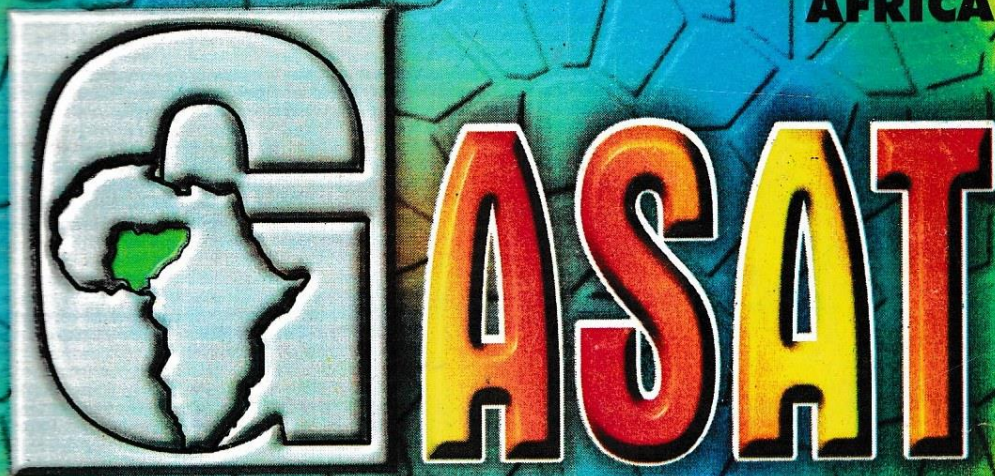


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**AFRICA**



**PROCEEDINGS**

*Linking Formal and Informal Science  
For Sustainable Development*



## RESOURCEFULNESS IN TEACHING: A PRIME STEP IN LINKING FORMAL AND INFORMAL SCIENCE

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### INTRODUCTION:

For sometimes now a need has arisen to create opportunities for both primary and secondary school learners to develop their ability to critically assess science and technology from a social and human perspective. It is believed that such exposure will develop in them higher order skills required for understanding of scientific concepts later in life. In learning, the sequence in which a learner encounters materials has a direct effect on achievement or mastery of the task. It has been proposed by psychologists like Bruner that, the instruction, which is provided to a learner, be made to proceed from enactive (direct purposeful learning experience) through iconic (representations) to symbolic or digital representation, which is highly abstract. Using this approach, it becomes imperative for teachers to naturally link learners' knowledge of informal science to their knowledge of formal science. In this arrangement, the teacher becomes the main bridge, linking formal and informal sciences for any sustainable development. To succeed, he requires a rich collection of media resources at close proximity to the learning environment.

The concept of science has been portrayed in various ways. Quite a number of people view it as abstract and far removed from day to day existence. Others see science as an instrument of the technological and economic development of a nation. Others still see it narrowly as limited to the study of subjects like Chemistry, Biology, Physics, Agriculture, Geography etc. It is worth noting that science means much more than the above expressed views. It is primarily a way of looking at and finding out more about things that occur in one's environment. (NPEC, 1998). For this reason scientific concepts must be imparted to learners early in life. Young learners at the pre-primary /primary school levels are very curious. They have inquisitive characteristics, actively interested in exploring their environment. Learners at this level also need learning experiences that can develop their motor and cognitive skills. These experiences can be met by utilizing the community's resources.

Thus, to develop and nurture reflective thinking in this group of learner's, activity –science educators should adopt oriented approaches, and learning resources must be skillfully utilized during such experience. Learning activities that involve taking these young learners out into their environment for: -

- Looking walk,
- Listening walk,
- Touching walk,
- Smelling walk,

should be arranged. In addition, all available local games that have scientific relevance to the formal science concepts as contained in their curriculum should be integrated into the teaching learning sessions.

Unfortunately, most public primary and secondary schools in Nigeria are bereft of appropriate science equipment and media resources for such learning activities. This calls for creative and resourceful teachers who have adequate knowledge of improvisation for requisite media resources and equipment.

This presentation is a demonstration of how this integrated approach could be skillfully used in Teacher Training Programme to produce the effective "thinking" and "acting" teacher needed to link the Formal and Informal Sciences for a sustainable Development. Thus, this paper considers that the most appropriate technology for improving the quality of science education in Nigeria is the development of resourceful teachers.

### **Rationale For Resourcefulness In Teaching Science**

Historically, the key reason for using instructional media in the teaching and learning of science was to improve the balance between concrete and abstract learning experiences. It has been known that media resources do not only provide the necessary concrete experiences but they also help learners to integrate prior experiences. These prior experiences include their informal scientific knowledge and skills. Concrete experiences facilitate learning and the acquisition, retention, and usability of abstract symbols and these learning experiences are derived from the community resources. Since the inception of Formal Education in Africa as a whole and Nigeria in particular, the use of existing community resources to enhance learning has been relegated to the background. Nigerian Education system appears to be caught between two competitive priorities, that of satisfying both qualitative and quantitative considerations. Wherever a school is established irrespective of the type of location there is bound to be in-flock of willing



learners just to acquire formal education. Consequently, Nigerian governments and politicians have capitalized on this “thirst” for education and have proliferated schools without consideration for quality or standards. This rapid expansion has not been equally matched with resource provision. While formal education was made easily accessible to the citizens with the increased learning institutions and students’ enrolment, the facilities remained obsolete and inadequate.

Science as the study of nature and the physical world through observation, testing, experimenting and measuring more than the study of any other discipline require practical exposure for proper understanding. The teaching of science at whatever level requires the use of appropriate media resources. Ekpo (1992) and Ezeliora (1992) stressed that for effective learning of science concepts, the young learners’ environment should be used as resource materials. Moreover since young pupil learn science better by doing activity-oriented approaches ought to be used. In a science lesson, it is therefore necessary that every pupil be given opportunity to handle and manipulate learning resources to find out facts for themselves and make verification among others. Ability to think and form science concepts depend to a large extent on the way materials are presented to the learners. This in turn calls for resourcefulness on the part of the teacher. The crisis of how to balance the quantitative and qualitative growth of Nigerian educational system is basically an issue of how to make optimal use of available human and material resources for education. The wealth of a nation is often seen as either a mere possession of natural resources or ability to transform the raw forms of these resources into products that will eventually be useful for human development. If this global economic analogy is extended into teaching/learning environment, one could say that a rich classroom is one with all necessary learning resources or it is one that is manned by an ingenious teacher who is skillful in overcoming teaching and learning difficulties.

#### **WHAT DOES RESOURCEFULNESS IN TEACHING ENTAILS?**

Resourcefulness as used in this paper is teaching in a way that involves the use of community resources that are familiar to the learners such that their (Learners) interest in the subject may be enlivened. A resourceful teacher sees instructional problems as challenges. They merely lead him or her to look for alternative ways of handling the task. A resourceful teacher is one who can think constructively and hard and without being engaged in such hard thinking there can be no technology. A resourceful teacher is the wealth of a school for when the required resources are not available or what they have looks obsolete; a resourceful teacher will create appropriate resources and environment for instructional use.

In the handling of science, a resourceful teacher improvises a lot of equipment. Such teachers are creative and resourceful in both thinking and manipulative skills. Such a one must also be committed and ready to devote time to the activity. Such local production will involve both the teacher and pupils in realistic problem solving activities which will stimulate learning. This is the prime step in linking formal and informal science, and, this is the point of optional exploitation of all available resources. In the face of escalating cost of funding education, amidst the empty classroom, a resourceful teacher can skillfully improvise standard science equipment and other media resources using both the substitution and construction approaches. Other community resources like local instructional games could also be adopted for use. Looking back nostalgically at Nigerian primary Schools, Obanya (1988) noted that during the pre-independence generation teachers were not better paid than today, nor were the schools receiving better allocations, yet teachers and pupils were able to transform empty school premises into beautiful parks, pleasant learning environments, study gardens, play fields and study trip centers.

#### **Putting Back Resourcefulness Into Teaching**

When Educational Technology was brought into the teaching-learning scene as a rational problem-solving approach it presented a way for educators to think systematically about learning and teaching. The content of Educational Technology offered at both Initial Teacher Training (ITT) and In-Service Training programmes (IN-SERT) could be reviewed and enriched to include improvisation as a core area of study. Teachers’ professional standards will thus be raised.

There is also a need for a consciously planned intensified Programme of educational technology at all levels to teacher education programmes. There is hardly any gain in deliberating on the need to link formal and informal science when teachers as the facilitators of learning fail to see the need and the areas for the linkage. To teach about things that occur in “one’s environment”, “outside one’s environment” is to be unscientific.

And much more, teaching technological subjects through mere lectures as it is currently done in our public schools is the best way of being non-technological. Head teachers and proprietors should give sufficient incentive for the serving teachers to unearth relevant knowledge of informal science in their environment and adopt for a better understanding of formal science concepts. Proprietors of schools should also provide fund and platform for the production of prototype materials through Action Research technique.



Ekukinam (1998) in a study set out to identify, appraise, classify and adapt local plays in Akwa Ibom State into suitable instructional games for the junior primary schools noted that, these local games were quite significant as practical and substantive resource materials for their learning. That study further reveals that the local plays identified relate significantly to the junior primary curriculum because they exhibit instructional values that could be classified under the components of their curriculum. (See Table 1)

Table 1: Instructional Values of Identified Local Games, Ekukinam (1998).

| GAME STRUCTURE | SRA | CRA | IO  | IS/AT | PS/LS | TOTAL |
|----------------|-----|-----|-----|-------|-------|-------|
| WORD GAME      | 115 | 111 | 154 | 90    | 231   | 701   |
| BOARD GAME     | 25  | 18  | 27  | 13    | 32    | 115   |
| TOTAL          | 140 | 129 | 181 | 103   | 263   | 916   |

$\chi^2$ -Cal=10.7; Critical Value =9.5 df=4 therefore  $H_0$  was rejected.

The study concluded that the hypothesis which stated that, “there is no significant relationship between local play and primary school curriculum” should be rejected. Each of the relevant components

- |                              |                             |
|------------------------------|-----------------------------|
| SRA - Subject Related Area   | CRA - Content Related Area  |
| IO - Instructional Objective | IS - Instructional Strategy |
| AT - Assessment Technique    | LS - Learning Skills        |
| PS - Pupils Activities.      |                             |

### Practical Demonstration Of The Intergrated Approach; Individualized Learning And Instructional Games Strategies.

**TOPIC: WATER: CHARACTERISTICS AND FUNCTION.**

- Target Audience:** Senior Primary and Junior Secondary 1 and 2.  
**Instructional Strategy:** Individualized learning approach and instructional games.  
**Instructional Media:** A local word game: “Ata Nso Iyak?”. Flash cards and realia (Specimen of pure water).  
**General Objectives:** Learners should be able to list all the characteristics of good water, and the functions of water.

**Specific Objectives:** By the end of the learners’ exposure to the topic, these target learners should be able to

- List the three main characteristics (properties) of good water.
- Name the various sources of water.
- Identify the numerous functions of water in the community.
- Visit a fish pond in the locality and write a report of their experience there.
- In a game situation, briskly recall names of fishes that you know.

**Entry Behavior:** The learners are familiar with the concept handled. They have seen water from their various source and the lives in them. They are also familiar with this local game situation.

**Lesson Presentation: Pre-Instructional Activities – Introduction.**

Water is very crucial to life and there are various sources of water depending on the environment and the period of the year. Put the following puzzles to the learners:

**Learners Activities 1:**

- List the main source of water that you know
- Identify the source of water that you know is commonly used in your home.



**Characteristics of water:**

The learners are informed that the rainwater is the purest source of water, and that pure water is colorless, odorless and tasteless.

**Learners Activity 11:**

You should collect water from well, stream, river, tap borne, pond and borehole. Take a close look at their colour, smell and taste them. Record your observation in a notebook.

**Function of water:**

The learners are helped to understand that all living things need water be it plant or animal. Water is needed for our meal, cleaning and farming.

**Learners Activity 111:**

- (a) You should at this stage name the various uses of water in the home.
- (b) Identify other functions of water outside the home.
- (c) Visit a local fish pond to you and record what you see there.
- (d) Visit a mechanized farm which uses irrigation system and write in your notebook what you see.
- (e) Just imagine how your meals will taste without fish.

**Facilitation for game session:**

Introduce the concept for the instructional game to the learners by showing them the visuals and names of some aquatic lives (e.g. turtle – a small sea animal protected by a hard shell, lancelet – a small fish like animal, star fish – a radically arranged sea life 5 or more rays or arms etc). Let the learners note that their interest was only on types of fish. Examples of fishes that could be crown are given thus:-

- (1) Blue shark – the British waters fish
- (2) Dollar fish – the moon fish
- (3) Dolphin – the long, shape nosed Mediterranean fish
- (4) Manatee – A herbivorous fish with two flippers in front and a spoon shaped tail.
- (5) Stingray – A shallow water fish with flexible tail armed near the base with serrated bony spine.
- (6) Tile fish – A large brilliantly colored Atlantic Ocean fish.
- (7) Tuna fish – A large Oceanic fish closely related to the tunny etc.

Instruct them on the rules of the game and how to determine the winner. Inform the moderator of the game and discuss the reckoning up pattern to decide on the winner party.

**FOLLOW THROUGH ACTIVITY AND CONCLUSION:**

Various approaches could be adopted to provide appropriate follow up activities depending on the feedback obtained from the three learner's activities.

Learners benefit more from studying abstract concepts if instruction which is provided is made to proceed from enactive through iconic to symbolic or digital representation. Learning of Informal science is quite enactive because the learning, concepts are part of the learners environment. It is the position of this paper that when informal and formal science are linked a better understanding of science will ensued. A resourceful teacher is the bridge that can cause the linkage. Hence, Teacher Education Programme should heighten the training of teachers so as to produce the much needed "thinking" teachers.

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