
2. Government should find the design and development of improvised learning materials for Basic Technology to boost the production of local materials to substitute standard ones.
3. Curriculum planners, authors should endeavour to include model for designing a specific instructional material under each topic of the Basic Technology text book so that the production of the relevant materials for such topic could be easy by the teachers
4. Seminars, workshops and conferences should be organized for Basic Technology teachers on regular basis to afford the in-service teachers to acquire improvisation skills.
5. Also, Basic Technology teachers in each state should form a union to afford them the opportunity of sharing knowledge on how to develop materials to be used in the subject.

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